L. DUFAY.

MANUFACTURE OF SCREENS OR COLORED SURFACES FOR COLOR PHOTOGRAPHY.

APPLICATION FILED MAY 23, 1908.

Patented Sept. 19, 1911.

1,003,720.

FIG. 1.

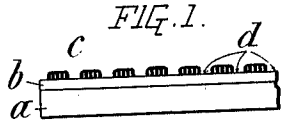



FIG. 3.

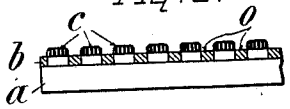



FIG. 2.

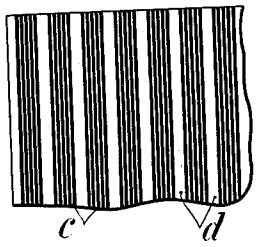



FIG. 4.

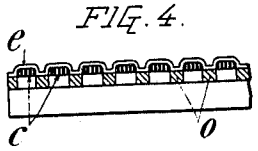



FIG. 5.

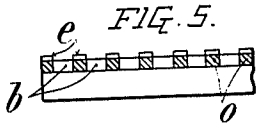



FIG. 7.

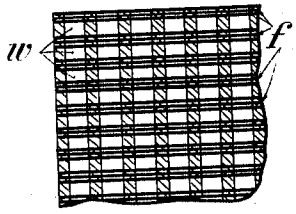



FIG. 6.

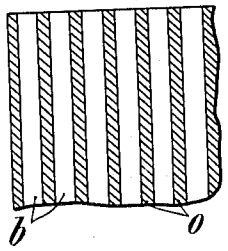



FIG. 8.

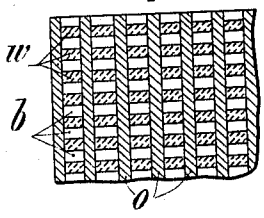



FIG. 9

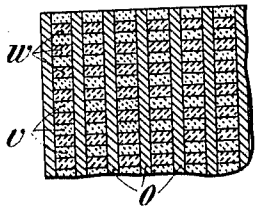



FIG. 10.

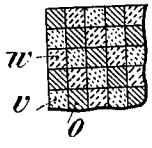



FIG. 11.


FIG. 12.


FIG. 13

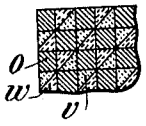



FIG. 14.

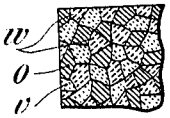
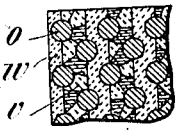



FIG. 15.




Witnesses

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# UNITED STATES PATENT OFFICE.

LOUIS DUFAY, OF CHANTILLY, FRANCE, ASSIGNOR TO SOCIÉTÉ ANONYME DES PLAQUES & PRODUITS DUFAY, OF CHANTILLY, FRANCE.

## MANUFACTURE OF SCREENS OR COLORED SURFACES FOR COLOR PHOTOGRAPHY.

1,003,720. Specification of Letters Patent. Patented Sept. 19, 1911.

Application filed May 23, 1908. Serial No. 434,599.

*To all whom it may concern:*

Be it known that I, LOUIS DUFAY, a citizen of the French Republic, and a resident of Chantilly, France, have invented certain new and useful Improvements in the Manufacture of Screens or Colored Surfaces for Color Photography, of which the following is a specification.

This invention relates—firstly, to chromatic screens or filters of absolute transparency and perfect luminosity, with selective divisions arranged side by side and having any desired shape, whether regular or irregular, geometrical or non-geometrical, and not constituted by foreign substances (grains of starch, colored printers' ink, etc.), but by colored divisions dyed side by side, without superposition and without uncolored spaces between the divisions, in a homogeneous layer of gelatin, the homogeneity of the screening layer enabling the prints to be seen not only by transparency, but also by reflection, and secondly, to the processes for manufacturing the screens in question, that is, to a process consisting in a systematic alternation of a special varnish with a suitable greasy material and suitably selected colored solutions, by means of which can be obtained, by superficial protection and successive partitioning of the colors, a screen with colored divisions arranged side by side, dyed in a homogeneous layer of gelatin.

Figures 1 and 2 show in end view and in plan respectively the first stage of the process. Fig. 3 shows the second stage. Fig. 4 shows the third stage. Figs. 5 and 6 respectively in end view and in plan, show the fourth stage. Fig. 7 shows the fifth stage. Fig. 8 shows the sixth stage. Fig. 9 shows the seventh stage. Figs. 10 to 15 show six patterns in which the colors can be distributed.

*Process.*—The accompanying considerably modified drawing represents a fragment of screen at the various stages of its preparation, and various constructions of the said screen.

The explanation given below relates to a screen comprising three selective colors, and is given merely by way of example, as the screen can have a larger number of suitably chosen selective colors.

The transparent support *a* (glass, film, etc.) intended to form the support for the screen, having been coated with a thin layer *b* of gelatin or of other suitable substance, is submitted to the following operations:—

1. A suitably chosen fraction of its surface (for instance two-thirds) is covered with greasy material *c* of any desired fluidity, a well known printing process such as photo-printing, typography, half-tone printing, etc., or even pulverizing or spraying being used for the purpose. The part played by the said greasy material *c* is simply to constitute a temporary reserve, in the form of lines, points, grains, etc., either regular or irregular, or having any geometric or irregular shape. Its color is, therefore immaterial, it is preferably black, so as to enable the work to be more easily observed. Figs. 1 and 2 show, by way of example, the application of the greasy material in the form of vertical equidistant lines *c c* indicated by vertical hatching.

2. The surface *d* which has been left free (Figs. 1 and 2), is dyed by imbibition, between the elements of greasy material, with one of the coloring solutions, for instance orange *o* (Fig. 3).

3. The whole surface is varnished with a varnish *e* (Fig. 4) fulfilling the two following conditions: *a*. Its solvent must not dissolve the greasy material used. *b*. Its resin or gum resin must be insoluble in a solvent of the greasy material used, and incapable of becoming incorporated into, or combining with, the said material. For instance, if the greasy material used contains linseed oil, and the varnish is composed of gum lac previously exhausted by means of ether and dissolved in alcohol which is a solvent of the varnish, the alcohol must not dissolve the greasy material, and on evaporating must leave on the whole surface a thin layer of gum lac. Such a varnish adheres strongly to gelatin, exactly at the points where the color was able to adhere, and forms an im-

permeable insulating layer. On the contrary, it does not coat the greasy material *c*, so that it is sufficient to cause a solvent of the latter material such as for instance turpentine essence or benzin to act and to apply a little friction in order to detach the varnish at these points and to dissolve the material itself, the result being to expose the gelatin *b* at every point at which it is protected by the first printing. After the said operation two-thirds *b* of the free surface of the screen will be free, and a third *o* painted orange, the said color being covered with an impermeable varnish *e* (Figs. 5 and 6).

4. Half the total surface is covered with greasy material, either in the form of horizontal lines *f* as shown in Fig. 7, or in any other form, whereupon the surface remaining free is dyed, for instance violet *w*, the said surface in the present case consisting of rectangles *w w* limited on the one hand by the greasy material just deposited, and on the other hand by the varnish covering the orange color already applied.

5. The surface is again varnished, then the greasy material is dissolved and removed as described in paragraph 3. There remains then (Fig. 8) one-third *o* of the surface colored orange (continuous hatching), another third *w* colored violet (long dotted hatching) and the third portion *b* free.

The colored surfaces being covered with a varnish, there will only remain one-third of colorless surface where the gelatin is exposed, the said third being dyed by simple imbibition with the third color *v* (green, short dotted hatching Fig. 9). The whole surface is then cleaned by means of a solvent for varnish, for instance alcohol, so that the screen will be constituted merely by the layer of the original gelatin dyed on the whole of its surface without superposition or uncolored space, the primary colors alternating with a perfect regularity. The homogeneous colored layer thus obtained is then preserved by means of a colorless and neutral impermeable layer. The screen is then ready for receiving the sensitive layer.

Figs. 10 to 15 show a few examples of the numerous forms in which the colors can be distributed. In Fig. 10 the colors are arranged side by side in the shape of square dots. In Fig. 11 one or more of the colors are in the shape of round dots, covering one or two-thirds of the surface, the other two-thirds or the other third, being covered with polygonal dots. In Fig. 12 the colors are arranged side by side in the shape of polygonal points. In Fig. 13 the colors are irregularly divided into squares and triangles. In Fig. 14 the three colors are also divided by thirds into polygonal points.

The various above mentioned forms can be combined as shown in Fig. 15 in which there are the vertical lines of Fig. 9, and the combination of the round and polygonal dots of Fig. 14, the limitation of the figures always being effected by the means hereinbefore described.

By repeating a sufficient number of times the operations of printing on the greasy material, of varnishing and of dyeing hereinbefore described, it will be possible to obtain a screen with any number of selective colors. In short, the arrangement side by side of *n* colors is obtained. 1. By protecting first of all a portion of the plate by greasy material alone, for the first color. 2. By means of greasy material and a special varnish for the second, third . . . *n*–1st color. 3. By means of this special varnish alone, without any greasy material for the *n*th and last color.

*Product.*—The chromatic screen or filter thus prepared constitutes a new product characterized by the absolute homogeneousness of its constitution, which distinguishes it completely from anything hitherto produced or even suggested. In fact, each colored point of the screen being produced by simple dyeing of the substantive material (constituted by gelatin), without addition of foreign colored particles, colored grains, greasy or other material, it follows that the material in question constitutes itself a filter, without any modification of the thickness or of the transparency which remains the same as that of the glass. Luminous rays are in no way perturbed, that is to say, there is no reflection or refraction, as they have not got to pass through heterogeneous media.

The selective divisions are generally colored orange, green and violet, but the number of colors can be increased to four or more, if it should be desired. The fineness of the divisions can be easily reduced to a point at which the filter becomes imperceptible to the naked eye. The selective divisions are exactly side by side, that is to say, there is no intermediate space between them that would remain inactive and consequently injurious to the final result. The said dyed divisions can have any desired shape, such as lines or points, squares, rectangles, regular or irregular, etc. Regular geometric figures are preferred, owing to the facility which they afford for covering with each of the colors an accurately known area of the plate.

The distribution of the colored points on the screen is absolutely regular, without agglomeration of the selective divisions of one and the same color, or without any gap that could modify locally the equilibrium

of the selective system, on the contrary there is a perfect alternation of the orange, green and violet. The exact quantitative distribution of colors on the screen and the uniformity of the arrangement of the points, result in producing on the eye a very homogeneous chromatic sensation, which is as near white as it is possible to obtain, without any spots, stripes or defects of any predominant color being perceived. The exact fundamental coloring of each of the selective divisions can be regulated with the greatest facility, and the total area of each colored point, in spite of its extreme smallness, has the same selective properties, without weakening at the edges or exaggeration in the center, as is the case with lines formed by colored greasy material. The result is an unsurpassed reliability in the selection, and an effect which owing to the richness and vivacity of the shades, still enhances the charm of accuracy.

The times of exposure can be reduced to a minimum, owing to the possibility of giving to the selective divisions a coloring of the exact intensity required for making a good selection, without having to fear the insufficiency at the outline of the colored points.

Screens obtained in the manner described can be sensitized either direct for the purpose of obtaining prints in colors adhering to the net work, the different layers of the plate-screen being glass, colored gelatin, impermeable layer, silver bromid; or they can be used as independent screens arranged in contact with the sensitive layer of an ordinary panchromatic plate, the different layers of the whole being glass, colored gelatin, silver bromid, glass. In the latter case the plate is separated from the screen for being submitted to all the operations of development, inversion, etc., and then carefully registered as regards the screen.

The screens in question can be used for obtaining photographic prints visible by reflection on paper or any other support. These screens being, in fact, constituted by a perfectly homogenous layer, without addition of foreign elements, their general intensity can be very easily reduced in a suitable proportion for obtaining, when looking at the print by reflection, a good impression of whites and light portions of the photographic print obtained. It is sufficient for the purpose to produce, by rubbing, a slight wearing off of the colored gelatin which, owing to the homogeneousness of the layer, acts uniformly on all the colors. Screens intended to be treated in that manner must be prepared on films provided on one side with the emulsion, and on the other with the chromatic filter, these films remaining in the free state or being temporarily fixed on glass in order to be subsequently transferred to paper or to any other final opaque support of the print.

What I claim as my invention and desire to secure by Letters Patent is:—

1. Process for the manufacture of homogeneous polychrome screens for color photography formed of color elements juxtaposed without superposition or uncolored spaces, colored in the mass of the supporting layer, consisting in the following operations:—covering in lines of greasy material the surface of a layer of transparent material adapted to be colored by imbibition, so as to leave free the surface destined to receive the first tint, then dyeing by imbibition the part left free, covering the whole with a varnish having a resinous base which only adheres to the colored part so as to protect it from any subsequent coloration, said varnish being of such composition that the solvent of the resin does not dissolve the greasy material while the said resin is insoluble in a solvent of the greasy material and not adapted to combine with or become incorporated in the said greasy material, then removing the varnish by friction where it covers the greasy material, removing the greasy material, by a suitable solvent, making a second similar application of greasy material, but in lines which are in a direction which crosses the direction of the lines of the first application, then coloring the free surface by imbibition with the second color, varnishing, removing the varnish over the greasy lines, dissolving out the greasy lines and finally coloring the remaining surface by imbibition with the third color.

2. Process for the manufacture of homogeneous polychrome screens for color photography formed of color elements juxtaposed without superposition or uncolored spaces, colored in the mass of the supporting layer, consisting in the following operations:—covering in lines of greasy material the surface of a layer of transparent material adapted to be colored by imbibition, so as to leave free the surface destined to receive the first tint, then dyeing by imbibition the part left free, covering the whole with a varnish having a resinous base which only adheres to the colored part so as to protect it from any subsequent coloration, said varnish being of such composition that the solvent of the resin does not dissolve the greasy material while the said resin is insoluble in a solvent of the greasy material and not adapted to combine with or become incorporated in the said greasy material, then removing the varnish by friction where it covers the greasy material, removing the greasy

material by a suitable solvent, making a second similar application of greasy material, but in lines which are in a direction which crosses the direction of the lines of the first application, then coloring the free surface by imbibition with the second color, varnishing, removing the varnish over the greasy lines, dissolving out the greasy lines, coloring the remaining surface by imbibition with the third color, and repeating this operation for each additional color which it is desired to add to the screen.

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

LOUIS DUFAY.

Witnesses:
H. C. COXE,
GEORGES BONNEUIL.