H. L. RECKARD.

PROCESS OF ENGRAVING.

APPLICATION FILED OCT. 5, 1909.

962,096. Patented June 21, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

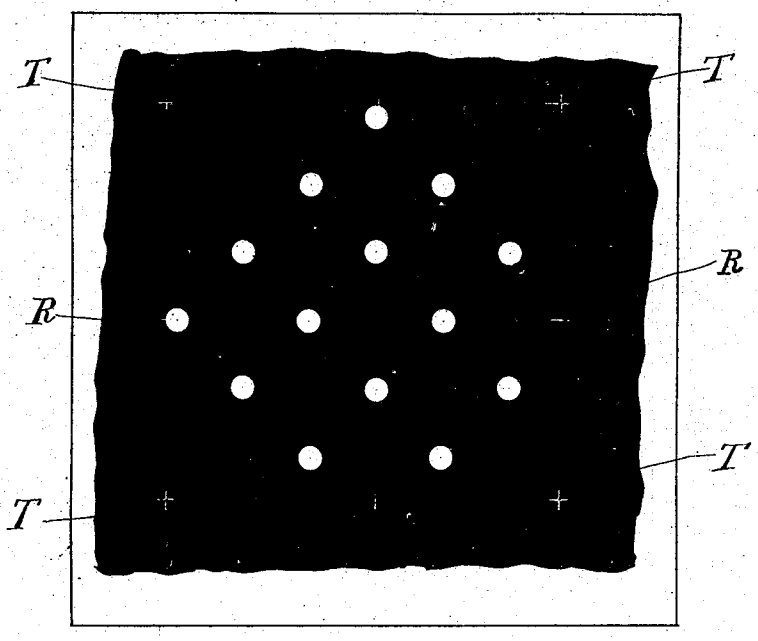


Fig. 2.

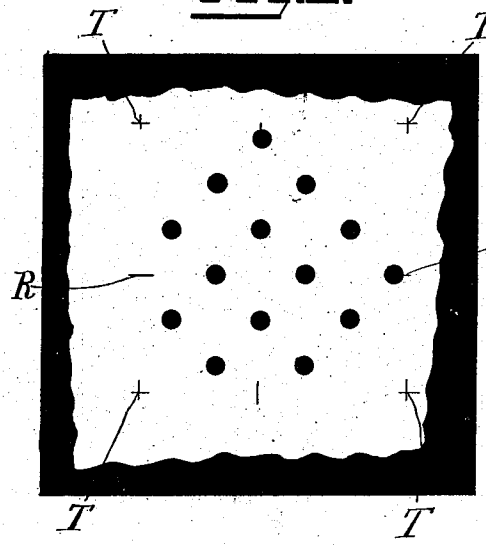
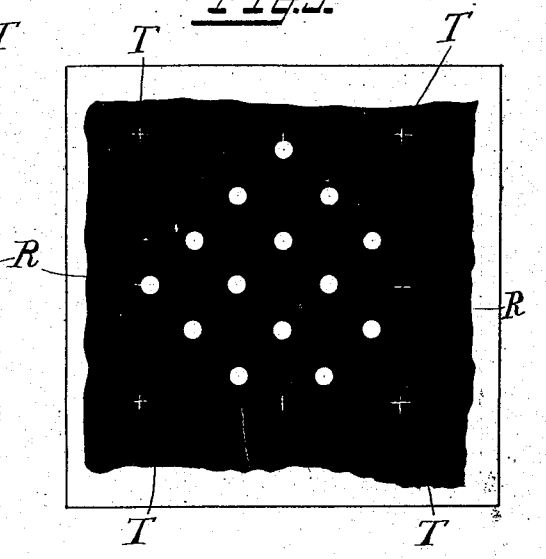


Fig. 3.



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3 SHEETS—SHEET 2.

Fig. 4.

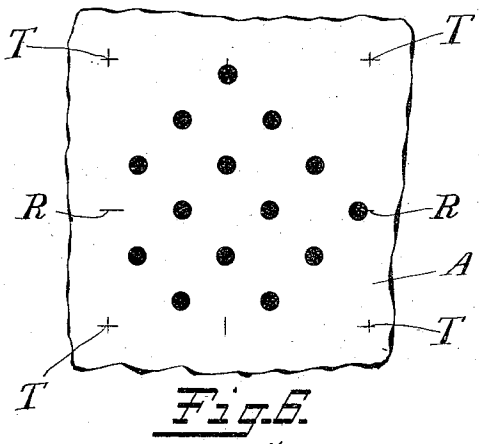


Fig. 5.

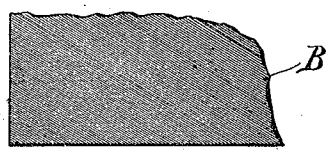


Fig. 6.

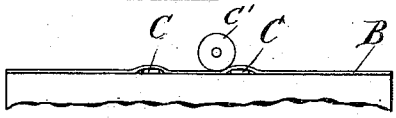


Fig. 7.

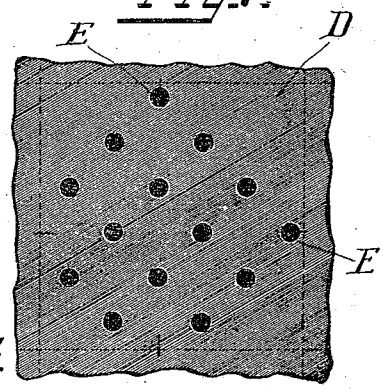
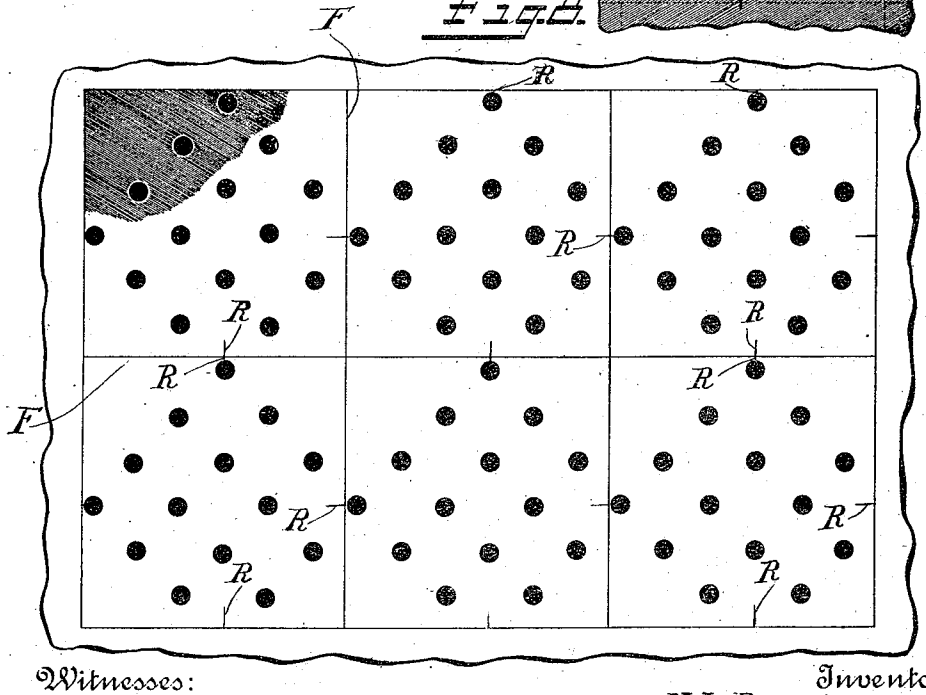


Fig. 8.



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APPLICATION FILED OCT. 5, 1909.

962,096.

Patented June 21, 1910.

3 SHEETS—SHEET 3.

Fig. 9.

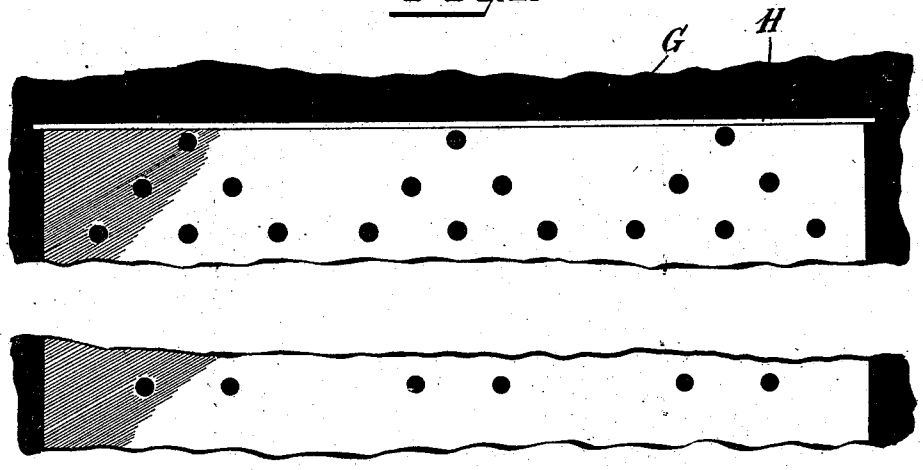


Fig. 10.

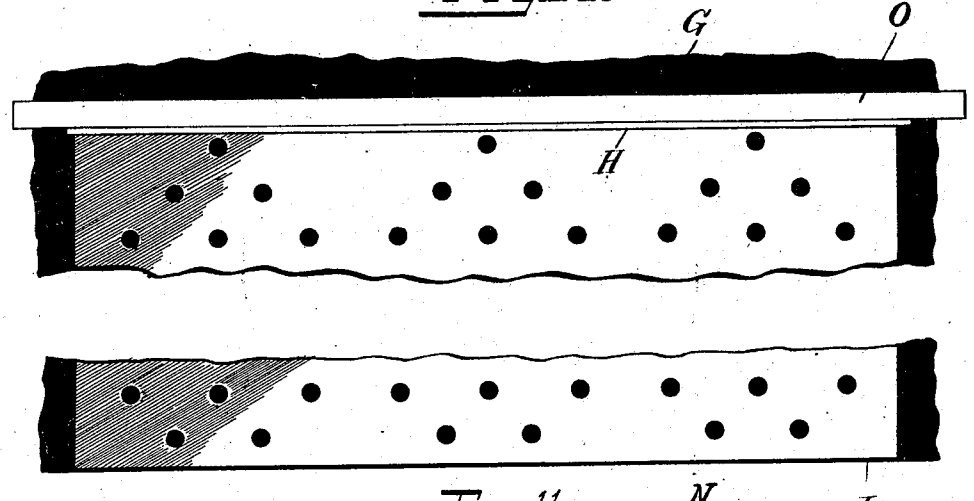
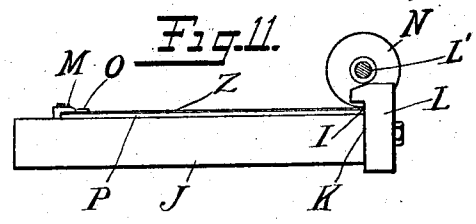


Fig. 11.



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UNITED STATES PATENT OFFICE.

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PROCESS OF ENGRAVING.

962,096. Specification of Letters Patent. Patented June 21, 1910.

Application filed October 5, 1909. Serial No. 521,144.

To all whom it may concern:

Be it known that I, HENRY L. RECKARD, a citizen of the United States, residing at Hartford, county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Processes of Engraving, of which the following is a full, clear, and exact description.

My invention relates to a process of engraving printing surfaces and has for its object to produce a simple, accurate, inexpensive and rapid method of engraving such surfaces for either intaglio or relief printing.

It further has for its object to provide, when necessary, suitable "grounds" upon the engraved surface.

The full process as described by me produces an engraved roller having a grounded intaglio printing surface for printing the original design. An intaglio printing surface is the form which is required for the printing of fabrics such as cottons, silks, plushes, velvets, carpets, wall-papers and the thinner kinds of oilcloth known as table oilcloth. A modification thereof produces surfaces for relief printing.

The following is a description of a process involving my invention, reference being had to the accompanying drawings, in which—

Figure 1 illustrates an original drawing of the design to be engraved. Fig. 2 is a photographic negative of the same somewhat reduced. Fig. 3 is a photographic positive of Fig. 1 correspondingly reduced. Fig. 4 is a photolithograph made from the positive of Fig. 3. Fig. 5 represents a Ben Day or similar film. Fig. 6 represents the Ben Day film being applied to the lithograph. Fig. 7 represents the photolithograph after the Ben Day film has been applied thereto. Fig. 8 represents a lay-out of transfers. Fig. 9 represents a sheet of zinc or the like to which the ink and the transfers of Fig. 8 have been applied. Fig. 10 represents a sheet of Fig. 8 prepared to transfer the design thereon to a roller so that the roller may be etched in such manner as to print repeats of the design of Fig. 1. Fig. 11 represents a machine for printing the design on a roller.

Referring more particularly to the drawings, Fig. 1 represents a drawing of a design to be engraved, which for convenience is shown as a simple design which may be repeated so as to make a continuous composite whole. This drawing has limit marks T, which define its limits.

In carrying out my process the distance covered by one revolution of the roller to be engraved when in the printing machine is first ascertained. If the roller is accurately geared to the printing bed or platen, this distance will be exactly the same as the circumference of the roller. If the design is to be repeated on the roller, this distance is divided into a number of equal parts, each equal to the length of the desired engraving of the original design. Thus, if the roller is to contain two repeats, this distance should be divided into two equal parts.

The original drawing, Fig. 1, is made upon paper, preferably white cardboard, the dimensions being considerably larger than the desired engraving thereof which is to be produced upon the surface to be engraved. This permits of reduction in photographing for the purpose of producing sharp, clean results. Where a single color is to be printed, the design should preferably be made in black. From the original design a photographic negative (Fig. 2) is made by means of a camera. From the negative a positive (Fig. 3) is made upon a photographic plate. This positive must have its length between its limit marks T exactly equal to one of the number of equal parts into which the distance covered by one revolution of the roller has been divided. Preferably I make the negative (Fig. 2) of the desired reduced size and make the positive (Fig. 3) of the same size as the negative (Fig. 2).

Wet plate photography is preferably used because of the resulting strong contrast of opacity and transparency.

Having produced the positive photograph upon the photographic plate, which I shall hereafter term the "photograph", a lithographic stone or suitable metal plate is prepared and given a sensitive coating and a photolithograph A is produced from the photograph in the usual manner. The stone or plate with the photolithograph thereon I term the "photolithograph", and is shown in Fig. 4. As is well known the surfaces of this photolithograph which were exposed to the light take ink and print while the surfaces which were not exposed will not take ink, and a transfer made from the photolithograph will have the black and white reversed from what they are in the photograph and the original sketch.

In case the design is such that "grounds" will have to be provided, I roll the photo-

lithograph until the ink is built up to a thickness of say 1/200 of an inch, as shown at C. I then take a flexible printing surface B provided with fine ridges or dots, such for instance as a "Ben Day" film, shown in Fig. 5, and covering its projections with ink, lay the same over such portions of the photolithograph as it is desired to provide with a ground and press it thereon by means of a soft roller C', as shown in Fig. 6. The printing film is somewhat stiff and its stiffness prevents the ridges or dots thereon from touching the depressed surfaces of the photolithograph close to the portions C where the ink is built up thereon. The large bare surfaces D therefore have printed thereon lines or dots corresponding to the projections on the flexible plate, as shown in Fig. 7. These lines or dots do not extend clear to the edges of the theretofore bare surfaces but stop short so as to leave clear lines E between the ground and the built up ink. The clear lines thus formed are necessary, it having long been known that in intaglio printing the grounds must not extend to the outlines of the design since otherwise a rough and uneven edge will be produced. The "Ben Day" film is preferably applied to the photolithograph since it is then necessary to apply it to only one element of the design. It may, however, be applied at a later stage as hereafter explained. Of course, the photolithograph when the printing film is applied is dried so that it will take ink wherever contact is made.

Having produced the photolithograph with the ground lines thereon, an accurate lay-out or development of the area covered by the roller in making one revolution is made on a smooth stiff card or metal plate faced with paper. This is divided into areas of exactly the size of the photograph. A number of lithographic transfers are then made from the photo-lithograph in the usual manner sufficient to cover the lay-out. The transfers are then cut to size and stuck up in the usual way, their edges abutting together as shown at F in Fig. 8. The limit marks may be extended as shown in dotted lines in Fig. 7.

After the transfers have been stuck up, as shown in Fig. 8, I may roll the roller to be engraved over the transfers thus arranged, transferring the ink of the transfers directly to the roller where it will remain after the paper of the transfers has been removed, but I prefer for accuracy and other reasons to transfer the ink of the transfers to a thin sheet of zinc G about 1/100 of an inch in thickness. This is done in the usual manner by bringing the thin zinc sheet into contact with the transfers under pressure and needs no further description.

After the ink of the transfers has been transferred to the zinc sheet and the paper of the transfers removed therefrom with water, the zinc sheet is rubbed up, slightly etched and rolled up with an inking roller in the usual lithographic manner until the pattern thereon becomes strong and sharp. If the grounds have not been applied to the photo-lithograph, the zinc plate may be rolled until the ink is built up thereon and the inked "Ben Day" or other film with its projections applied to the zinc sheet so as to print ground lines thereon wherever grounds are necessary, in the manner described in connection with the photo-lithograph. The zinc sheet when the film is applied is of course dried so that ink will be deposited wherever contact is made.

Obviously if the surfaces are very small the steps relating to the production of grounds may be omitted altogether.

After the zinc plate has thus been prepared, with or without the grounds, it is etched. In doing this it is first powdered with fine asphalt and dusted clean with cotton or with a brush (preferably with cotton). The plate is then warmed until the asphalt is melted into the ink, forming a hard, smooth acid resist. The exposed edges and back of the zinc plate are then coated with asphalt varnish, except a space H about 1/16 of an inch wide at the beginning of the design, as shown in Fig. 9. The plate is then immersed in dilute nitric acid (about sixteen parts water to one part nitric acid) until the exposed portions are eaten away to a depth of about 2/1000 of an inch, so that it may be inked with an acid resisting ink applied with a smooth inking roller. Etching must be of such depth that the inking roller will deposit no ink in the depths of the plate. The surface of the plate is a type surface and not a planographic surface. The design to be engraved upon the roller is in the depths of the plate. After etching, the acid resist and asphalt are washed off the zinc plate with turpentine and one edge is cut off on a line with the remote edge or end of the design, as shown at I at the bottom of Fig. 10. The plate is then inked with a stiff acid resisting ink and placed on the smooth table J of a transfer machine as shown at Z (Fig. 11). This table has an edge K, with which the edge of the plate when in proper position will exactly coincide, and brackets L, which engage the trunnions L' of the roller and support it just as it leaves the zinc plate. The plate is laid upon the table so that its cut edge I coincides exactly with the edge K of the table J and is securely clamped in that position by clamps M. The roller N to be engraved is then supported above the table. A strip of thin clean paper O is placed on the zinc plate in a line parallel with the edge or beginning of the design, about 1/16 of an inch away from the de-

sign so as to leave uncovered the etched line at the beginning of the design. The sticky ink holds the paper in place. The roller is then lowered on to the strip of paper (which is to provide a perfectly clean rest for the roller) and pressure applied. The roller is then caused to make one complete revolution, rolling over the surface of the inked plate, its axis being maintained parallel to the edge K and the edge of the plate which coincides therewith, so that the ink is thereby transferred to the surface of the roller. In order to make the zinc plate contact more perfectly with the roller to be engraved, I preferably place between it and the table a yielding backing P. The supporting of the roller just as it leaves the zinc plate permits a uniform pressure to be given to all parts of the zinc plate and thus produces a uniform impression upon the roller.

The rolling of the roller over the zinc plate covers the whole surface of the roller with the design and if the lay-out was an accurate development of the roller and due care taken in sticking up the transfers and placing the zinc sheet, there will be a perfect joint and no overlapping. The design shows on the roller in clean copper filled in with grounds, where grounds are used, the field around the design being covered with acid resisting ink. The space H after etching is depressed and carries no ink, thus making the beginning of the design as printed on the roller clean and sharp. It assists in transferring the design to the roller, but does not appear on the roller since the design on the plate is of such dimensions as to entirely cover the circumference of the roller.

The roller when the ink has been transferred thereto is next etched. In doing this it is first powdered with fine asphalt powder applied with soft cotton and then dusted with a clean piece of cotton. The asphalt adheres to the inked parts but does not adhere to the clean copper. The roller is then warmed from the inside until the asphalt blends with the ink. When cooled the roller is immersed in a bath of acid being rotated to insure even etching. I prefer to use as an etching solution chlorid of iron two parts, water one part, but nitric acid may be used.

By the process above described, from a single sketch or element of the design, a pattern which will completely cover a roller of any given dimensions, both longitudinal and circumferential, and in such manner as to print a continuous pattern on fabric can be quickly and cheaply made. The use of a zinc plate is particularly desirable since it forms a permanent structure which does not warp or get out of shape and can be used repeatedly. Thus, for instance, if during the transfer of ink from the zinc plate to the roller, the roller becomes accidentally blurred or smudged, the roller and zinc plate may be immediately washed with turpentine whereupon a new coat of ink can be given to the zinc plate and the roller applied thereto a second time. If the zinc plate is not used but the roller is rolled over the lay-out sheet with the transfers thereon and any accident happens, a new set of photolithographic transfers has to be made and laid out before the design can be gotten upon the roller. Furthermore, when the zinc plate is used, the design can be preserved indefinitely thereon. The rollers are costly on account of the amount of copper therein and a design is seldom kept upon a roller for any great length of time. The zinc of the plates, however, is not costly and after the engraved zinc plate is once obtained, it can be used for printing any roller of proper size, and, if necessary, a roller of slightly larger size than the proper diameter can be worked down at any time to just the proper size for the use of any zinc plate. Manufacturers engaged in fabric printing and the like have a large variety of rollers of different sizes and thus have on hand rollers which closely approximate any given size.

The production of grounds by my method is simple and accurate and leaves the required marginal line. In producing such grounds by my process, comparatively little time is required. The production of grounds in the manner above described is not, however, a necessary feature of my process broadly considered which may be used when no ground is necessary or where grounds are supplied by other methods. Thus, the foundation for the ground may be supplied in any known way upon the original sketch or upon the photographic plates or upon the photolithograph without interfering with the other features of my process. I prefer to put them on the photolithograph in the manner described.

In the process above described when the zinc plate is used, the design, as printed by the engraved roller, is turned end for end relatively to what it was in the original drawing. In a great many designs this is of no importance. When the design is produced by rolling the roller over the transfers so as to eliminate the use of the zinc plate, the design as printed by the roller is not turned end for end relatively to the original drawing.

In case it is desired to use the zinc plate and the design is such that it must not be turned end for end as printed by the engraved roller, various expedients may be employed. Thus, what is known as "turning the negative" may be resorted to, that is, the film of either one of the plates shown in Figs. 2 or 3 may be transferred from its

original glass to a second glass in the well known manner. If the remainder of the process is then carried on as above described, the design as printed by the engraved roller when the zinc plate is used will not be turned end for end. A second method less liable to distort the design is to photograph the original design through a prism which gives the required results. A third method consists in obtaining the photograph of Fig. 3 turned end for end by placing the negative of Fig. 2 in the front end of a camera and exposing a sensitive plate to light passing through the negative from rear to front and through a lens located within the camera between the two plates. In doing this the negative of Fig. 2 is used as a transparency which is photographed on to the second plate, producing a positive which, when used in carrying out the remainder of the process above described, will result in producing a roller which will print the original design not turned end for end. Still another way consists in applying the etched zinc plate properly inked to another zinc sheet, thereby transferring the ink to said second sheet; applying asphalt powder to this second sheet, as above described; properly dusting and warming the sheet, and etching this second zinc sheet. When this second zinc sheet is used to apply ink to the roller, the design as printed by the roller will not be turned end for end relatively to what it was in the original drawing.

It is also obvious that in the case of a simple design, the original drawing from which the first photographic plate is made may be drawn so that the design thereon is turned end for end relatively to the position which it is desired it shall be in when printed upon the engraved roller.

If the original drawing is a negative of the design to be printed by the engraved roller or the roller is to be a type face roller instead of an intaglio roller the photographic negative of the original drawing is the necessary "photograph" and the step represented by Fig. 3 is omitted.

In inking up the lithograph on the zinc plate, it is done in the ordinary lithographic manner, in which the exposed surfaces are ordinarily very slightly etched for purposes well understood in lithography.

In order to define the limits of the design so as to make it repeat properly, I place limit marks T thereon, which I term trimming marks. These are reproduced upon the photographs, photo-lithographs and transfers and serve to indicate the lines along which the transfers are to be trimmed. I also provide registration marks R, which, when reproduced upon the transfers, serve as registration marks and assist in sticking up the transfers on the lay-out so that they will register properly. These cutting and registration marks are, before etching, erased or blotted out on the zinc sheet or other surface to be engraved, where necessary. When they will appear on the grounded or ungrounded intaglio surfaces of rollers for fabric printing, they need not be erased, since they will be obliterated on the fabric printed by reason of the flow of color thereon.

What I claim is:

1. In a process of photo-mechanically engraving of metal rollers, the improvement which consists in producing a photographic negative of the design to be engraved, producing therefrom a photograph the opaque portions of which correspond in form and dimensions to the parts of the metal surface to be removed from the roller, producing a photo-lithograph therefrom, producing a transfer from said photolithograph, transferring the ink from such transfer to a thin metal sheet, etching said sheet so as to remove the surface of the portions uncovered by said ink, applying ink to the raised portions of said etched metal sheet, printing said ink upon a metal roller and etching said metal roller so as to remove the surface of the portions uncovered by the ink printed thereon.

2. In a process of engraving designs on metal, the improvement which consists in producing a lithograph upon a plain surface, producing a transfer from said lithograph, transferring ink from said transfer to a plain metallic surface, etching said metallic surface so as to remove the portions thereof uncovered by ink, building up with ink one of said plain surfaces when the design has first appeared thereon, and applying thereto a yielding body having closely adjacent inked projections so as to print upon the uninked portions not closely adjacent to the built up portions.

3. In a process of engraving designs on metal, the improvement which consists in producing a lithograph, building up the ink on said lithograph, applying to said lithograph a flexible sheet having closely adjacent inked projections thereon so as to print upon the uninked portions not closely adjacent to the built up portions, producing a transfer from said lithograph, transferring the ink from said transfer to a metal surface and etching said metal surface so as to remove the portions uncovered by ink.

4. In a process of photo-mechanically engraving of designs on metal, the improvement which consists in producing a photograph the opaque portions of which correspond in form and dimensions to the metal surface to be removed, producing a photo-lithograph therefrom upon a plain surface, producing a transfer from said photo-lithograph, transferring ink from said transfer to a plain metallic surface, etching said metallic surface so as to remove the portions

thereof uncovered by ink, building up with ink one of said plain surfaces when the design has first appeared thereon, and applying thereto a yielding body having closely adjacent inked projections so as to print upon the uninked portions not closely adjacent to the built up portions.

5. In a process of photo-mechanically engraving of metal, the improvement which consists in producing a photograph the opaque portions of which correspond in form and dimensions to the metal surface to be removed, producing a photo-lithograph therefrom, building up ink on said photo-lithograph and applying thereto a yielding body having closely adjacent inked projections so as to print upon the uninked portions not closely adjacent to the built up portions, producing a transfer from said photo-lithograph, transferring the ink of said transfer to a metal surface and etching said metal surface so as to remove the portions thereof uncovered by ink.

6. In a process of photo-mechanically engraving of designs on metal, the improvement which consists in producing a photograph the opaque portions of which are of the form and dimensions of the portion of the metallic surface to be removed, producing a photo-lithograph therefrom, building the ink up upon said photo-lithograph, applying to said photo-lithograph a flexible sheet having closely adjacent inked projections thereon so as to print upon the uninked portions not closely adjacent to the built up portions, producing a transfer from said photo-lithograph, transferring the ink from said transfer to a metal surface and etching said metal surface so as to remove the portions uncovered by ink.

7. In a process of photo-mechanically engraving of metal, the improvement which consists in producing a photograph the opaque portions of which are of the form and dimensions of the portion of the metallic surface to be removed, producing a photo-lithograph therefrom, building the ink up upon said photo-lithograph, applying to said photo-lithograph a flexible sheet having closely adjacent inked projections thereon so as to print upon the uninked portions not closely adjacent to the built up portions, producing a transfer from said photo-lithograph, transferring the ink from said transfer to a metal surface and etching said metal surface so as to remove portions uncovered by said ink, inking the metal surface thus etched, transferring the ink therefrom to a metal roller, and etching said metal roller.

8. In a process of photo-mechanically engraving of metal surfaces, the improvement which consists in producing a photograph, the opaque portions of which correspond in form and dimensions to the portions of the metal surface to be removed, producing a photo-lithograph therefrom, producing a plurality of transfers from said photo-lithograph, trimming and sticking up said transfers so as to produce a continuous design, transferring the ink of said transfers to a thin metallic sheet, etching said thin metallic sheet so as to remove the portions thereof uncovered by ink, removing a portion of said plate adjacent to the remote edge of the design thereon, laying said metallic sheet upon a table, rolling a metallic roller over said metallic sheet properly inked from the beginning of said design to said remote edge, the axis of said roller being maintained parallel to said edge.

9. In a process of photo-mechanically engraving of metal surfaces, the improvement which consists in producing a photograph, the opaque portions of which correspond in form and dimensions to the portions of the metal surface to be removed, producing a photo-lithograph therefrom, producing a plurality of transfers from said photo-lithograph, trimming and sticking up said transfers so as to produce a continuous design, transferring the ink of said transfers to a thin metallic sheet, etching said thin metallic sheet so as to remove the portions thereof uncovered by ink, trimming said metallic sheet along the remote edge of the composite design so as to leave a straight edge, laying said metallic sheet upon a table so that its trimmed edge corresponds with the edge of the table, rolling a metallic roller over said metallic sheet properly inked from the beginning of said design to said trimmed edge, the axis of said roller being maintained parallel to said edge.

10. In a process of photo-mechanically engraving of metal surfaces, the improvement which consists in producing a photograph, the opaque portions of which correspond in form and dimensions to the portions of the metal surface to be removed, producing a photo-lithograph therefrom, producing a plurality of transfers from said photo-lithograph, trimming and sticking up said transfers so as to produce a continuous design, transferring the ink of said transfers to a thin metallic sheet, etching said thin metallic sheet so as to remove the portions thereof uncovered by ink, trimming said metallic sheet along the remote edge of the composite design so as to leave a straight edge, laying said metallic sheet upon a table so that its trimmed edge corresponds with the edge of the table, rolling a metallic roller over said metallic sheet properly inked from the beginning of said design to said trimmed edge, the axis of said roller being maintained parallel to said edge, and supporting said roller independently of said plate at the instant it passes the edge of said plate.

11. In a process of photo-mechanically

engraving of designs on metallic rollers, the improvement which consists in producing an inked metallic plate of greater length than the periphery of the roller, the portions thereof uncovered by ink corresponding to the portions of the surface of the roller to be removed, applying an acid resist to the margin of said metallic plate, except for a space along the beginning of the design, so as to provide after etching a depressed area at that point, etching said plate thus prepared, inking the raised portions of said plate, rolling a metallic roller over said plate in contact with the portions originally inked and etching said roller.

12. In a process of photo-mechanically engraving of designs on metallic rollers, the improvement which consists in producing an inked metallic plate, the portions thereof covered by ink corresponding to the portions of the surface of the roller not to be removed, applying an acid resist to the margin of said metallic plate except for a narrow space along the beginning of the design, and etching said plate thus prepared, cleaning and inking said plate and applying a thin protecting strip to the ink on said plate adjacent to the space which was uncovered by said acid resist, applying a roller to the originally inked parts of said plate and etching said roller.

13. In a process of photo-mechanically engraving of designs on metallic rollers, the improvement which consists in producing an inked zinc plate, the portions thereof uncovered by ink corresponding to the portions of the surface of the roller to be removed, applying an acid resist to the edges of said zinc plate except for a narrow space along the edge of the beginning of the design, and etching said plate thus prepared, cleaning and inking said plate and applying a thin protecting strip to the ink on said plate adjacent to the space which was uncovered by said acid resist, lowering the roller to be engraved onto said protecting strip and rolling it toward and to the other edge of the design on said plate.

14. In a process of photo-mechanically engraving of designs on metallic rollers, the improvement which consists in ascertaining the distance which will be covered by one revolution of the roller to be engraved while making one complete revolution in a printing machine, dividing said distance into an integral number of parts corresponding to the number of repeats desired, producing a photograph of the design to be engraved, the opaque portions of which are of the form and dimensions of the portion of the metallic surface to be removed from the roller, said photograph being of a length exactly equal to one division of said distance covered by said roller, producing a photo-lithograph, producing a plurality of transfers from said photo-lithograph, trimming and sticking up said transfers arranged so as to form a continuous design upon a lay-out of the roller, applying said transfers to a thin metallic sheet, etching said thin metallic sheet, applying ink to the raised portions of said metallic sheet, transferring said ink under pressure in said printing machine to the metallic roller to be engraved so that the edges of the design impressed upon the roller abut, the circumference of the roller being covered by the design, and then etching said metallic roller.

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