

No. 637,557.

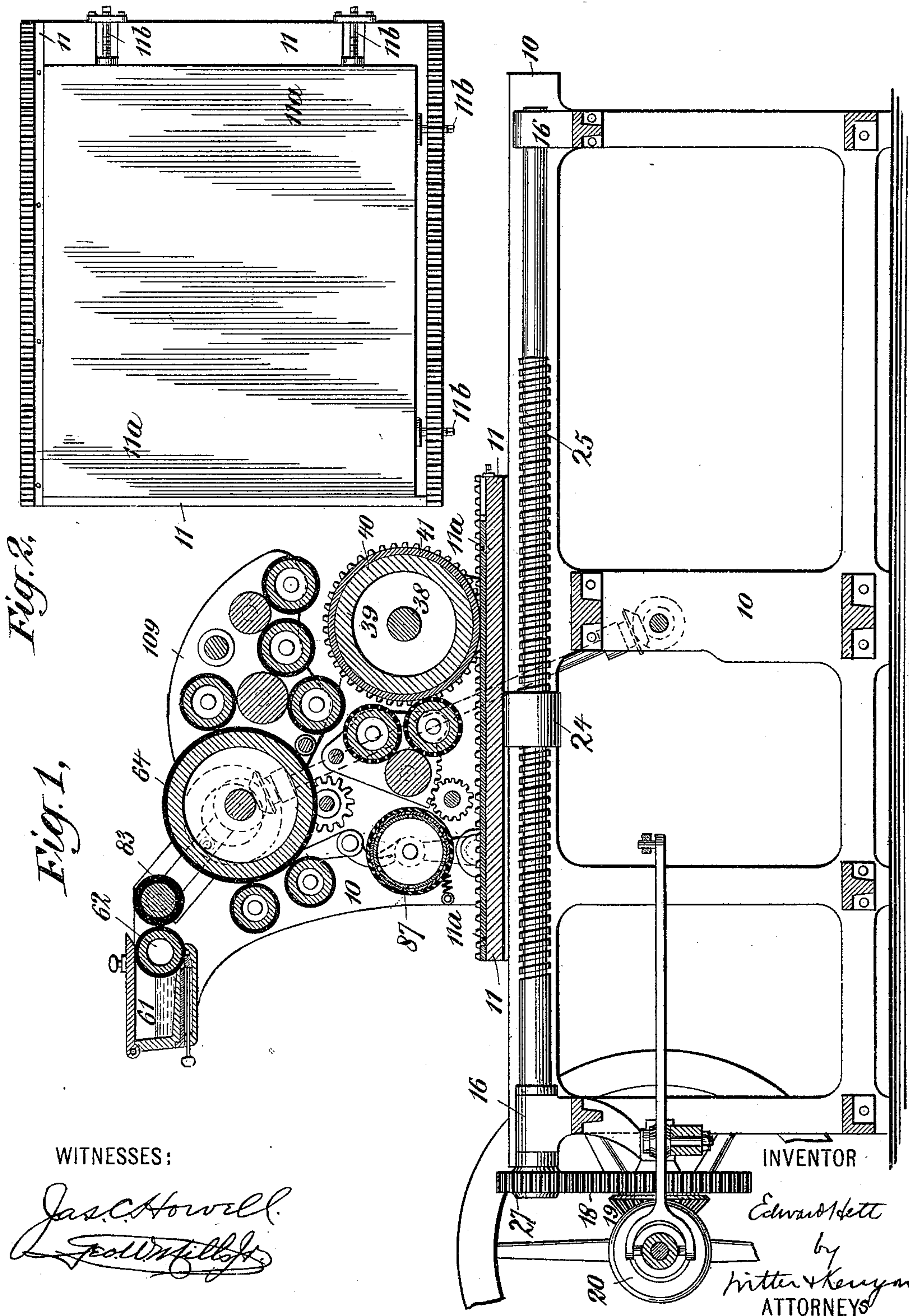
Patented Nov. 21, 1899.

E. HETT.
ART OF MULTICOLOR PRINTING.

(Application filed Nov. 2, 1898.)

(No Model.)

2 Sheets—Sheet 1.



WITNESSES:

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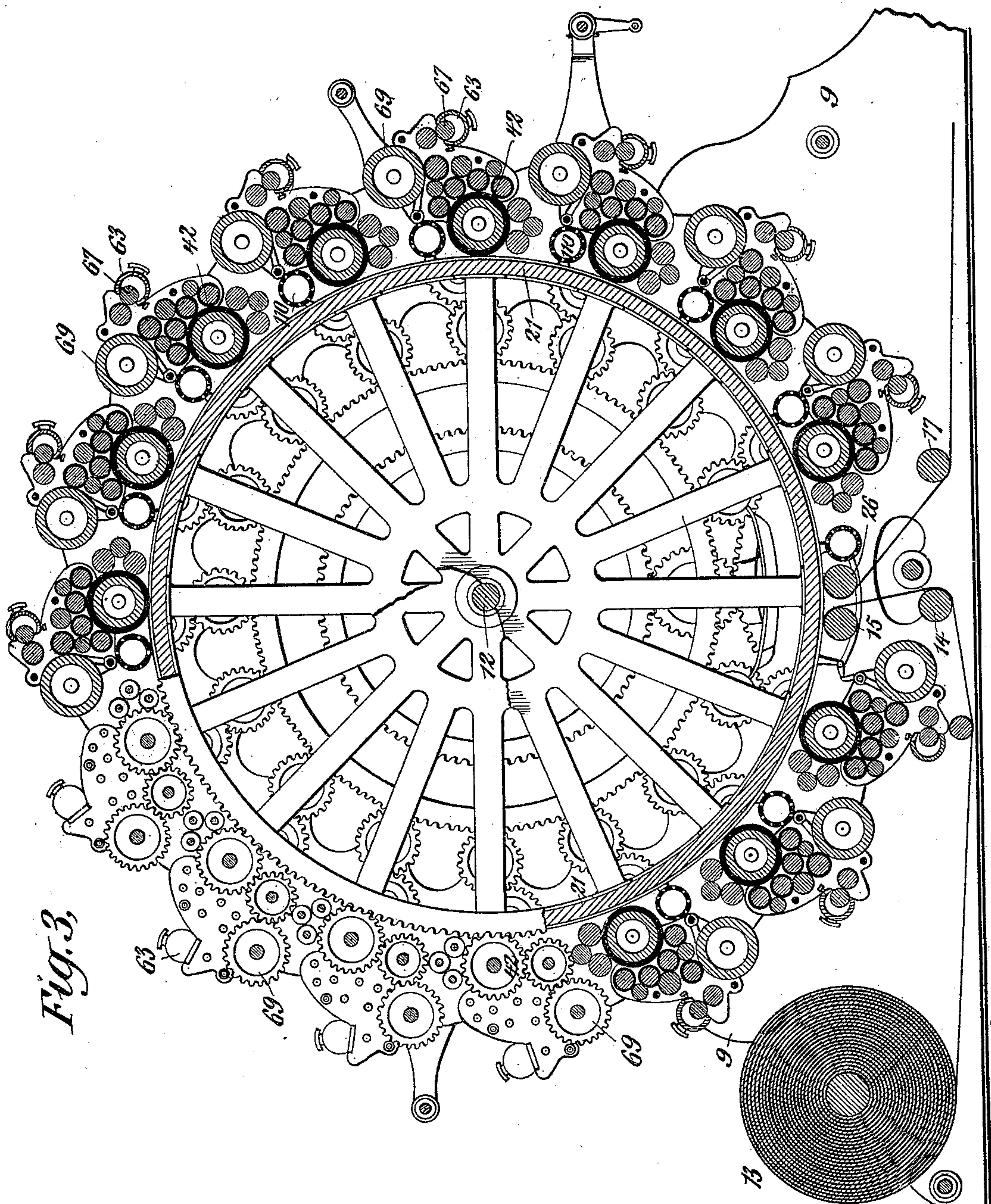


Fig. 3.

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UNITED STATES PATENT OFFICE.

EDWARD HETT, OF NEW YORK, N. Y.

ART OF MULTICOLOR-PRINTING.

SPECIFICATION forming part of Letters Patent No. 637,557, dated November 21, 1899.

Application filed November 2, 1898. Serial No. 695,281. (No model.)

To all whom it may concern:

Be it known that I, EDWARD HETT, a citizen of the United States, and a resident of New York, (New Dorp,) in the county of Richmond
5 and State of New York, have invented a new and useful Improvement in the Art of Multicolor-Printing, of which the following is a specification.

My invention relates to the art of multicolor-
10 printing, whether with planographic-printing surfaces or with printing-surfaces etched or otherwise similarly developed in relief or in intaglio. It has special utility, however, in the art of "multicolor lithography," meaning
15 by that the art of multicolor-printing by means of planographic surfaces, acting upon the principle of the mutual repulsion of grease and water, as with ordinary lithographic stones. The invention will therefore be more
20 specifically described in connection with multicolor lithography.

Heretofore in producing by lithography pictures that have a large plurality of colors the effort and practice have been to produce the
25 picture with as few impressions (in number) as possible, and hence with as few colors as possible, and to that end the practice of the lithographic artist has been to select as his colors a relatively small number of such basic
30 or primary colors as by their combinations in the printing will give a fair approximation to the colors of the picture to be reproduced and then to painstakingly proceed to so draw the series of color-stones for these primary or
35 basic colors, as to cause them to repeat or overlay their respective colors upon one another in layer upon layer, thus attaining approximately the different distinct colors of the picture by blendings and repetitions achieved
40 in the printing, and then to print separately the different primary or basic colors at intervals of time, allowing thorough and complete drying between printings. The effort and practice have been to reduce the number of
45 primary or basic colors to a minimum, for each additional color employed has ordinarily meant another handling through the press of the entire edition printed, and so the effort and practice have been to increase the
50 repetitions and overlayings of colors to a maximum. In ordinary lithographic work it is consequently the practice to introduce the

primary or basic colors to a greater or less extent—that is, in fuller or lighter tints, controlled by the fullness or lightness of the
55 drawing—in almost every part of the picture, almost all of the separate distinct colors of the picture being produced by a large plurality of repetitions or overlayings of the different primary or basic colors employed. 60
This principle or practice, and in fact the general method itself, of printing with planographic surfaces every point of which physically touches every point of the paper at each
65 printing operation, has been supposed by the practical lithographer and printer to require that the printing of the different primary or basic colors be done not in approximately instantaneous succession, but with substantial
70 drying intervals between. These drying intervals are incidentally provided in the ordinary and usual method of lithographic printing where one color is printed at a time and the entire edition, or a substantial part of it,
75 passes through the press for one color before it passes through the press for a subsequent color. I have discovered, however, that the first color printed will dry practically instantaneously—that is, will dry sufficiently to permit another color to be immediately printed
80 upon it and sufficiently to prevent any offsetting of the ink of the first printing back onto the non-printing or any portions of the second printing-surface, and so with a second color printed over the first at the same
85 place on the paper, and so with four and sometimes five colors or thereabout, varying somewhat with the varying conditions of ink, paper, character of design, atmosphere, &c., but that the limit, approximately, of
90 practically instantaneous drying in the sense here intended is soon reached, and that thereafter the printing of another color at that place on the paper will so saturate the paper at such place as to render impossible
95 the immediate printing of another color upon it, and I have further discovered that this limit of number of colors can be largely exceeded, taking the picture as a whole, provided the designs are so drawn with respect
100 to one another that the limit is not exceeded at any one place in the picture and on the paper, and that under such circumstances a practically unlimited number of aggregate

printings can be made in approximately instantaneous succession and successfully and without harmful offsetting from the paper onto the later printing-surfaces. I employ the term "dry" herein as meaning not absolute dryness, in fact, or to the touch, but that unsaturated or only partly wetted condition of the paper which permits it to absorb or take up still more ink or color from a new printing-surface, while not harmfully offsetting or giving back a previously-printed color to that new printing-surface. When the point of saturation is reached and the paper takes no further ink or color from a new printing-surface, but instead offsets back onto that new printing-surface, it ceases to be dry within the meaning of this specification. It ceases to absorb or take up color as a dry surface would take it up. Heretofore also it has been the practice in the art of lithography in preparing the printing-surfaces for the several separate colors to so transfer the drawings for each separate color that the position of the transfer on one printing-surface has had no particular or definite relation to the position of the transfers on the other printing-surfaces constituting the series and to empirically regulate the position of each transfer in the printing-press itself before beginning the printing by adjusting the printing-surface or the press, or both, until its transfer registers with the already-printed impressions on the sheets as they are fed in and to painstakingly feed sheet after sheet of the edition accurately to that register, and so that the new impression registers with the preceding impressions. Thus the whole burden of attaining accurate register has been thrown on the printing department. Heretofore also it has been the common practice in lithography, as stated above, to print the successive colors not in approximately instantaneous succession—as, for instance, in one and the same press at one and the same time—but one impression or color at a time, with substantial intervals of hours, or perhaps of days, between the printing of one color and the printing of the next color and with a separate handling of the entire edition for each separate printing. Moreover, in multicolor typographic printing each separate printing has involved a separate and painstaking preparatory "make-ready" or "cut-and-try" adjustment of the printing-surface and every part of it to the impression-surface, or vice versa, or both, to insure even and regular printing-pressure over the entire face of the picture, these preparatory adjustments consuming much valuable time of press and workmen and involving expensive delays.

By my improvements in the art I am enabled to reverse the present practice in almost all of its leading and important features. Instead of building up the separate distinct colors of a picture by starting with a minimum of different basic colors and compounding them in and by the printing through

a maximum of repetitions or overlayings achieved in the drawings, I am enabled to attain the separate distinct colors of the pictures to be produced, or substantially all of them, by separately mixing each of said separate distinct colors apart from and prior to the printing and as accurately in regard to shade, &c., as desired, preparing a large plurality of separate color-printing surfaces, greater in number than the limit of colors which would dry approximately instantaneously if overlaid at one point and substantially as many as there are separate distinct colors in the picture to be produced, a maximum of colors and a maximum of color-printing surfaces, and preparing these color-printing surfaces for a minimum of repetitions or overlayings, in no case more than will in the printing dry (all of them) approximately instantaneously—that is, will dry sufficiently to prevent offsetting and to permit another color to be immediately printed—and, finally, printing from all of said color-printing surfaces in approximately instantaneous succession and in any desired order. I am enabled to do this because, instead of so transferring the designs for each separate color that the position of the transfer on one printing-surface has no actual or necessary relation to the position of the transfers on the other printing-surfaces constituting the series, but experimentally regulating the position of each transfer in the printing-press itself before beginning the printing by adjusting the printing-surface or the press, or both, and painstakingly feeding the sheets of paper into the press accurately sheet by sheet with reference to the particular adjustment of the printing-surface in the press, I so transfer the designs by the method herein described and claimed that the position of each design of the series on its printing-surface has a definite and accurate relation to the position of every other design of the series on every other printing-surface of the series, and I print from these printing-surfaces in any desired succession and accurately in register, according to the definite and accurate relation to each other of the positions of the designs on the several printing-surfaces attained in the transferring-department. Thus the burden of attaining accurate register is taken from the printing-department and is thrown onto the transferring-department, and I preferably do this transferring from flat basic surfaces onto rounded and onto continuous rounded printing-surfaces, and instead of printing each color separately—that is to say, with a separate handling of the paper or edition for each printing and with substantial drying intervals between printings—I print the colors for which separate printing-surfaces have been prepared in approximate—that is, substantially instantaneous—succession—that is to say, with but one handling of the paper or edition for the entire series of printings and without substantial drying

intervals between printings—and preferably continuously and on the web and preferably with rounded and continuous printing-surfaces and on a continuous impression drum.

5 In carrying out my invention in the best way at present known to me I proceed as follows, reference being had in parts of this description to the accompanying drawings, which form part hereof and which are specifically described hereinafter.

10 The artist studies the picture or painting to be reproduced, determines the number and character of the colors that are to be separately printed, and prepares a series of registering drawings or designs, one for each separate color. In this work of the artist my invention permits important modifications of the existing practice. The new principle to guide the artist in his primary selection of
15 the number and character of colors to be separately printed is to select substantially as many different colors as there are separate distinct colors in the picture to be reproduced and to select as nearly as possible the shades and tones of those colors actually found in
20 the picture, so that the color effects of the resulting prints shall be, as far as possible, pure color effects—namely, color effects attained by mixing and blending the colors prior to the printing—and shall be as little as possible composite color effects—namely, color effects attained by overlaying one color upon the other in the printing. In other words, the existing practice of selecting as
25 few colors as possible and overlaying or repeating them as much as possible may be exactly reversed, and the artist may reduce the overlaying or repeating of colors to a minimum and instead reproduce substantially each and every prominent color of the picture with a pure color effect. Some overlaying of colors is of course necessary and proper, as for blending, depth, finish, &c., but this overlaying of colors is by my process
30 preferably kept at a minimum. It finds its essential limit in the number of colors which if printed in approximately instantaneous succession and over one another will sufficiently dry approximately instantaneously—that is, without special intervals of time being provided between printings for that purpose—this limit varying somewhat with the character of the design, character of inks employed, &c. The designs for the separate
35 colors to be separately printed should be prepared by the artist with this limitation in mind. My improvement allows of further important advantages in artistic work, some of which are referred to hereinafter. The
40 artist having made the designs for the several colors, the original color-stones exhibiting those designs are etched and prepared and proved in the usual way and are then passed on to the transfer-department.

65 In the transferring-department I transfer the several designs for the separate colors to a series of printing-surfaces in a novel and

peculiar way. I first prepare a series of registering basic surfaces, one for each of the designs to be separately printed, in such a way that each basic surface when prepared shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it. To do this, I begin with a non-contractible and non-extensible transfer-base, such as a sufficiently-thick sheet of zinc, which base or the parts of the sheet which I employ as a base shall exactly duplicate the superficies of the printing-surface, (the sheet of zinc may of course have unused margins which I do not consider a part of the base,) and I apply the design or a suitable number of impressions thereof to the base accurately and with painstaking care, according to the exact position in reverse that it is desired that the design and every part of it shall occupy on the printing-surface, the entire series of registering designs being applied in related and identical positions on the series of bases or successively on the same base, so that if such base or bases could be at such time used as printing-surfaces the entire series of designs printed by them would exactly register one upon another. I then bring each basic surface in turn into positive and positively-matching contact with its printing-surface without slipping or sliding motion of either upon the other during such contact or any motion of any part of either upon the other lengthwise or sidewise of the superficies of either during such contact, whereby the design is positively communicated to the printing-surface, every part of it in exactly the position positively predetermined by the position of the design on the matching superficies of the transfer-base, all of the printing-surfaces of the series being held for the purposes of such contact and throughout such contact in the same identical relationship, each one as every other, with respect to the designs and every part of them upon their respective basic surfaces, whereby the designs so communicated to the printing-surface will subsequently register automatically in the printing. I will now describe in more detail this novel and peculiar method in the best form of its application at present known to me. The design for one of the colors—say the first color—having been printed upon transfer-paper in the usual way, I apply that design to a suitable setting-up plate or other transfer-base accurately, according to guiding-marks on the setting-up plate, by sticking up the transfer-paper on which that design is printed accurately on the setting-up plate according to the guiding-marks thereon. For the setting-up plate I preferably use a suitably-stiff sheet of zinc faced with ordinary paper, the paper being made securely fast to the face of the zinc sheet, on which paper the guiding-marks have been suitably printed or otherwise placed. These guiding-marks may be the ordinary crossed lines at the sides of the design and above and be-

low it, or they may be a general key design printed on the setting-up plate, or the design of one of the colors printed upon that plate, or any other suitable marks. The setting-up plate, with the design that is to be transferred applied to it or stuck up on it, I designate herein as the "basic surface" for the color in question. At the proper time a basic surface is prepared in the way just described for each separate color to be printed by applying the design for that color to a setting-up plate accurately, according to the guiding-marks thereon, the same setting-up plate being used in succession in the preparation of this series of basic surfaces or setting-up plates, that are substantially duplicates of one another in the respect of having the same identically-located guiding-marks thereon. I then bring each basic surface in turn into a definite relation with reference to certain mechanical guide or guides in a transfer-press in such a way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has. I then establish suitable contact in the transfer-press between each basic surface and a suitable printing-surface, the printing-surfaces being held—each one of them—in the same position with reference to the aforesaid mechanical guide or guides in the transfer-press as every other printing-surface of the series in the corresponding transfer step. In this way the designs for the several colors to be separately printed are communicated from the respective basic-surfaces for those several colors to the respective printing-surfaces in accurate and related position on those printing-surfaces. I then suitably develop the surfaces, having the designs thus communicated to them into printing-surfaces of the kind desired, (whether planographic, relief, or intaglio,) one for each of the several colors to be separately printed. If desired, a key basic surface may first be prepared by applying a key design to a suitable setting-up plate, and certain advantages result, or the key design, when transferred from the basic surface to a suitable printing-surface, may be developed thereon and printed therefrom onto one or more suitable setting-up plates as the guide or key for applying thereto the separate color designs in the process of preparing the series of related printing-surfaces, as set out above. However, as stated, any other desired method may be employed for securing upon said setting-up plates guiding-marks to guide in the applying or sticking up of the designs for the different colors. In practice it may even be advantageous to use the basic surface of the first color as at the same time a key basic surface, printing from the printing-surface of that first color upon the setting-up plate or plates as a guide for the application thereto or sticking up thereon of the designs for the other colors. In this case the design for the first color, which is so to be used as a key design, may be ap-

plied quite at random in the first instance to the setting-up plate, all that is necessary being that the designs for the other colors shall subsequently be applied accurately to their several setting-up plates with respect to the design for the said first color. In the transferring one or more setting-up plates may be used. In general practice, however, it will be customary to use only one, more than one being required only when it is desired to hurry the completion of various transfers. The setting-up plate is preferably flat and will ordinarily be a plate of zinc, although any suitable material that is non-contractible and non-extensible in regard to its superficies under the conditions of use will answer the purpose. In one form of embodiment of my invention one end and one side of the setting-up plate are planed and accurately squared or otherwise accurately and permanently shaped in two directions with reference to certain corresponding and matching mechanical guides forming a part of the reciprocating bed or carriage of the transfer-press. This accurate and permanent matching of the shape of the setting-up plate to that of the bed of the transfer-press that is to carry it is important, for it is one means which may be employed, and a simple means, for bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in the transfer-press, whereby the design upon each basic surface may have, in the act of transferring, the same position with reference to said mechanical guide or guides that every other design of the series has in that same act of transferring. Each basic surface is in turn inserted in the reciprocating bed or carriage of the transfer-press, its accurately planed and squared corner being accurately placed in the corresponding and correspondingly accurately planed and squared recess in the bed or carriage and is forced home, care being taken that no dirt or obstruction interferes, and is firmly clamped in place. The design upon it is thus brought into a definite position with reference to the squared recess or guides in the bed or carriage. A suitable printing-surface, properly mounted in a definite position with reference to the same mechanical guides, is brought into suitable contact with the basic surface so that its pinion comes into proper engagement with a rack mounted on the bed which carries the basic surface, a definitely-marked tooth entering, in the operation, a definitely-marked recess of the rack, always the same. Pressure being applied, the bed is moved forward, the design on the transfer-paper on the basic surface being bodily transferred by that act along with the transfer-paper that carries it to the printing-surface. The bed is moved backward and forward a sufficient number of additional times to insure the proper pressure; but the communicating of the design from the basic surface and its definite and positive locating or positioning on the printing-sur-

face have been achieved at the first contact. The subsequent pressure merely achieves in the old way the driving out of the last traces of the ink of the design from the transfer-paper, so that that transfer-paper may be removed without running the risk of removing any of the ink of the design from the printing-surface. Such subsequent pressure is incidental to the operation of removing the transfer-paper. The pieces of transfer-paper are soaked off, the ink design remaining on the printing-surface in the usual way. That surface is now suitably prepared for final printing purposes by etching, using such of the well-known methods as are best adapted to properly treat the surface and depending upon the character of printing-surface desired, whether planographic, relief, or intaglio. When the surface is a tube, it may be revolved in a bath for the purpose of washing or etching, or both. It may be dried by raising it and revolving it in the air. It may be dampened by dampening-rollers, an operation which has not heretofore been done in a transfer-press. It may be inked with inking-rollers similar to those now employed in lithographic-printing presses, an operation which has not heretofore been done in transfer-presses. Thus a power transfer-press may take the place of the slow laborious hand transfer-presses now in use. A more uniform result is produced more rapidly and economically. By the process of transferring here described the series of designs for the several colors to be separately printed are brought one by one on their respective basic surfaces into the same position with reference to the same mechanical guide or guides in the transfer-press and are accurately held in that position throughout the operation of transferring, and for each a suitable printing-surface is brought into suitable contact with a basic surface, and in such a way that the series of printing-surfaces during the operation of transferring are held, each one of them, in the same position with reference to the aforesaid mechanical guide or guides in the transfer-press as every other printing-surface of the series. It will thus be seen that the designs for the entire series of colors that are to be separately printed are communicated from the basic surfaces to the printing-surfaces in accurate and related positions on these printing-surfaces, and these printing-surfaces will therefore carry a series of designs which will interchangeably register each with all the others when the printing-surfaces are suitably mounted in a printing-press in positions accurately fixed to that end, each with respect to every other and all with respect to the impression-surface. Thus accurate and exact register is obtained automatically and at any desired speed in the printing after once the transferrer in the transferring-department has accurately applied to or stuck up on the setting-up plate the designs or impressions taken from the original color-stones. There only does the personal factor

enter in connection with the problem of securing register in my improved process.

It will be observed that in this preferred form of my invention in transferring the color designs from the basic surfaces to the printing-surfaces each basic surface is first brought into a definite relation with reference to certain mechanical guide or guides in the transfer-press in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has. It will also be observed that the design is communicated from the basic surface to the printing-surface by establishing suitable contact between the two, the series of printing-surfaces being held, each of them, in the same position with reference to the aforesaid mechanical guide or guides in the transfer-press as every other printing-surface of the series during the operation of transferring. It will also be observed that in the preferred form of my invention the design communicating contact between the basic surfaces and their respective printing-surfaces is a positive and progressive rolling contact, one at least of those two surfaces being curved or rounded; also, that the printing-surface is preferably the curved one and the basic surface and its base preferably flat, the base being in such case an accurate and exact representation or duplicate of the evolved or unrolled superficies of the printing-surface, and as such conveniently lending itself to the accurate arrangement or disposition of the design upon it in reverse, the design being face up. However, this part of my invention is not in its broadest expression limited to the employment of the preferred steps recited above. It is embodied whenever the series of surfaces that are adapted to be subsequently developed into printing-surfaces and are to that end to receive the separate designs for the separate colors are arranged by means of any suitable instrumentalities in a positive and the same identical relationship, each one as every other to the designs for those colors upon their respective basic surfaces, each printing-surface in the same relationship to its design or to the impression or impressions thereof as every other printing-surface to its design or to the impression or impressions thereof, and the designs or impressions thereof are then communicated to such surfaces by causing each such surface to make positive and positively-matching contact with its design or with the impression or impressions thereof while in such positive and identical relationship thereto.

A more detailed description of suitable apparatus that may successfully be employed to carry out this part of the invention in its preferred form is as follows, reference being had to the drawings, Figures 1 and 2, in which figures like numerals indicate like parts.

Fig. 1 is a central longitudinal section of a transfer-press suitable to carry out this part

of my process. Fig. 2 is a plan view of a part of the same. Fig. 3 is a cross-section of a printing-press adapted to carry out the printing part of my general process.

5 The machine is provided with a suitable and substantial frame 10, which may be of any approved design, and on this is a horizontal reciprocating bed 11, having thereon a removable zinc or equivalent flat transfer-
10 base or setting-up plate 11^a, which has one side and one end accurately planed and squared and accurately fitted to a corresponding and matching planed and squared recess in the reciprocating bed or carriage, as shown
15 in Fig. 2. The setting-up plate being thus accurately placed on the bed is held to the bed by pins 11^b or by other suitable fastenings. The bed may be held in any suitable slideway. It has a depending fixed nut 24,
20 which engages a screw 25, which is journaled in suitable bearings 16 and extends longitudinally of the machine, this screw being adapted, therefore, by its rotation first in one direction and then in another to move the
25 bed backward and forward, and to enable the screw to be turned it has at one end a gear-wheel 27, meshing with a gear-wheel 18, which is journaled on one end of the machine-frame and is provided with a cone 19, adapted to
30 engage and be driven by a cone 20. Suitable mechanism for driving in a reverse direction may be employed. The details of these driving mechanisms need not be further set out.

35 The form-cylinder 39 is preferably provided with a hollow barrel or body portion 40, over which is slipped a printing-surface tube 41, adapted to receive the transfers from the setting-up plate 11^a of the bed, and when the
40 transferring work is to be performed the cylinder is lowered into contact with the bed and is positively geared with it, so as to move with it, as shown in Fig. 1; but when the cylinder is being dampened, inked, or otherwise operated on it is raised out of contact with the
45 bed, and suitable driving connections (not necessary to be shown) enable the said cylinder at such times to be turned as desired. The shaft 38, which carries the form-cylinder
50 39, is to that end suitably movable up and down.

The ink is supplied to the form-cylinder 39 from a fountain 61, which will not be described in detail, as any suitable fountain
55 will do. In the mouth of the fountain is an ink-roller 62, which is adapted to discharge intermittently on the roller 83, which reciprocates between the roller 62 and the main ink-distributing roller 64, so as to apply the
60 ink to the latter roller in sufficient but not too copious quantities. The function of the further inking-rollers is manifest from the drawings and need not be further referred to.

65 The water-roller 87 is of any suitable construction. The water from it is applied to the printing-surface on the form-cylinder 39

by ordinary means that need not here be described.

The frames 109 and the rollers which they carry may be swung up, thus making it easy
70 to get at the form-cylinder 39 and remove it when necessary.

When the machine is to be used, the designs on transfer-paper are stuck up, as heretofore described, on the zinc setting-up plate
75 11^a and the form-cylinder 39 is lowered to bring the printing-surface on the form-cylinder into contact with the bed and to apply pressure, and the cylinder and bed are adjusted by means of certain marked cogs in
80 the gears and racks to enable the cylinder to begin its work at the right place and always at identically the same place. The bed is then carried forward, which revolves the form-cylinder, and the latter takes upon its printing-
85 surface the transfer-paper from the plate 11^a. The transfer-paper is then soaked off from the printing-surface on the form-cylinder, but the ink remains, as will be understood by those conversant with this line of industry. The
90 cylinder-surface is then developed into a printing-surface of the character desired. If a planographic-printing surface is desired, the cylinder is gummed up by hand or by being revolved in a gum-bath, any suitable bath
95 apparatus being employed for that purpose. It is then dried, after which it is washed off with water to remove the gum, as by revolving in the same bath apparatus now filled with water. The dampeners or water-rollers
100 are then applied to the surface, after which it is inked and resined and is suitably etched by being revolved in an etching-bath and dried. It is then washed in water and then
105 in water with turpentine, then dampened and inked, and if satisfactory it is then removed and is ready for application to a suitable planographic or lithographic printing press. It will of course be understood that
110 when the washing operations are being performed the bed and frames 109 and the inking-rollers are moved out of the way of the form-cylinder, and the inking and watering are also done while the cylinder is raised, the frames 109 in the latter case being of course
115 dropped so as to bring the inking-rollers into contact with the printing-surface on the form-cylinder. If a relief or intaglio printing surface is desired, a suitable deep-etching procedure is adopted to that end to develop the
120 cylinder into printing-surfaces of that character. The entire series of printing-surfaces (one for each color to be printed) having received related transfers, as described, and having been suitably etched or in other suitable
125 manner developed into printing-surfaces of the character desired, as described, are turned over to the printing department. In this latter part of my general process I print the colors for which separate printing-sur-
130 faces have been prepared in approximately—that is, substantially—instantaneous succes-

sion—that is to say, at one printing operation with but one handling of the paper or edition for the entire series of printings and without substantial or prolonged drying intervals between printings and preferably continuously and on the web and on a circumferentially-continuous impression-surface. One way that I have found successful in carrying out these steps of my general process is in detail as follows: The first step in the printing is to determine the order of arrangement of colors—that is to say, which color shall be printed first, which second, and so on—and here my process permits a distinct artistic advance, for the order of the printings can be determined largely by the artistic requirements of the picture. The order of printing of the colors having been determined upon, the cylindrical printing-surfaces prepared in the transferring-department are mounted in a suitable press—such, for instance, as the printing-press herein shown and described—and mounted in the order determined upon for the printing. The entire series of cylindrical printing-surfaces, moreover, are so mounted upon the press with respect to each other and to the drum impression-cylinder that they occupy a correspondingly positive relationship with respect to the impression-surface that each held to the setting-up plate and are in a positive and predetermined registering relationship with respect to one another, so that their designs will one and all exactly register on the paper. This may be conveniently attained and maintained, as hereinafter shown in connection with the printing-press of the drawings. The connection between the several parts of the press is positive and absolute, and the coincidence of register once attained is thereby reliably and automatically maintained. Proper dampening-rollers and proper inking-rollers are supplied for each printing-tube—such, for instance, as those shown in the printing-press of the drawings. The paper is preferably supplied in the web and is fed continuously onto a proper circumferentially-continuous supporting-drum or impression-cylinder, where it is held firmly in place on the drum and whence it passes with the drum under each one of the entire series of printing-tubes successively (arranged peripherally around the drum) and is continuously delivered with the finished pictures printed upon it. Thus the printing is done continuously and on the web, and the printing by all of the entire series of printing-surfaces is done in approximately instantaneous succession upon any given portion of the paper or web, one printing-surface giving its impression after another and one color being impressed or printed after another without any substantial drying intervals between the impressions or printings and without any movement of the paper upon or with respect to its supporting cylinder or drum between the printing of any one color of the series and that of every other color of the series. The details of the

printing as carried out in the apparatus that is shown in the drawings, which is well adapted to carry out this part of my process, are as follows:

Reference is here made to one of the accompanying drawings, forming a part of this specification—to wit, Fig. 3, which is a cross-section, partly central, of a suitable printing-press adapted to print as many as fifteen different colors in approximately instantaneous succession and continuously and represented as printing on the web. The machine is provided with a suitable frame 9, which may be of any approved kind, and in this is held a main drum or impression-cylinder 21, which is carried by a shaft 12, which is journaled in the frame and over which runs the web or paper from the roll 13, which is hung in the frame at one side of the main drum, and from this the paper web travels over guide-rollers 14 and 15 to the main drum 21, thence around the drum and off over guide-rollers 26 and 17, after which the paper is taken care of in any suitable way. The paper is held snugly on the drum 21 by suitable grippers, which are arranged on opposite sides of the drum and at necessary intervals around its periphery and suitably adapted to release their grip at the end of the printing operations. The machine may be driven in any convenient way, which it is not necessary here to describe. The printing-surfaces are arranged around the main drum and are positively connected with the same by gearing, so as to be positively driven therewith while the printing operation is proceeding. They are so mounted, however, as to be capable of being moved outward out of contact with the drum when not printing, if desired. The details of this mounting need not be here described. It is of course apparent that when the printing-surfaces are moved out means should be provided for moving out also the inking and other necessary mechanism adjacent to those surfaces; but the arrangement for doing this need not be described. The ink is supplied to each printing-surface from an air-tight fountain 63, and each fountain is provided with suitable means (not shown) to enable it to be filled and with the customary plug to control the supply to the discharge-roller and with a discharge-roller 67 in its mouth. The fountain and the inking-rollers may be together tilted up away from the printing-surface. The rollers 67 deliver ink through intermediate rollers to the main ink-distributing rollers 69, which through intermediate rollers that need not be described ink the printing-surfaces 42 quickly and well. The water-rollers 110 extend across the face of the main drum 21, but out of contact with the drum, and each roller 110 is adapted to contain a supply of water to water an adjacent printing-surface, and the roller is perforated and is covered by a cloth through which the water oozes, so that when the roller is swung into contact with the intermediate rollers it

will moisten the same, and they will carry the necessary water to the next printing-surface 42.

In operating the machine the several air-tight fountains 63 are filled with the different colored inks to be printed and are preferably kept filled automatically in any suitable way, the printing-surfaces have been suitably prepared and developed, so as to make the desired series of impressions on the paper web, and the drum 21 is provided with a yielding rubber cover, so that it will present a good surface for the paper. The several printing-surfaces are so spaced and distanced around the main drum and are so positively connected with and driven with the main drum by the gearings that when each is so turned on its axis as that its gearing will properly mesh with that of the main drum (which may be determined once for all when the press is first set up and the gearings then permanently marked where they should come together when properly meshed) the impressions made on the paper web by the entire series of printing-surfaces will exactly register each with every other. The paper is then fed through the machine, as described, and on being started the first printing-surface will impress its print and color on the paper, then the next printing-surface will when the first impression begins to reach it begin to make its impression on the same place and in exact register, then the third printing-surface makes its impression on the same place when that place on the paper reaches it, and so on. When this part of the paper emerges from the machine, the picture upon it is completed. Meantime other impressions have been following the first continuously and completed pictures are continuously delivered from the machine. Each printing-surface operates continuously, and all fifteen are printing simultaneously, and the fifteen different impressions in as many different colors, (although some of the colors may be printed twice or oftener, if desired, by as many different printing-surfaces,) which together when superposed at the same place on the paper in exact register with each other constitute the finished picture, are made in approximately instantaneous succession without special or substantial drying intervals between them and without movement of the paper upon or from the main drum between them. The printing-surfaces print continuously in reliable sequence, and the positive and predetermined relationship among them all and between each one of them and the paper-carrying main drum permits and completes the method of obtaining accurate register heretofore described in connection with the transferring part of the general process.

In connection with the descriptions of and references to mechanisms herein it is proper to remark that I do not limit myself in the carrying out of my general process or of any of its parts to the use of any of the said mechanisms or to the use of any special mechan-

isms whatever. My process may be carried out in many different ways, and in so carrying it out many different forms of mechanism may be employed, as well the mechanism that I have devised for the purpose as mechanisms that may hereinafter be devised for the purpose, or even in many details of the process mechanisms that are old for other uses or purposes. I do not herein claim any of the special mechanisms herein shown or described, most of said mechanisms forming the basis of other applications for patents filed or to be filed.

It is preferable and desirable that the surfaces that are to be developed into printing-surfaces should originally be planographic surfaces and so capable of receiving any sort of drawing or design in the transferring steps of my process; but having received such drawing or design or an ink imprint or impression direct or reverse thereof it is immaterial whether the surfaces be developed into planographic or lithographic printing surfaces or into relief-printing surfaces, or into intaglio-printing surfaces, or some of the series into the one kind and others of the series into the other kind or character of printing-surface. In any case the printing-surface when developed will print the drawing or design, so as above transferred to it and accurately and in register with all the other printing-surfaces of the series. To obtain the deep etching necessary to produce relief or intaglio printing surfaces, any of the known methods of deep etching may be employed or any that may hereafter be devised so long as they do not prevent or interfere with any of the essential steps of my process. In deep etching it will sometimes be desirable and economical to employ on parts of the printing-surface mechanical instrumentalities, such as a "routing" machine, to supplement the work of the etching acids, and such can be used in connection with the developing step of my process. Of course if the surfaces be developed into planographic-printing surfaces dampening devices will be necessary in the printing-press as well as inking devices, but if the surfaces be developed into relief or intaglio printing surfaces all dampening devices may be dispensed with in the printing-press.

Among the advantages of my improved process are these: It permits of printing in approximately instantaneous succession from an entire series of printing-surfaces without any special or substantial drying interval between the printing of one color and the printing of the next throughout the series and without any handling of the paper between successive printings and permits of printing continuously and on the web, and it renders the result of such printing at once better and cheaper. The multicolor-printing may be of largely pure-color effects, relative quick drying in that case peculiarly adapting it to my quick printing. Purer-color effects are thus attainable, brighter, more varied, more ex-

act. Again, the repetitions or overlayings may be less, in which case there will be a sharper clearer picture, and the work of the artist easier, simpler, more direct. Again, fuller tints may be used, which means not only less fine and less difficult work for the artist, but more solid and more substantial and more durable printing-surfaces less liable to be spoiled in the etching and preparation and in use. Again, the printing of all the colors in approximately instantaneous succession—that is to say, practically continuously at one operation, which is permitted by my new method of printing—avoids the necessary and inherent evils of successive printings with intervals for drying, among which are the expense and time and space of repeated handlings, the difficulty of obtaining even measurably approximate register, irregular changes wrought in the paper between printings by changing atmospheric conditions, by irregular dampness and dryness, &c. Better results are obtained with cheap paper in my new process than has heretofore been attained by the use of expensive paper. Again, in the new method opaque colors (like white, for instance, or yellow or vermilion) may be used more freely (either alone or in admixture with other colors) than in the old method, and this gives greater range and scope to the artist and greater accuracy and fidelity in the final result. Again, in the new process there is a wider range of choice in the order in which the colors may be actually printed, which is destined to produce important artistic results. Again, almost every tint and tone and color effect in the old method is a delicate balance attained by the compounding in the printing of many light and delicate tints, so that an error of value in any one of them will alter the final composite tint. Thus too strong or too weak a yellow may spoil half of the colors of the picture. Again, in the old method, even at its best, the color practice is a continual practice of compromises in which very few of the final resulting tints or colors are really true facsimiles of the picture to be reproduced. In the new method such sacrifices need never occur. Again, in all lithographic work there is a large opportunity for blundering and carelessness on the part of mechanics. Thus where a final color is composite, produced by seven or eight or more aggregated tints repeated or overlaid over each other, the liability to error undiscovered at the time and to the consequent spoiling of large quantities of work is greater than where that same final color is printed at once as a pure color. For a mistake not evident at the time or a careless blunder in printing any one of the seven or eight or more separate tints will spoil the result, and often an error in a single one will produce quite grotesque results. In the new method the delicate balance of colors may be attained on the palette or in the color-box—that is, visibly and before any

printing, and so before any harm is done, and it can be experimentally modified until satisfactory, and subsequently no defect of printing-plate or carelessness in printing will change that color. In the old way the delicate balance is attained only step by step, the whole edition being put through the first step before any goes through the second, and so on to the last, and it is often not until the last steps are reached that one can tell whether or not blunders were made in the first steps, and then it is too late to correct them. Again, in the new process the final registering of the different-color designs is not a matter of judgment or of adjustment in the printing-department, but becomes automatic there. Thus all the devices and methods and labor and loss of time of the press now required for obtaining and maintaining accurate register are done away with. In the new method the final register is obtained absolutely and beforehand and by a method including an absolute system of transferring followed by a related system of printing. In the new method judgment is eliminated, adjustment is not required, the old "rule of thumb" does not apply, time is saved, wages are saved, and copies are saved. Again, the quality of registering in the new way is positively perfect and entirely independent of the quality of the paper (or other material) imprinted, which while held and supported in a substantially immovable position upon the revolving-drum impression-cylinder passes approximately instantaneously under all the printing-surfaces, thus making possible printing on the web continuously and thus eliminating at once the factors of time and all possibility of error involved in successive operations of printing with intermediate handlings and separate feedings of the paper for each separate operation of printing, each of which in the old way customarily is made with varying printing-pressures and under varying atmospheric conditions. Again, there are peculiar advantages in the method as applied to rounded printing-surfaces, also as applied to rounded and continuous printing-surfaces, also as applied to flat setting-up plates in conjunction with rounded or with rounded and continuous printing-surfaces, also as applied to a continuous impression-surface in connection with printing continuously and on the web. Again, the new method in its preferred forms involves the avoidance of the great time losses in relief-plate or typographic printing incident to what is known as "making ready" in the printing-press, an operation which consumes a notable proportion of the time of press and pressmen in the old methods of typographic printing. In carrying out my invention with relief or intaglio printing-surfaces in the best form known to me in practice the printing-surfaces are inevitably so constructed and developed and are so held in the printing-press in a positive relationship to each other and to the impression surface or drum that

the printing-pressure is sufficient at every point of the printing-surfaces and uniform at every point, and this primarily and as a matter of construction of the parts and not as the
 5 result of experimental "make-ready" adjustments. This is of course also the case with planographic-printing surfaces.

The new method involves in its preferred form printing on the web and printing continuously and printing in approximately instantaneous succession. This is self-feeding. This it is that permits or attains the quickness and economy of the new method, avoiding the losses and errors of many separate
 15 feedings and printings. This it is that permits the use of continuous cylindrical printing-surfaces. Together these several features constitute the fastest and cheapest method of printing possible, for there is the minimum
 20 of lost motion, the minimum of lost time, the minimum of labor, and the minimum of possibility of errors. The entire series of printing-surfaces are working continuously and simultaneously, and a plurality of pictures are
 25 being simultaneously printed and each picture is being printed in all its colors at one operation in less than the time of one revolution of the paper-carrying drum or cylinder, and a plurality of finished pictures are delivered at each complete revolution of the
 30 drum impression-cylinder. The speed of the paper web under the printing-surfaces in the new method can be as great as or greater than that of the paper sheets over the flat printing-surfaces in the old method. As an illustration of the great gain in rapidity of production in the new method over the old it
 35 might be stated that the product of one of the improved presses, such as the one shown in the drawings, running at only the same surface speed as one of the lithographic presses now in use would be equal to the product of about one hundred and twenty-five of the lithographic presses now in use. Again, the
 40 result is better, as well as cheaper, in the new method than in the old. Whereas in the old methods register has been attained by laborious adjustment of each new stone or plate in the printing-press by the pressman and
 45 constant watchfulness to maintain the adjustment and by painstaking feeding of each separate sheet of paper into the press by the feeder at each separate operation of printing, in the new way accurate register is practically attained in the transferring department by accurate and exact transferring onto a series of
 50 printing-surfaces in accurate and related register throughout the series and with reference to the predetermined positions which those printing-surfaces are to occupy when properly mounted on the positively-connected form-cylinders of the press. Again, there are advantages of importance in connection with the ink and ink supply and mixing, and
 55 inks may be mixed by daylight, but supplied to presses printing continuously through the twenty-four hours.

The invention has been specifically described rather in connection with multicolor lithography; but it is apparent from the nature of the invention that it is applicable to the case of relief and intaglio printing, as heretofore stated—that is to say, where the design or its reverse is capable of being transferred or communicated to a printing-surface
 75 in the way heretofore described, and set out in the claims that follow, and the relief or intaglio printing-surface can be developed from the design so transferred—as, for instance, by deep etching—that is to say, the
 80 process will not be substantially different where that step or feature of it which consists in suitably developing the surface to which the design has been communicated into a printing-surface is carried out by deeply
 85 etching such surface or otherwise suitably treating it until it becomes a relief or an intaglio printing-surface for that design.

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

1. The method of preparing a series of registering printing-surfaces which consists in preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies
 95 of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which
 100 is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the
 105 base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with its printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical
 110 relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

2. The method of preparing a series of registering planographic-printing surfaces which consists in preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical

cal positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a planographic-printing surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

3. The method of preparing a series of registering rounded printing-surfaces which consists in preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a rounded printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

4. The method of preparing a series of registering rounded and continuous printing-surfaces which consists in preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a rounded and continuous printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

poses of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

5. The method of preparing a series of registering printing-surfaces which consists in preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching rolling contact with its printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

6. The method of preparing a series of registering rounded printing-surfaces which consists in preparing a series of registering flat basic surfaces each one of which shall accurately and exactly represent in reverse the evolved or unrolled superficies of one of the proposed rounded printing-surfaces with its design upon it, the basic surfaces consisting of a flat non-contractible and non-extensible base which duplicates the evolved or unrolled superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching rolling contact with a rounded printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

7. The method of preparing a series of registering rounded and continuous printing-surfaces which consists in preparing a series of registering flat basic surfaces each one of which shall accurately and exactly represent in reverse the evolved or unrolled superficies of one of the proposed rounded and continuous printing-surfaces with its design upon it, the basic surfaces consisting of a flat non-contractible and non-extensible base which duplicates the evolved or unrolled superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching rolling contact with a rounded and continuous printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, whereby the designs so communicated to the printing-surfaces may subsequently register automatically in the printing, substantially as described.

8. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with its printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register

is automatically obtained, substantially as described.

9. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies or one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a planographic-printing surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into planographic-printing surfaces, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register is automatically obtained, substantially as described.

10. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with its printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into printing-surfaces

of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom in approximately instantaneous succession, whereby register is automatically obtained, substantially as described.

11. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with its printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom in approximately instantaneous succession and on the web, whereby register is automatically obtained, substantially as described.

12. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a rounded printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the

printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register is automatically obtained, substantially as described.

13. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a rounded and continuous printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded and continuous printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register is automatically obtained, substantially as described.

14. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into posi-

tive and positively-matching contact with a rounded and continuous printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded and continuous printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom in approximately instantaneous succession and on the web, whereby register is automatically obtained, substantially as described.

15. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering flat basic surfaces each one of which shall accurately and exactly represent in reverse the evolved or unrolled superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a flat non-contractible and non-extensible base which duplicates the evolved or unrolled superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching rolling contact with a rounded printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relation, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register is automatically obtained, substantially as described.

16. The method of securing register in multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, preparing a series of registering flat basic surfaces each one of which shall accurately and exactly represent in reverse the evolved or unrolled superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a flat non-contractible and non-exten-

sible base which duplicates the evolved or unrolled superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching rolling contact with a rounded and continuous printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relation, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded and continuous printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register is automatically obtained, substantially as described.

17. The improvement in the art of multicolor-printing which consists in preparing a series of basic surfaces one for each color to be separately printed by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed; mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, and printing therefrom, whereby register may be automatically attained, substantially as set forth.

18. The improvement in the art of multicolor-printing which consists in preparing a series of basic surfaces one for each color to be separately printed by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all

the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed; mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, and printing from said printing-surfaces in series in approximately instantaneous succession, whereby register may be continuously and automatically attained, substantially as set forth.

19. The improvement in the art of multi-color-printing which consists in preparing a series of basic surfaces one for each color to be separately printed by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed; mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression-surface, supporting the paper on a continuous impression-surface, and printing from said printing-surfaces in series thereon in approximately instantaneous succession and on the web, whereby register is continuously and automatically attained, substantially as described.

20. The improvement in the art of multi-color-printing which consists in preparing a series of basic surfaces one for each color to be separately printed by applying the design

for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable rounded printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the rounded printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed; mounting said rounded printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression-drum, supporting the paper on a continuous impression-drum, and printing from said rounded printing-surfaces in series thereon in approximately instantaneous succession and on the web, whereby register is continuously and automatically attained, substantially as described.

21. The improvement in the art of multi-color-printing which consists in preparing a series of basic surfaces, one for each color to be separately printed, by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable rounded and continuous printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the rounded and continuous printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed; mounting said rounded and continuous printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression-drum, supporting the paper on a continuous impression-drum, and printing from said rounded and continuous printing-surfaces in series thereon in approximately instantane-

ous succession and on the web, whereby register is continuously and automatically attained, substantially as described.

22. The improvement in the art of multi-
 5 color-printing which consists in preparing a series of basic surfaces one for each color to be separately printed by applying the design for that color to a flat setting-up plate or other
 10 suitable flat surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide
 15 or guides in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable rounded printing-surface, the
 20 printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from
 25 the basic surfaces to the rounded printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed; mounting said rounded print-
 30 ing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression-drum, supporting the paper on a continuous impression-drum, and printing
 35 from said rounded printing-surfaces in series thereon in approximately instantaneous succession and on the web, whereby register is continuously and automatically attained, substantially as described.

40 23. The improvement in the art of multi-color-printing which consists in preparing a series of basic surfaces one for each color to be separately printed by applying the design for that color to a flat setting-up plate or other
 45 suitable flat surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or
 50 guides in such way that the design upon it shall have the same position with reference to said mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface
 55 and a suitable rounded and continuous printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of
 60 the series, whereby the designs are communicated from the basic surfaces to the rounded and continuous printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the
 65 several colors to be separately printed; mounting said rounded and continuous printing-surfaces in series in a printing-press in posi-

tions accurately fixed each with respect to every other and all with respect to the impression-drum, supporting the paper on a continuous impression-drum, and printing from
 70 said rounded and continuous printing-surfaces in series thereon in approximately instantaneous succession and on the web, whereby register is continuously and automatically
 75 attained, substantially as described.

24. The method of securing register in multicolor-printing which consists in preparing a basic surface by placing guiding-marks upon
 80 a suitable surface and applying the design for one color thereto accurately according to the guiding-marks thereon, bringing said basic surface into a definite relation with reference to certain mechanical guides, establishing contact between the basic surface and
 85 a second surface held in definite relation to the basic surface whereby the design is communicated from the basic surface to said second surface, suitably developing the second surface into a printing-surface for that color,
 90 preparing a second basic surface by applying the design for a second color to the same marked surface or a duplicate thereof accurately according to the same guiding-marks
 95 thereon, bringing the second basic surface into the same relation with reference to the mechanical guides as was had by the first basic surface, establishing contact between the second basic surface and a third surface held in the same relation to the basic sur-
 100 face as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to said third surface, suitably developing the third surface into a printing-surface for the second
 105 color, and so on for each printing-surface for each color to be separately printed, mounting said printing-surfaces in series in a printing-press in positions accurately fixed with respect to every other and all with respect to
 110 the impression surface or surfaces, whereby register may be continuously attained, and printing from said printing-surfaces in series, substantially as described.

25. The method of securing register in multicolor-printing which consists in preparing a basic surface by placing guiding-marks upon
 115 a suitable surface and applying the design for one color thereto accurately according to the guiding-marks thereon, bringing said basic surface into a definite relation with reference to certain mechanical guides, establishing
 120 contact between the basic surface and a second surface held in definite relation to the basic surface, whereby the design is communicated from the basic surface to said second surface, suitably developing the second surface into a printing-surface for that color,
 125 preparing a second basic surface by applying the design for a second color to the same marked surface or a duplicate thereof accurately according to the same guiding-marks
 130 thereon, bringing the second basic surface into the same relation with reference to the

mechanical guides as was had by the first basic surface, establishing contact between the second basic surface and a third surface held in the same relation to the basic surface, as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to said third surface, suitably developing the third surface into a printing-surface for the second color, and so on for each printing-surface for each color to be separately printed, mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, whereby register may be continuously attained, and printing from said printing-surfaces in series in approximately instantaneous succession, substantially as described.

26. The method of securing register in multicolor-printing which consists in preparing a basic surface by placing guiding-marks upon a suitable surface and applying the design for one color thereto accurately according to the guiding-marks thereon, bringing said basic surface into a definite relation with reference to certain mechanical guides, establishing contact between the basic surface and a second surface held in definite relation to the basic surface, whereby the design is communicated from the basic surface to said second surface, suitably developing the second surface into a printing-surface for that color, preparing a second basic surface by applying the design for a second color to the same marked surface or a duplicate thereof accurately according to the same guiding-marks thereon, bringing the second basic surface into the same relation with reference to the mechanical guides as was had by the first basic surface, establishing contact between the second basic surface and a third surface held in the same relation to the basic surface, as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to said third surface, suitably developing the third surface into a printing-surface for the second color, and so on for each printing-surface for each color to be separately printed, mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, whereby register may be continuously attained, and printing from said printing-surfaces in series in approximately instantaneous succession and continuously, substantially as described.

27. The method of securing register in multicolor-printing which consists in preparing a basic surface by placing guiding-marks upon a suitable surface and applying the design for one color thereto accurately according to the guiding-marks thereon, bringing said basic surface into a definite relation with reference to certain mechanical guides, establishing contact between the basic surface and a sec-

ond surface held in definite relation to the basic surface, whereby the design is communicated from the basic surface to said second surface, suitably developing the second surface into a printing-surface for that color, preparing a second basic surface by applying the design for a second color to the same marked surface or a duplicate thereof accurately according to the same guiding-marks thereon, bringing the second basic surface into the same relation with reference to the mechanical guides as was had by the first basic surface, establishing contact between the second basic surface and a third surface held in the same relation to the basic surface, as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to said third surface, suitably developing the third surface into a printing-surface for the second color, and so on for each printing-surface for each color to be separately printed, mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, whereby register may be continuously attained, and printing from said printing-surfaces in series in approximately instantaneous succession and continuously and on the web, substantially as described.

28. The method of securing register in multicolor-printing which consists in preparing a basic surface by placing guiding-marks upon a suitable surface and applying the design for one color thereto accurately according to the guiding-marks thereon, bringing said basic surface into a definite relation with reference to certain mechanical guides, establishing contact between the basic surface and a second surface rounded and held in definite relation to the basic surface, whereby the design is communicated from the basic surface to said second surface, suitably developing the second surface into a printing-surface for that color, preparing a second basic surface by applying the design for a second color to the same marked surface or a duplicate thereof accurately according to the same guiding-marks thereon, bringing the second basic surface into the same relation with reference to the mechanical guides as was had by the first basic surface, establishing contact between the second basic surface and a third surface rounded and held in the same relation to the basic surface, as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to said third surface, suitably developing the third surface into a printing-surface for the second color, and so on for each printing-surface for each color to be separately printed, mounting said rounded printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, whereby register may be con-

tinuously attained, and printing from said rounded printing-surfaces in series, substantially as described.

29. The method of securing register in multicolor-printing which consists in preparing a basic surface by placing guiding-marks upon a suitable surface and applying the design for one color thereto accurately according to the guiding-marks thereon, bringing said basic surface into a definite relation with reference to certain mechanical guides, establishing contact between the basic surface and a second surface rounded and continuous and held in definite relation to the basic surface whereby the design is communicated from the basic surface to said second surface, suitably developing the second surface into a printing-surface for that color, preparing a second basic surface by applying the design for a second color to the same marked surface or a duplicate thereof accurately according to the same guiding-marks thereon, bringing the second basic surface into the same relation with reference to the mechanical guides as was had by the first basic surface, establishing contact between the second basic surface and a third surface rounded and continuous and held in the same relation to the basic surface, as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to said third surface, suitably developing the third surface into a printing-surface for the second color, and so on for each printing-surface for each color to be separately printed, mounting said continuous rounded printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, whereby register may be continuously attained, and printing from said continuous rounded printing-surfaces in series, substantially as described.

30. The method of securing register in multicolor-printing which consists in preparing a basic surface by placing guiding-marks upon a suitable surface and applying the design for one color thereto accurately according to the guiding-marks thereon, bringing said basic surface into a definite relation with reference to certain mechanical guides, establishing contact between the basic surface and a second surface rounded and continuous and held in definite relation to the basic surface whereby the design is communicated from the basic surface to said second surface, suitably developing the second surface into a printing-surface for that color, preparing a second basic surface by applying the design for a second color to the same marked surface or a duplicate thereof, accurately according to the same guiding-marks thereon, bringing the second basic surface into the same relation with reference to the mechanical guides as was had by the first basic surface, establishing contact between the second basic surface and a third surface rounded and continuous and

held in the same relation to the basic surface as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to said third surface, suitably developing the third surface into a printing-surface for the second color, and so on for each printing-surface for each color to be separately printed, mounting said continuous rounded printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, whereby register may be continuously attained, and printing from said continuous rounded printing-surfaces in series in approximately instantaneous succession and continuously and on the web, substantially as described.

31. The method of securing register in multicolor-printing which consists in preparing a basic surface by suitably placing a design thereon, establishing contact between the basic surface and a second surface whereby the design is communicated from the basic surface to said second surface, suitably developing that second surface into a printing-surface, printing from said printing-surface, using the printed surface as a guide or key for the preparation of a second basic surface, preparing such second basic surface by placing the design for one color thereon accurately according to said guide or key, bringing said second basic surface into a definite relation with reference to certain mechanical guides, establishing contact between said second basic surface and still another surface held in definite relation to the basic surface whereby the design is communicated from the basic surface to the other surface, suitably developing that other surface into a printing-surface for that color, using the same printed surface or a duplicate thereof as a guide or key for the preparation of a third basic surface by accurately placing the design for a second color thereon, bringing said third basic surface into the same relation with reference to the mechanical guides as was had by the second basic surface, establishing contact between said third basic surface and still another surface held in the same relation to the basic surface as was had by the printing-surface for the first color, whereby the design is communicated from the basic surface to the other surface, developing that other surface into a printing-surface for the second color, and so on for each printing-surface for each color to be separately printed, mounting the said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with reference to the impression surface or surfaces, whereby register may be continuously attained, and printing from said printing-surfaces in series, substantially as described.

32. The improvement in the art of multicolor-printing which consists in preparing a series of registering designs or drawings one

for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with its printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom in approximately instantaneous succession, whereby register is automatically obtained, substantially as described.

33. The improvement in the art of multi-color-printing which consists in preparing a series of registering designs or drawings one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with its printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the

same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom in approximately instantaneous succession and on the web, whereby register is automatically obtained, substantially as described.

34. The improvement in the art of multi-color-printing which consists in preparing a series of registering designs or drawings one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a rounded and continuous printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded and continuous printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom in approximately instantaneous succession and on the web, whereby register is automatically obtained, substantially as described.

35. The improvement in the art of multi-color-printing which consists in preparing a series of registering designs or drawings one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of registering flat basic surfaces each one of which shall accurately and exactly rep-

resent in reverse the evolved or unrolled surfaces of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a flat non-contractible and non-extensible base which duplicates the evolved or unrolled superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching rolling contact with a rounded and continuous printing-surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relation, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded and continuous printing-surfaces of the character desired, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register is automatically obtained, substantially as described.

36. The improvement in the art of multicolor-printing which consists in preparing a series of registering drawings or designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, arranging a series of surfaces, adapted to be subsequently developed into printing-surfaces for those colors, in a positive relationship to the designs for those colors, or to one or more impressions thereof, each surface in the same relationship to its design or the impression or impressions thereof, as every other surface to its design or impression or impressions thereof, communicating the designs or impressions thereof to such surfaces by causing each such surface to make contact with its design or with the impression or impressions thereof while in the same positive and identical relationship with respect to its said design or to the said impression or impressions thereof that each other such surface bears to its design or to the impression or impressions thereof during contact, suitably developing such surfaces by etching or in other suitable manner into printing-surfaces of the character desired, mounting such printing-surfaces in series in a correspondingly positive relationship with respect to a suitable impression surface or surfaces, and in a positive and predetermined registering relationship with respect to one another, preparing each of the

several colors prior to the printing, inking the appropriate printing-surfaces therewith, and printing from said printing-surfaces in series in approximately instantaneous succession whereby the multicolor-picture may be produced quickly and economically and accurately, substantially as described.

37. The improvement in the art of multicolor-printing which consists in preparing a series of registering drawings or designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, applying those designs or impressions thereof to a suitable setting-up plate or plates, arranging the setting-up plate or plates and a series of surfaces adapted to be subsequently developed into printing-surfaces in a definite position with respect to each other so that each surface to be used as a printing-surface shall have the same relationship to the design for that surface or to the impression or impressions thereof as every other surface has to its design or to the impression or impressions thereof, communicating the designs or impressions thereof by contact to such surfaces while in such positive and identical relationship, suitably developing such surfaces by etching or in other suitable manner into printing-surfaces of the character desired, mounting such printing-surfaces in series in a correspondingly positive relationship with respect to a suitable impression surface or surfaces and in a positive and predetermined registering relationship with respect to one another, preparing each of the several colors prior to the printing, inking the appropriate printing-surfaces therewith, and printing from said printing-surfaces in series in approximately instantaneous succession whereby the multicolor-picture may be produced quickly and economically and accurately, substantially as described.

38. The improvement in the art of multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of basic surfaces, one for each color to be separately printed, by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to such mechanical guide or guides that every other design of the series has, establishing suitable contact be-

tween each basic surface and a suitable printing-surface, the printing-surfaces being held, each one of them, in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed, mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression surface or surfaces, preparing each of the several colors prior to the printing, inking the appropriate printing-surfaces therewith, and finally printing from said printing-surfaces in series in approximately instantaneous succession whereby the multicolor-picture may be produced quickly and economically and accurately, substantially as set forth.

39. The improvement in the art of multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of basic surfaces, one for each color to be separately printed, by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to such mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed, mounting said printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression-surface, preparing each of the several colors prior to the printing, inking the appropriate printing-surfaces therewith, supporting the paper on a continuous impression-surface, and finally printing from said printing-surfaces in series thereon in approximately instantaneous succession and on the web, whereby the multicolor-picture may be produced quickly and economically and accurately, substantially as set forth.

40. The improvement in the art of multicolor-printing which consists in preparing a series of registering designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of basic surfaces, one for each color to be separately printed, by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to such mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable rounded and continuous printing-surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the rounded and continuous printing-surfaces in accurate and related positions, suitably developing such surfaces into printing-surfaces for the several colors to be separately printed, mounting said rounded and continuous printing-surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression-drum, preparing each of the several colors prior to the printing, inking the appropriate rounded and continuous printing-surfaces therewith, supporting the paper on a continuous impression-drum, and finally printing from said rounded and continuous printing-surfaces in series thereon in approximately instantaneous succession and on the web, whereby the multicolor-picture may be produced quickly and economically and accurately, substantially as set forth.

41. The improvement in the art of multicolor-printing which consists in preparing a series of registering designs or drawings one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to the base accurately according to the position in reverse that it is desired that the design

shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in turn
 5 into positive and positively-matching contact with a planographic-printing surface whereby its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series
 10 being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other
 15 suitable manner into planographic-printing surfaces, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing
 20 therefrom in approximately instantaneous succession, whereby register is automatically obtained, substantially as described.

42. The improvement in the art of multi-color-printing which consists in preparing a
 25 series of registering designs or drawings one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another
 30 but no more at any given point than will dry approximately instantaneously, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the
 35 proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to
 40 the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series
 45 of bases, bringing each basic surface in turn into positive and positively-matching contact with a planographic-printing surface whereby its design is positively communicated to the printing-surface in predetermined position
 50 thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other
 55 suitable manner into planographic-printing surfaces, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing
 60 therefrom in approximately instantaneous succession and on the web, whereby register is automatically obtained, substantially as described.

65 43. The improvement in the art of multi-color-printing which consists in preparing a series of registering designs or drawings one

for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another
 70 but no more at any given point than will dry approximately instantaneously, preparing a series of registering basic surfaces each one of which shall accurately and exactly represent in reverse the superficies of one of the
 75 proposed printing-surfaces with its design upon it, the basic surfaces consisting of a non-contractible and non-extensible base which duplicates the superficies of the printing-surface and a design thereon which is applied to
 80 the base accurately according to the position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related
 85 and identical positions on the base or series of bases, bringing each basic surface in turn into positive and positively-matching contact with a rounded and continuous planographic-printing surface whereby its design is positively
 90 communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relationship, each one as every other,
 95 with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded and continuous planographic-printing surfaces, mounting such
 100 printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom in approximately instantaneous succession and on the
 105 web, whereby register is automatically obtained, substantially as described.

44. The improvement in the art of multi-color-printing which consists in preparing a
 110 series of registering designs or drawings one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another
 115 but no more at any given point than will dry approximately instantaneously, preparing a series of registering flat basic surfaces each one of which shall accurately and exactly represent in reverse the evolved or unrolled superficies of one of the proposed printing-surfaces
 120 with its design upon it, the basic surfaces consisting of a flat non-contractible and non-extensible base which duplicates the evolved or unrolled superficies of the printing-surface and a design thereon which is applied to the base accurately according to the
 125 position in reverse that it is desired that the design shall occupy on the printing-surface, the entire series of designs being applied in related and identical positions on the base or series of bases, bringing each basic surface in
 130 turn into positive and positively-matching rolling contact with a rounded and continuous planographic-printing surface whereby

its design is positively communicated to the printing-surface in predetermined position thereon, all the printing-surfaces of the series being held for the purposes of such contact in the same identical relation, each one as every other, with respect to the designs upon their respective basic surfaces, suitably developing such surfaces by etching or in other suitable manner into rounded and continuous planographic-printing surfaces, mounting such printing-surfaces in a positive and predetermined relationship with respect to one another and to a suitable impression surface or surfaces and printing therefrom, whereby register is automatically obtained, substantially as described.

45. The improvement in the art of multi-color planographic printing which consists in preparing a series of registering drawings or designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, arranging a series of planographic surfaces, adapted to be subsequently developed into planographic-printing surfaces for those colors, in a positive relationship to the designs for those colors, or to one or more impressions thereof, each surface in the same relationship to its design or the impression or impressions thereof, as every other surface to its design or impression or impressions thereof, communicating the designs or impressions thereof to such surfaces by causing each such surface to make contact with its design or with the impression or impressions thereof while in the same positive and identical relationship with respect to its said design or to the said impression or impressions thereof that each other such surface bears to its design or to the impression or impressions thereof during contact, suitably developing such surfaces by etching or in other suitable manner into planographic-printing surfaces, mounting such planographic-printing surfaces in series in a correspondingly-positive relationship with respect to a suitable impression surface or surfaces, and in a positive and predetermined registering relationship with respect to one another, preparing each of the several colors prior to the printing, inking the appropriate printing-surfaces therewith, and printing from said planographic-printing surfaces in series in approximately instantaneous succession whereby the multi-color-picture may be produced quickly and economically and accurately, substantially as described.

46. The improvement in the art of multi-color planographic printing which consists in preparing a series of registering drawings or designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors

will in the printing be more or less overlaid upon one another but no more at a given point than will dry approximately instantaneously, applying those designs or impressions thereof to a suitable setting-up plate or plates, arranging the setting-up plate or plates and a series of planographic surfaces adapted to be subsequently developed into planographic-printing surfaces in a definite position with respect to each other so that each surface to be used as a printing-surface shall have the same relationship to the design for that surface or to the impression or impressions thereof as every other surface has to its design or to the impression or impressions thereof, communicating the designs or impressions thereof by contact to such surfaces while in such positive and identical relationship, suitably developing such surfaces by etching or in other suitable manner into planographic-printing surfaces, mounting such planographic-printing surfaces in series in a correspondingly-positive relationship with respect to a suitable impression surface or surfaces and in a positive and predetermined registering relationship with respect to one another, preparing each of the several colors prior to the printing, inking the appropriate printing-surfaces therewith, and printing from said planographic-printing surfaces in series in approximately instantaneous succession whereby the multi-color-picture may be produced quickly and economically and accurately, substantially as described.

47. The improvement in the art of multi-color planographic printing which consists in preparing a series of registering designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of basic surfaces, one for each color to be separately printed, by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into a definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to such mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable planographic-printing surface, the printing-surfaces being held, each one of them, in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the printing-surfaces in accurate and related positions, suitably developing such surfaces into planographic-printing surfaces for the several

colors to be separately printed, mounting said planographic-printing surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with
 5 respect to the impression surface or surfaces, preparing each of the several colors prior to the printing, inking the appropriate printing-surfaces therewith, and finally printing from
 10 said planographic-printing surfaces in series in approximately instantaneous succession whereby the multicolor-picture may be produced quickly and economically and accurately, substantially as set forth.

48. The improvement in the art of multi-
 15 color planographic printing which consists in preparing a series of registering designs one for each color to be separately printed, the designs being so prepared with reference to one another as that the colors will in the
 20 printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of basic surfaces, one for each color to be separately printed, by applying the
 25 design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing each basic surface into definite relation with reference to certain mechanical
 30 guide or guides in such way that the design upon it shall have the same position with reference to such mechanical guide or guides that every other design of the series has, establishing suitable contact between each basic surface and a suitable planographic-printing
 35 surface, the printing-surfaces being held, each one of them in the same position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the printing-surfaces in accurate and related positions, suitably developing such surfaces into planographic-printing surfaces for the several
 40 colors to be separately printed, mounting said planographic-printing surfaces in series in a printing-press in positions accurately fixed each with respect to every other and all with
 45 respect to the impression-surface, preparing each of the several colors prior to the printing, inking the appropriate printing-surfaces therewith, supporting the paper on a continuous impression-surface, and finally printing from said planographic-printing surfaces
 50 in series thereon in approximately instantaneous succession and on the web, whereby the multicolor-picture may be produced quickly

and economically and accurately, substantially as set forth. 60

49. The improvement in the art of multicolor planographic printing which consists in preparing a series of registering designs one for each color to be separately printed, the designs being so prepared with reference to
 65 one another as that the colors will in the printing be more or less overlaid upon one another but no more at any given point than will dry approximately instantaneously, preparing a series of basic surfaces, one for each color to
 70 be separately printed, by applying the design for that color to a setting-up plate or other suitable surface, the design for each color being accurately applied with reference to all the designs for all the other colors, bringing
 75 each basic surface into definite relation with reference to certain mechanical guide or guides in such way that the design upon it shall have the same position with reference to such mechanical guide or guides that every
 80 other design of the series has, establishing suitable contact between each basic surface and a suitable rounded and continuous planographic-printing surface, the printing-surfaces being held, each one of them in the same
 85 position with reference to the aforesaid mechanical guide or guides as every other printing-surface of the series, whereby the designs are communicated from the basic surfaces to the rounded and continuous printing-surfaces
 90 in accurate and related positions, suitably developing such surfaces into planographic-printing surfaces for the several colors to be separately printed, mounting said rounded and continuous planographic-printing sur-
 95 faces in series in a printing-press in positions accurately fixed each with respect to every other and all with respect to the impression-drum, preparing each of the several colors prior to the printing, inking the appropriate
 100 rounded and continuous printing-surfaces therewith, supporting the paper on a continuous impression-drum, and finally printing from said rounded and continuous planographic-printing surfaces in series thereon in
 105 approximately instantaneous succession and on the web, whereby the multicolor-picture may be produced quickly and economically and accurately, substantially as set forth.

In testimony whereof I have signed my
 name to this specification in the presence of
 two subscribing witnesses. 110

EDWARD HETT.

Witnesses:

EDWIN SEGER,
 SIDNEY MANN.