

UNITED STATES PATENT OFFICE.

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ART OF PREPARING AND TRANSFERRING PHOTOGRAPHIC AND OTHER DESIGNS FOR ENGRAVING.

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To all whom it may concern:

Be it known that I, WILLIAM JOHN CHARLTON, a citizen of the United States, and a resident of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in the Art of Preparing and Transferring Photographic and other Designs for Engraving and other Purposes, of which the following is a specification.

My invention is related to many methods known in the arts by which a picture or delineation upon one surface is carried over to another by mechanical means; and its object is to effect such transference of designs, and especially of those which have been made by photo-chemical action, with a degree of accuracy not hitherto attained. It is well known that when an original design—such as a map or diagram drawn or engraved upon a stone, block, or plate—has to be transferred for engraving or other purposes to another surface through the intervention of a sheet of transfer-paper especially prepared for the purpose, much difficulty is experienced in keeping the scale and size of such work absolutely unchanged. The same is true of photographic pictures on paper and other media, like films of collodion, gelatine, albumen, &c., when the transfer of such pictures is desired to wood, stone, glass, or metal for artistic or practical purposes. Extreme accuracy as to size and scale has been unattainable hitherto, and as a consequence photography applied in this way as an aid to engraving and similar arts has a very limited scope. Speaking generally, the great obstacle in the way of exact transferring has been the irregular and uncontrollable expansion and contraction of paper, due to its absorption of water or its loss of the same in drying; and in photography, as in other graphic arts, paper is by far the most convenient medium on which to support the picture made by light, or film bearing it, which is to be transferred and carried over by well-known manipulations to the new surface fitted to receive it. In the case of a photograph prepared for the purposes of transfer the first distortion occurs when the exposure of the sensitive surface upon the dry paper is subjected to the several neces-

sary developing, toning, fixing, and washing operations which fit the picture for use, for the action of the water in all of them swells the paper and causes it to become both longer and wider, thereby changing the size of the picture as it was when first produced by exposure, and doing that unequally in a very marked degree. This inequality (which it is impossible to control) is inherent in the paper as manufactured, and it may be accepted as a universally-acknowledged fact that the swelling of a sheet of paper in length is never proportionately equal to the swelling of the same in width. When this distorted picture is dried, it will be found to have shrunk, but not back exactly to what it was, or, with any certainty, to a definite relation thereto. Here we have a second distortion superimposed upon the first. Finally, when the photographic picture so produced is again dampened for transfer (an operation which is always necessary to cause the face of the sheet to come into intimate contact with the surface which is to receive the picture) a third distortion is caused, which is also quite uncertain as to its relation to the original or to the photographic copy in any one of the preceding steps. It follows, therefore, that apart from the legitimate difficulties which exist the transfer by mechanical means of photographic designs on paper and like media capable of absorbing water has been hitherto impossible when a high degree of accuracy was indispensable. I overcome this difficulty perfectly as follows: The sensitive paper on which the photograph is to appear and from which it is to be carried over to another surface is (in the dark) to be thoroughly wetted with water, in the first instance, which is to be used in excess, until it has swelled to its fullest extent. If the sensitiveness or any other valuable characteristic of the paper depends on some free soluble substance in the sensitive coating thereupon, I use a solution of that substance to wet and swell the paper with, and not pure water, which is sufficient when the chemicals on the paper are insoluble. After the full expansion of the paper in all directions has been accomplished I drain the same free of all superfluous fluid and support it on a sheet of glass or a surface of hard rubber, or other flat and convenient

support, and then expose it in such a way as is best calculated to give faithfully the desired picture. After exposure the chemical treatment of the sheet is proceeded with as usual, and the photograph so produced is again thoroughly drained and blotted off. Having reached this stage, the final transfer of the damp sheet to the new surface is effected, and when the face bearing the visible image has attached itself sufficiently thereto the paper which bore it is removed in the usual way and the picture left upon its new support. A photographic design transferred in this way will be found not only of the precise size given it by the rays of light, but also totally free from distortion. The reason of this is obvious, for the paper on which I produce the image, with the help of light, cannot swell, (being already fully swelled,) and cannot contract (as it is kept wet from first to last) either in length or width, and it necessarily follows that the picture, when it goes over, is absolutely free from distortion or change of any kind. The importance of the accuracy thus achieved will be manifest by taking a well-defined case, in which the transfer method, united with photography, may be turned to good account. An example of this sort is found in the preparation of rollers or cylinders etched or engraved for textile printing, or in the production of engraved plates for indirectly aiding in the execution of such work. In textile printing the design is frequently of the most complex description, consisting of an assemblage of curved and intersecting lines, as when leaves and flowers are represented. If a piece of material printed all over with such a pattern is examined, it will usually be found to consist of the same design, covering perhaps only a few square inches, repeated over and over again in width as well as in length; but it will also be seen that it is impossible to find any indication of the junction of the several repetitions of the pattern, or to find lines of demarcation separating them. This can only be accomplished by making each unit of the pattern a definite fraction of the surface to be covered and all the units precisely alike, measured in their length or width. Hitherto this accuracy has been reached in a variety of ways long known to and practiced by calico and wall-paper printers, into a discussion of which it is not necessary to enter; but if transferring of any kind, and especially photographic transferring, is to be used and it should be required to cover a roll or cylinder completely and exactly with, perhaps, twenty or thirty photographed reproductions of one and the same design placed edge to edge, so that the lines run into each other and thereby form a connected whole, it is manifest that there must be no distortion or error in the size of the several copies of the picture employed, which would of course be cumulative. By my method a cylinder can be directly covered with a succession of identical photographic pictures of the pattern capable of ex-

actly filling the space allotted to them both in length and circumferentially about the convex surface; but more commonly this same result is accomplished indirectly, as follows:

Assuming that the original sketch or drawing from the designer of one unit of the pattern which is to be reproduced, engraved, and then printed upon the fabric is made of about the right size, I produce in the ordinary camera a negative picture of the same in the well-known way, which bears some convenient relation to it. This negative is then placed in an enlarging or "solar" camera of suitable construction, and the visible picture which the transmitted light produces is thrown upon a white sheet of paper or other white surface and focussed precisely of the requisite size for subsequent pantographic reduction. An indefinite succession of sensitive sheets, fully expanded by water or watery liquids, as hereinbefore described, could now be made to take the place of the focusing screen or sheet and an exposure made for each, whereby would be obtained as many photographic prints as required all of precisely the focused size; but in the present instance only one developed, fixed, and washed print is required, which, being the exact size (usually a definite multiple of the original sketch or drawing of the design) is transferred to a flat plate of zinc or like soft metal, this being done while the photographic picture is still wet, and therefore before it has suffered any change due to loss of water and consequent shrinkage. The act of transferring may be performed in any way adapted to the particular kind of photographic paper used, and the zinc plate may or may not be first prepared by coating, graining, etching, or otherwise treating it for the purpose of making the photograph stick firmly thereto. In my practice I have found Eastman's so-called "transferotype-paper" is well adapted for my purpose, giving results which are in all respects faultless. After the photographic and washing operations of a sheet of that paper are completed I again remove the superfluous water and then press the face of the paper into intimate contact with the surface of a cleaned zinc plate, using for that purpose a screw-press resembling a large copying-press of very moderate power, with sufficient flat packing between the platen and the back of the photograph. I find that after the lapse of a little time the thin collographic film adapted to leave the paper and which constitutes the picture adheres firmly to the zinc without the intervention of any adhesive coating, and that when this has taken place the paper-support can be removed in the usual way, leaving a design of absolutely correct dimensions, totally free from distortion, firmly attached to the new surface on which it now rests.

With a view to the production of the engraved cylinder, which is the ultimate object of this particular application of my in-

vention, the plate bearing the transfer design is engraved by hand or etched in well-known ways, so as to represent on a large scale a single unit of the design which is to be reproduced more or less frequently upon the copper roll and from it by printing upon the textile material. This engraving on the flat plate may represent one color only or several, according to circumstances; but in either case the plate is placed upon the table of a pantographic machine (the construction of which is well understood) and as the stylus in the hand of the operator is made to traverse the engraved design in whole or in part the prepared copper roller, which in printing is to receive the color and print the design upon the cloth, has simultaneously traced upon its surface by the diamond tracing-points of the pantograph as many reduced repetitions of the engraved details upon the plate as it is intended shall go upon the roller. The whole surface of the copper having been traced over in this way, the lines and markings so produced upon its surface are etched or engraved to a depth sufficient to hold the color it is desired to print, after which it is fitted for use.

The foregoing descriptive sketch serves to make intelligible the indispensableness of great accuracy in cases of photographic transfer like that cited. Hitherto paper and similar supporting media subject to expansion by water and contraction by the loss of the same have not been successfully employed, though numerous attempts have been made to control the unmanageable behavior of such substances when dampened.

I wish it to be understood, however, that my process is not limited in its scope to the preparation and transfer of photographic pictures as aids in the production of textile printing-surfaces, for it is equally useful in the production of cylinders and rollers for wall-paper printing and in surfaces both cylindrical and flat for oilcloth-printing and other allied arts; also, in the making of certain accurate transfers and offsets for intaglio, relief, and lithographic work, and although I have described the use of an enlarging-camera as especially serviceable in producing the transferable pictures, because of the extreme accuracy with which the size of the visible image can be maintained and determined, and because the surface of the wet and sensitive paper is untouched by anything pending its exposure, still I am well aware that practically identical results can be obtained in other ways—as, for instance, by accomplishing the enlargement or reduction, as the case may be, when the negative is made and printing from it photographically by contact with the wet paper and using a dry or a wet negative for the purpose; nor is it necessary that a negative should always be used, for a transparent positive on glass can also be very well employed in many cases and engravings, etchings, and other dilinea-

tions made with the help of the same on the surface to which such transferred pictures have been carried over; nor is it necessary that such a positive should have a photographic origin, for perfectly satisfactory designs for many purposes can be made by hand or printed on tracing-gelatine, tracing-celluloid, or even tracing-paper of good quality, as, in like manner, artificial negatives can themselves be made with a scratching-needle on glass rendered opaque by a coating applied to one of its sides in a way very well understood. Furthermore, I do not confine myself to any particular kind of transfer-paper or to any particular manner of accomplishing the operation of transferring, which in the arts is constantly and variously performed, and I wish further to explain that while photographic papers generally are provided with coatings which are insoluble in water and in solutions of the substances which cause or exalt their sensitiveness this is not always the case with lithographic and plate-transfer papers and some other kinds; but it is so very frequently, and such papers as have coatings which become soft and pliant in water without dissolving therein should be chosen.

Photographic papers when intended for transferring purposes are generally prepared so as to let a film of collographic matter go over with the image; but this is not an invariable rule, special solvents of the image-bearing surface being also employed, and other means; and I do not therefore confine myself to any particular kind of photographic paper. In lithographic transferring also, and especially in the practice of transfer-photolithography the collographic film on the paper is usually quite stationary, and it is the ink only that goes over to the new support.

In this specification and in the claims when the words "transfer-paper" are used any absorbent and expandible medium which may be used for supporting an image and transferring the same is understood, and when "water" is spoken of as employed for wetting and expanding transfer-paper that expression is meant to include all watery or equivalent liquids that perform a like function without injuriously affecting the image, the image-bearing coating, or the chemicals which must be present.

The principle upon which my invention rests, and which is fully set forth in this specification, I believe to be broadly new, and I therefore do not confine myself to specific details so long as that principle is maintained and followed.

What I claim is—

1. The improvement in the art of transferring designs, which consists in first expanding the transfer-paper employed to its limit by the application of water thereto, then producing the design thereon in inked or colored lines, tints, or markings, and then transferring the same mechanically to the new sur-

face fitted to receive it while the paper is still wet and before the contraction due to drying has taken place, substantially as described.

2. The improvement in the art of transferring designs by photographic means, which consists in first expanding to its utmost by water a piece of sensitive photographic paper adapted for transferring purposes, then producing a photograph of the design to be transferred thereon, and then transferring the same mechanically to the new surface fitted to receive it before contraction of the paper due to drying has taken place, substantially as described.
3. The improvement in the art of transferring designs, with the aid of photography, from an original delineation to a surface adapted to receive the same, which consists in first expanding by water to its utmost a sheet of sensitive transferotype-paper or its equivalent, then producing on glass or like support a negative picture of the original design, then by light transmitted through said negative in suitable apparatus projecting a luminous image on the moist expanded paper bearing the sensitive film and completing the photograph so exposed, and then transferring

mechanically such photographed design to the surface adapted to receive it before contraction of the paper has taken place by drying, substantially as described.

4. A sheet of transfer-paper expanded to its limit by water and bearing a transferable design which has been applied thereto before the drying of said sheet, substantially as described.

5. A sheet of photographic paper expanded to its limit by water and bearing a collographic or equivalent film similarly expanded, with a design subsequently photographed thereon incapable of further expansion, substantially as described.

6. A sheet of photographic transfer-paper expanded to its limit by water and having a transferable collographic or equivalent film similarly expanded, with a design subsequently photographed thereon, and adapted for transfer to a new support without change of size, substantially as described.

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Witnesses:

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