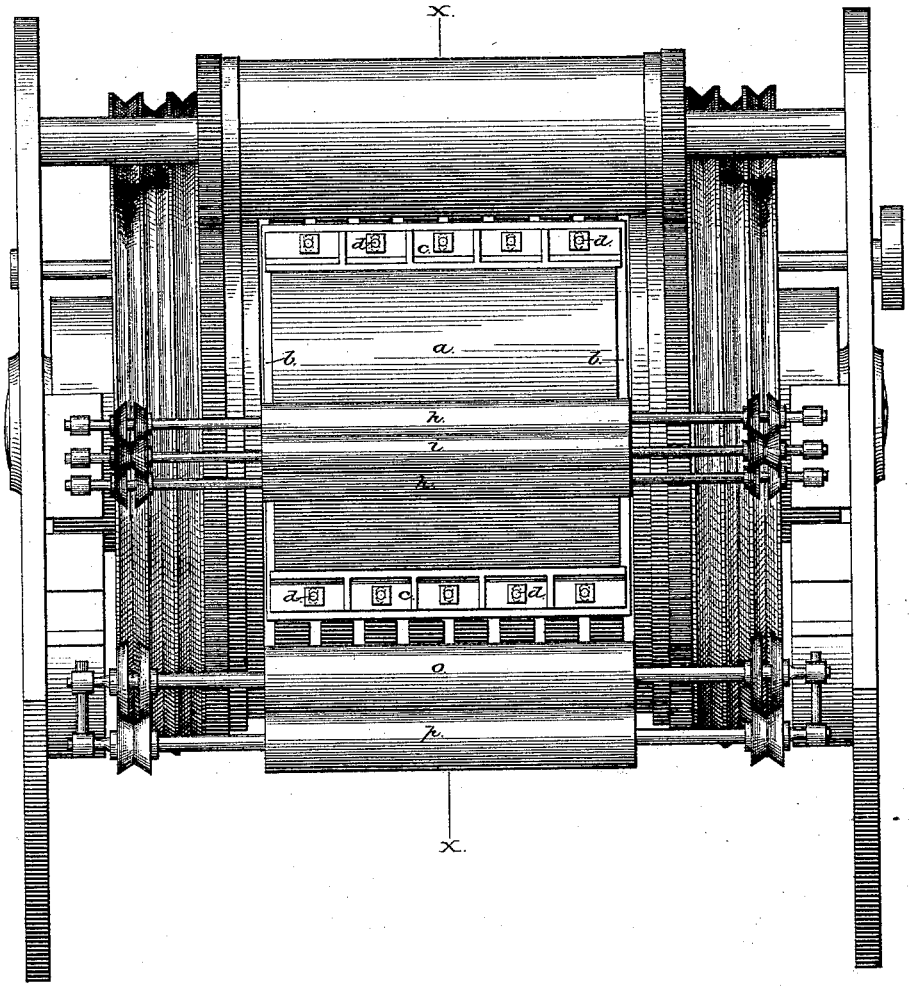
(No Model.) 3 Sheets—Sheet 1.

W. H. FORBES.

CHROMATIC PRINTING MACHINE.

No. 302,244. Patented July 22, 1884.

Fig. 1.



WITNESSES

John A. Ellis.

Thos. T. Thurlow

INVENTOR

William H. Forbes.

J. W. Osborne

ATTORNEY

(No Model.) 3 Sheets—Sheet 2.

W. H. FORBES.

CHROMATIC PRINTING MACHINE.

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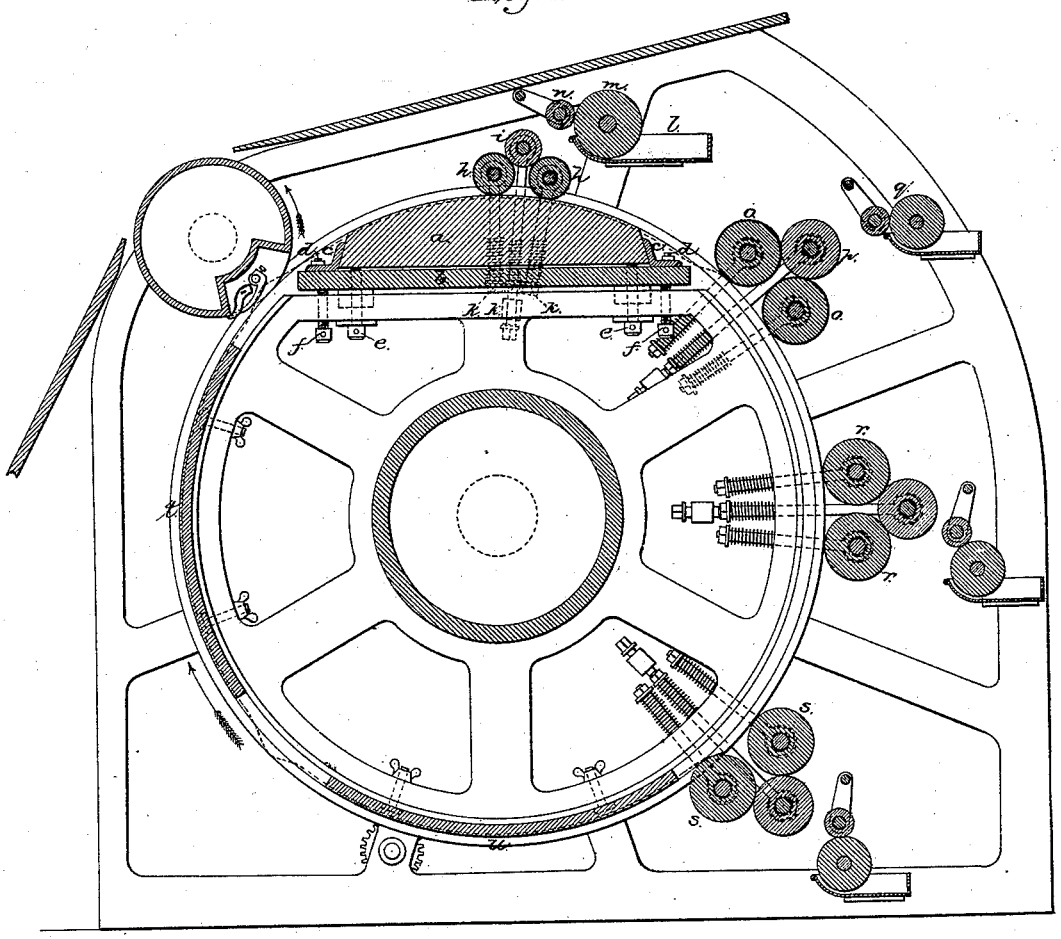
Fig. 2.



WITNESSES

John A. Ellis

Thos. F. Thurlow

INVENTOR

For William H. Forbes

J. W. Osborne

ATTORNEY

(No Model.) 3 Sheets—Sheet 3.

W. H. FORBES.

CHROMATIC PRINTING MACHINE.

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Fig. 3.

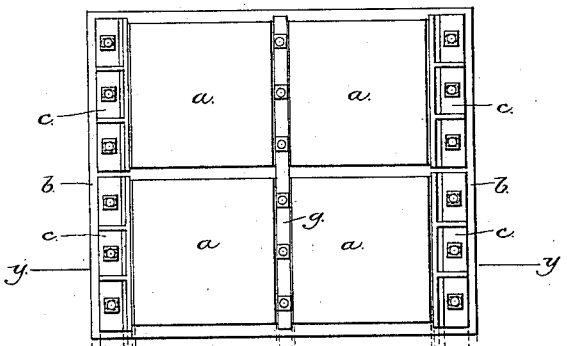
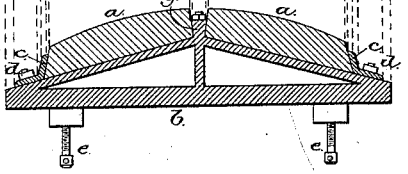


Fig. 4.



WITNESSES

John A. Ellis.

Thos. T. Thurlow

INVENTOR

for- William H. Forbes

J. W. Osborne

ATTORNEY

UNITED STATES PATENT OFFICE.

WILLIAM H. FORBES, OF BOSTON, MASSACHUSETTS.

CHROMATIC-PRINTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 302,244, dated July 22, 1884.

Application filed February 5, 1881. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. FORBES, of Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Chromatic-Printing Machines, of which the following is a specification.

My invention relates to the mechanisms for printing two or more designs in different colors, and in register one with the other on a single sheet of paper, whereby a chromographic picture or delineation is produced.

For the efficient working of my invention a chromatic press may be employed. Such presses, as heretofore conceived and made, are designed to print on one sheet a continuous series of impressions from relief-plates or engraved wooden blocks in the typographic manner. The sheet, after it is received by the machine, is impressed in turn by each form properly inked with the color it is intended each should print, and the result is a picture or design in which each color conduces to the general effect. There is no essential difficulty in producing good results in this way. If the attempt be now made to substitute for the relief-plates lithographic stones or zinc plates prepared with printable drawings or transfers, so as to produce a chromo-lithographic picture by consecutive printings therefrom, an insurmountable difficulty is met with. This is due to the fact that a printable lithographic or zincographic drawing is on the surface of the stone or metal, not raised above it, and the sheet of paper, while it is being printed, is therefore pressed into intimate contact with the whole surface. If, then, the same sheet be presented to a number of stones in rapid succession, each printing a different color, the fresh ink upon any one impression will offset where it overlaps upon the clean parts of the next-following stone, producing there a smear which will continue to grow both from the sheets and from the rollers, and which will in a short time destroy the work. It is for this reason that, in ordinary chromo-lithographic printing, the ink upon each successive impression is carefully and thoroughly dried, (several days being usually required for this purpose,) before the next-following impression is made upon the sheet. In producing chromographs from relief-plates this difficulty does not exist, because no offset of the ink can take place, as only those parts of a plate come in contact with the sheet which are meant to print. The advantages of lithographic printing for color-work are, however, very great, for by that method the gradation and details of shading are much more readily, perfectly, and artistically obtained, and a better result produced than is possible from relief-plates or wood. In my invention I combine these two methods, generally using lithographic, zincographic, or photo-collographic printing for the outline, most of the details, and the shadows, and relief-printing for the colors required to complete the design, although this apportionment may be sometimes reversed or modified. I have found that excellent results can be produced by this combination, if the first printing only in the series is made from stone or its equivalent in the lithographic manner; and that it is perfectly safe to print on the impression so made, and while its ink is still wet, with one or more relief-plates or engraved blocks, whereby I gain most of the advantages inherent in lithography, zincography, or photo-collography, joined with the great rapidity and cheapness obtainable by typographic printing.

Although it is possible to combine the two methods by the simultaneous use of two presses, I prefer in the practice of my invention to employ a chromatic press of good construction, making certain essential changes and additions generally applicable to all presses of the kind, whether the printing-surface be convex or flat. These I proceed to particularize in connection with a known chromatic press, selecting for this purpose the press, a United States patent, which was granted to Thomas B. Dooley, December 14, 1880, and numbered 235,606. This machine consists of two parallel cylinders, the surface-speed of each being the same. One of these is the form-cylinder, the other the impression-cylinder. The diameter of the former is to that of the latter as the number of forms the press prints plus one is to one. In the drawings forming part of this specification, the diameter of the form-cylinder of the press shown is four times that of the impression-cylinder. The press is therefore adapted for printing three colors at every perfect revolution. The

sheet is taken by grippers on the impression-cylinder, and during three successive revolutions of said cylinder it is brought in contact, successively, with three different forms on the form-cylinder, completing the picture. During the fourth revolution the sheet is thrown off the impression-cylinder and another taken on. The inking of the forms is done by rollers—a separate set for each form. Each roller runs in bearings attached to the side framing of the press, which can slide to and fro in the direction of the radius of the form-cylinder, and which are held by springs toward its axis. The spindle of each roller is provided near its ends with pulleys or collars, which run in V-shaped annular grooves on that part of the face of the form-cylinder which is outside the belt occupied by the forms—one pair of grooves for each set of rollers. The grooves and collars are so adjusted that if the former were complete all the way round the cylinder the rollers would never touch any of the forms. To effect the inking of any particular form, therefore, it is necessary to depress concentrically the two grooves belonging to its rollers for a space corresponding to its length, (nearly one-fourth the circumference of the form-cylinder in the machine shown,) so that the rollers, under the influence of their springs, may run upon the form and ink it, rising out of the way of all other forms when that operation is over. The form-cylinder in this press is built up of short sections in a way made intelligible by the drawings in the patent hereinbefore cited. In this description reference is only made to those parts which are connected with the present invention. The way in which the sheets are seized and discharged, the adjustment of the pressure exerted by the inking-rollers on the forms, the distribution of the ink, and other details need not be referred to, and will be found fully set forth in the above-mentioned patent.

In the accompanying drawings, Figure 1 is a plan showing the press as seen from above, the feed-board, water-fountain, ink-fountains, and composition-rollers removed. Fig. 2 is a section on the line *x x*. As this line passes between two of the cylinder-sections, some of the surfaces in the view appear as in elevation. Fig. 3 is a plan showing a method of holding a number of stones. Fig. 4 is a section of the foregoing on the line *y y*.

As shown in Fig. 2, I place first in the series of forms attached to the form-cylinder a lithographic stone or its equivalent, so that the impression from it is always made upon a clean unprinted sheet, whereby the printing-surface suffers no injury. When this printing-surface consists of zinc, or when the work has been produced photographically or otherwise on a collographic surface, which also admits of being readily bent, the shape of the cylinder need not be changed from that used for typographic forms, and such plates are fastened to the form-blocks in a way similar to that used for stereotype or electrotype relief-plates; but when a large lithographic stone is to be printed from a modification is desirable of the shape of the short sections constituting the printing-belt of the form-cylinder. Such a stone, *a*, is shown in section in Fig. 2. Its upper surface is curved cylindrically, using the proper radius, and in the press its flat side rests upon a strong iron plate, *b*, to which it is firmly held by the angle-strips *c c*, the two outside faces of which meet at an obtuse angle. Two opposite edges of the stone are beveled to fit flat against the angle-strips, which latter are bolted to the plate by the bolts *d d* *d*, passing through oval slots in the strips, so that the stone may be laterally adjusted in every direction, with a view to the proper registration of the drawing upon it. The plate *b* has a flat surface provided for it upon the cylinder, and the screws *e e* from the inside (of which four or more may be used) enter the plate or projecting lugs upon the same, and hold it fast when its position has been properly determined. The screws *f f* *f f*, the nuts of which are attached to the cylinder, butt against the under side of the plate, and are used to lift or lower it, so that an equal and sufficient pressure shall be exerted upon the stone when it passes under the impression-cylinder in printing. It often happens that the work required from a press of this description is of small size, in which case several repetitions of the same design are printed at once, a blank margin being left between each. Under such circumstances several small stones can be used. Figs. 3 and 4 show in plan and section the manner in which four such small stones may be held upon the plate *b*. The face of the plate has two inclined surfaces, so constructed that stones of the usual thickness placed upon them will admit of being ground to the required curvature. The opposite edges of each stone are beveled, as in the previous case, and the rib *g* and angle-strips *c c c c* hold them to the plate. The methods which have been detailed accomplish the ends in view; but there are other ways of holding a lithographic stone or stones in place upon the form-cylinder and making the proper adjustments with reference to register and the impression-cylinder, the consideration of all which at length is unnecessary. It may be added, also, in connection with this part of the subject, that should the accumulation of weight upon one side of the cylinder seriously disturb its balance the same may be restored by an adjustable counterpoise attached to its axis in a manner well understood.

Whether the first printing be made from stone, zinc, or gelatine, it is necessary that the whole surface be evenly damped with water, after each impression, before the inking-rollers come upon it. This I accomplish by means of the rollers *h h*, made of the usual absorbent material used by lithographers. The collars

on the spindles of these rollers, like those used for printing in this kind of chromatic-press, are V-shaped, each consisting of two disks, and the riding-roller *i*, lying upon the damping-rollers, is like that in common use, and has also collars of a V shape, but reversed, to drop between and lie on those of the damping-rollers. The V-shaped grooves belonging to the damping-rollers are concentrically depressed in that quarter of the circumference of the form-cylinder in which the stone is placed, so that the damping-rollers and their rider, drawn down by their respective springs *k k k*, will fall upon the stone or other printing-surface as that surface passes under them, and rise out of the way when it is passed. In Fig. 2 these rollers are shown on the stone in the act of damping it. These rollers receive a suitable supply of water from the water-fountain *l*, the water being taken from the surface of the fountain-roller *m* by the carrying-roller *n*, which vibrates between the fountain-roller and the rider *i*.

The mechanisms by which the fountain-roller is driven and the carrying-roller made to vibrate, as well as that which controls the quantity of water supplied to the damping-rollers, are not shown in the drawings, as such devices are well known and understood and are in every-day use. The inking-rollers *o o*, for the lithographic or equivalent printing-surface, follow the damping-rollers as closely as may be. They are constructed with the leather covering or other material used in the lithographic method of printing, and have in contact with them the distributing-roller *p*. Two inking-rollers are shown in the drawings; but the number may of course be increased, to suit the requirements of the work, and the distribution of the ink carried from the fountain *q* may be made over any desirable number of intermediate rollers. The inking-rollers have also V-shaped collars, which may run in the grooves upon the cylinder provided for the damping-rollers. In the position of the press shown in the drawings the inking-rollers are about to fall upon the stone. The rollers *r r* and *s s* are for inking the forms *t* and *u*, respectively. Their general arrangement is in all essential respects identical with the foregoing, and will be found fully set forth in the United States Patent hereinbefore cited.

The production of a chromographic design consisting of three colors in this press would proceed as follows: Assuming all the forms to have been inked, a sheet is fed to the grippers on the impression-cylinder while the blank quarter of the form-cylinder is passing under the same. As both cylinders revolve, this sheet is brought into contact with the lithographic surface, and the first impression taken. The stone passes on, and is immediately damped by the rollers *h h* and subsequently inked by the rollers *o o*. In the meantime the first relief-form, *t*, passes under the impression-cylinder, and the second impression is printed, after which the third impression from the relief-form *u* is accomplished in like manner. During this last printing the grippers release the sheet, and its front edge is thrown over the delivery-board, on which it finally falls when the blank space upon the form-cylinder is again under the impression-cylinder, the grippers being then ready to seize the next sheet. At the close of the last printing, the form *t* begins to receive ink from the rollers *r r*, and during the next quarter-revolution the form *u* comes under the rollers *s s*. In this way the several operations of damping, inking, and printing are accomplished, and a finished design is the result, in which the lithographic and typographic methods have been conjointly and advantageously employed in the production of work which has hitherto been equaled only when the sheets were dried after each printing.

Having thus described my invention and the manner in which the same is practically carried out, what I claim, and wish to secure by Letters Patent, is—

1. In a press for chromographic printing, an impression-cylinder, in combination with a form-cylinder bearing a lithographic stone or its equivalent, and one or more surfaces for printing in relief.

2. In a chromographic press, the combination of the following elements: a form-cylinder provided with a lithographic or equivalent printing-surface, and also with one or more relief-surfaces, mechanisms, substantially as described, adjacent to said cylinder for damping and inking the lithographic surface and inking the relief-surface, and an impression-cylinder of relatively small size.

WILLIAM H. FORBES.

Witnesses:
O. F. STEPHENSON,
CHAS. N. SNOW.