L. D. DU HAURON & R. DE BERCEGOL.

MANUFACTURE OF SCREENS FOR USE IN COLOR PHOTOGRAPHY.

APPLICATION FILED JAN. 2, 1907.

1,005,644. **Patented Oct. 10, 1911.**

Fig. 1.

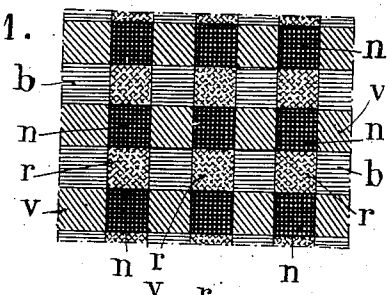


Fig. 2.

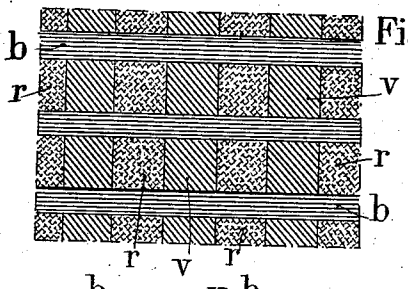


Fig. 3.

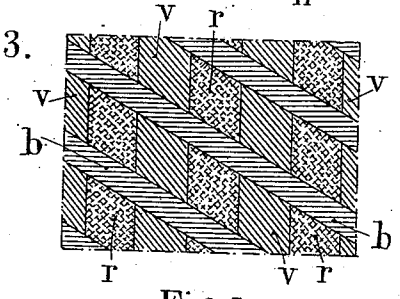


Fig. 4.

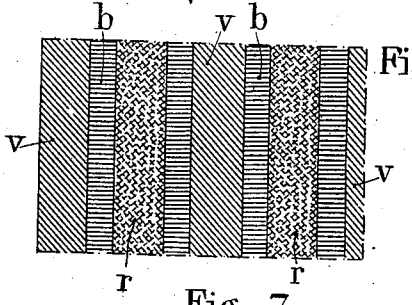


Fig. 5.

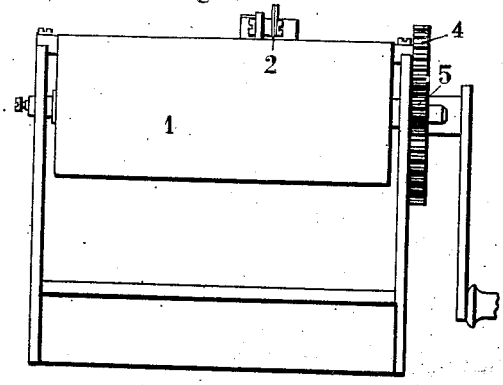


Fig. 7.

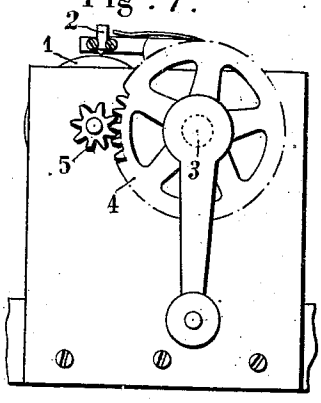


Fig. 6.

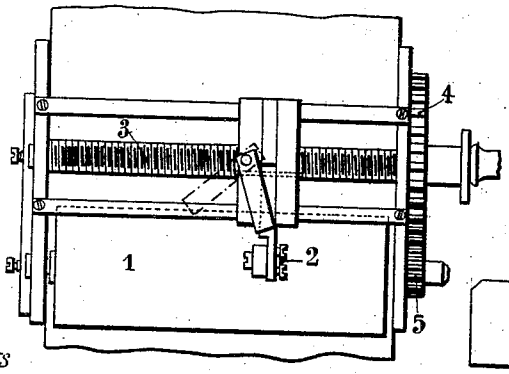
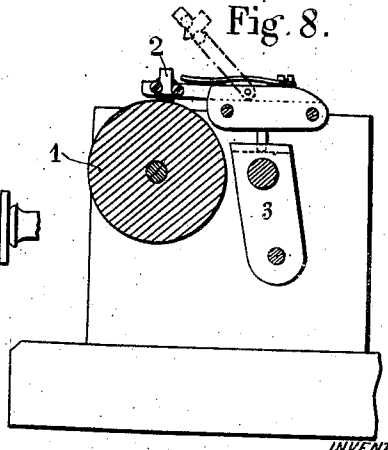


Fig. 8.



WITNESSES

Walton Harrison.

C. E. Wolcke

INVENTORS

Louis Ducos du Hauron

Raymond de Bercegol

BY

Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

LOUIS DUCOS DU HAURON AND RAYMOND DE BERCEGOL, OF JOINVILLE-LE-PONT, FRANCE.

MANUFACTURE OF SCREENS FOR USE IN COLOR PHOTOGRAPHY.

1,005,644. Specification of Letters Patent. Patented Oct. 10, 1911.

Application filed January 2, 1907. Serial No. 350,334.

To all whom it may concern:

Be it known that we, LOUIS DUCOS DU HAURON and RAYMOND DE BERCEGOL, both of 17 Avenue Pauline, Joinville-le-Pont, Seine, Republic of France, engineers, have invented Improvements Relating to the Manufacture of Screens for Use in Color Photography, of which the following is a full, clear, and exact description.

This invention relates to the manufacture of polychromatic screens for use in color-photography, so as to permit the multiplication of a common device or subject.

The object to be obtained is to cover a transparent or translucent surface, such as glass, celluloid, paper, etc., with an extremely large number of exceedingly small regular figures, *e. g.*, bands, rectangles, lozenge-shaped figures, etc., having three distinct colors placed close together without any interval, and each of which theoretically should, altogether, cover a third of the surface.

The present process enables us to obtain this result under practical, rapid, economical and therefore industrial conditions.

Figure 1 shows on an enlarged scale a portion of the screens obtained by the process, Figs. 2, 3 and 4 show variations, Fig. 5 is a side view of a machine for tracing the lines, Fig. 6 is a plan view, Fig. 7 is an end view, and Fig. 8 is a section on the line of the cutting tool.

This process is essentially characterized by the two following features: *a*, the automatic placing of the colors in virtue of the inconsistency existing between the colors dissolved in liquids of different nature repulsing one another, namely between greasy colors and colors dissolved in water or in alcohol. *b*, the application of these colors according to parallel lines drawn by means of a ruling machine.

In order to be better understood, we will now describe several ways of practically carrying out this process.

On a hard very plane material such as copper, zinc, lithographic stone, etc., lines are drawn by means of a machine, the different parallel lines being separated by intervals equal to their width. Then the parts in relief are coated, or the hollows thus formed are covered with a greasy coloring material, green for instance such as printing ink, and, by means of pressure, the series of lines is reproduced on a sheet of gelatin, for example, after drying, one can by the same means make a tracing of another color, orange-color for instance, crossing the first, then the bare intervals are colored by applying on the whole surface of the sheet a color, blue-violet for instance, dissolved in water, to which the greasy colors will be impermeable. The screen thus obtained possesses, as shown in Fig. 1 at a much larger scale, a great quantity of small elements, either in the form of squares, rectangles or lozenges, according as the two series of lines are perpendicular or oblique, green *v*, orange-colored *r* and blue *b*. Furthermore at the crossings of the lines are formed small elements of black or dark color *n* which will have only one disadvantage that of slightly darkening the whole of the screen. However, these black or dark elements *n* can be avoided by operating in the following manner: On a surface such as gelatin capable of absorbing water color a first series of lines is drawn, as hereinbefore specified, by means of a greasy ink of blue-violet color and then an aqueous material of yellow color is applied over the whole surface, this material does not adhere to the greasy lines and only fills the intervals comprised between these lines. A second series of lines is then drawn by means of a greasy ink of light-blue color taking care to cross the lines; these light-blue lines in being superposed to the yellow will produce the green and in being superposed to the blue-violet will only very slightly increase the intensity of this color. These three operations have thus produced on the gelatin surface, blue violet lines and green rectangles, resulting from the superposition of the yellow lines and of the light blue lines, and since the lines and the squares are produced by inks having greasy solvents, they are not attacked by the other color, whose solvent is aqueous. Finally over the whole surface can be applied a layer of red aqueous color which in mixing with yellow gives the orange-red color.

The present process can also be applied to glass surfaces, one then operates as follows: On a sheet of glass there is spread gelatin containing in suspension very fine colorless grains such as those of the starch. After drying, there is thus obtained a very slightly

grainy surface, holding the greasy ink, avoiding the blurring and enabling to obtain under the press series of lines of a great clearness. In order to avoid the breaking of glass and constitute very homogenous prints, the plate produced by the ruling machine must be absolutely smooth or constituted by a soft material (ebonite, celluloid or a very thin metal, etc.,) placed on a sheet of india-rubber or any other flexible material, in order to be able to exactly fit, when submitted to pressure, the unevenness of the glass. After having applied the two colors in greasy inks, as previously stated, the gelatin is caused to absorb the aqueous color which fills the hollows and completes the trichromatic screen. When the third color is the blue-violet there can still be added to the gelatin before it spreads over the transparent support, starch which in this case must be dissolved. The last operation then consists in causing to act in the hollows left by the greasy colors, a solution of iodin which causes the starch to turn into blue-violet.

The present process can also be carried out as follows—1. On a substance permeable to water a first set of greasy lines which might be colorless, is drawn; 2. Over the whole surface an aqueous color containing tannin, alum, or any other substance susceptible of making the gelatin impermeable is applied; 3. By means of a dissolvent, such as turpentine or mineral essence, etc., the greasy lines are destroyed in order that only the aqueous color lines should subsist. 4. A second set of greasy lines crossing the preceding lines, and which might be colorless, as the first ones, is drawn; 5. A second water color likewise containing tannin, alum, etc., is applied over the whole surface; 6. As previously done, said second set of greasy lines is destroyed. 7. Finally, the third water color is applied over the whole surface.

If there is mixed with the aqueous color a suitable proportion of material having the property of tanning gelatin and to fill the pores thereof such as; alum, tannin, alcohol, formic aldehyde, etc., the space occupied by this color will be impermeabilized. A second aqueous color will be applied by the same means and after drying, the third color which is also aqueous, and spread over the whole surface will adhere but in the empty spaces left by the two others.

Instead of being obtained by transfer, the lines can be drawn directly upon the screen, in this case the procedure is as follows: On a sheet of glass, celluloid, etc., covered with a material which is permeable to water, such as gelatin, there is spread a colored varnish, such as red for example, which is impermeable to water. Then, by means of a plane or circular ruling machine, there are drawn small parallel furrows or grooves which are separated by intervals equal to their width. Then the sheet thus prepared is dipped for a few seconds into a water color, such as green for example, which impregnates the gelatin throughout, where it has been exposed, leaving unacted upon the parts covered with varnish and only dyeing superficially the layer of gelatin. The surface being cleaned, one will have a screen composed of green and red-orange bands which are arranged exactly by the side of each other and capaple of producing by the two color process, beautifully colored photographs.

A third color is distributed as follows: There is spread over a surface provided with two series of bands or lines, a second varnish which is impermeable to water, is colorless, and is designed to serve solely as a protector; one then hollows out fresh tracks which are a little deeper than those above referred to, in such a manner as to expose the lower layer of gelatin which the first bath did not have time to reach. These tracks intersect the first mentioned ones either perpendicularly or obliquely and should be separated by spaces equal to twice their own width. The sheet is then dipped for a few seconds into a blue-violet water-color bath and a three-color screen is produced. It has an extremely large number of small green and red-orange rectangles, *v*, *r*, respectively, intersected by blue-violet lines *b*, as shown in Fig. 2 of the accompanying drawing. These small figures will be lozenge-shaped if the second series of bands or tracks has been drawn obliquely, as shown in Fig. 3 of the drawing. The colors may obviously be arranged in any desired order. One may also take a transparent sheet covered with a thick layer of gelatin which is superficially colored green for example, on which is spread a varnish impermeable to water. After having drawn the first series of bands or tracks, the sheet is dipped into a second water-color bath as for instance red orange color, then a colorless protective varnish is spread thereon, the second deeper series of bands or tracks is drawn, and finally the sheet is dipped into a third water-color bath as for instance blue-violet. Celluloid which is superficially colored green, for example, may also be employed; this is covered with colorless gelatin and the first series of bands or tracks is drawn sufficiently deeply for them to expose the colorless celluloid. The sheet is then colored with a pigment dissolved in acetone, amyl acetate or any other liquid which will bite on or penetrate the celluloid. There is then spread over the whole surface a second layer of gelatin, then the second deeper series of bands or tracks is drawn, and finally there is spread over the whole surface a third color

having a base of acetone or amyl acetate. The gelatin having protected the parts of the surface not acted upon by the chisel or tool of the ruling machine, and, after having freed the celluloid from the gelatin, there will be produced a screen which is capable of resisting water and a large number of other liquids.

In using celluloid the procedure is as follows:—The sheet of celluloid is covered with a thin layer of gelatin which is colored by means of a water color, then the first series of bands or tracks is drawn through the gelatin; the sheet is colored with a second color having amyl acetate or acetone for its base, which only acts on the exposed parts of the celluloid; the whole is then covered with a second layer of colorless gelatin; the second series of bands or tracks which are deeper than the former ones is drawn and a third color of the same nature as the second is spread over the sheet.

In all the above cases, the first series of bands or tracks can be drawn in such a manner that the interval which separates them shall be equal to twice their width, as shown in Fig. 4 of the drawing. Then, after soaking and varnishing, similar bands or tracks are drawn extending nearly to the middle of the space which is afterward soaked in the third color. In this manner, the screen is formed solely by bands which are parallel to each other, but this process has the disadvantage of only overcoming part of the difficulties of registration, while the method in which the lines cross overcomes them entirely. Thus, the second series of bands or tracks can be hollowed to the same extent as the first; in this case, two colors are superposed and form at the point at which the series of lines cross each other as hereinbefore specified and as shown in Fig. 1 small squares *n* which are black or have a dark color.

In most cases, as above specified the gelatin may be replaced by collodian or by any other material which may be easily spread in a thin layer and is capable of absorbing colors having water, alcohol, etc., as their bases.

For drawing lines the ruling machines may be used in which gravers or chisels are employed and by mounting preferably on these machines a plurality of chisels or gravers arranged so as to form a number of lines at a time. Also, in order to produce filmlike screens, one can use a circular ruling machine similar to that shown by way of example in Figs. 5, 6, 7 and 8. This machine consists of a movable cylinder 1 around which the sheet is rolled and of a chisel or cutting tool 2 which is fed along by a leading screw 3 and toothed wheels 4 and 5, of which the pinion 5 is attached to the shaft of the cylinder 1. In order that the eye may not be able to distinguish separately the small colored divisions, their dimensions should be made as small as possible and thus a surface will be obtained which will appear homogeneous and whitish by transmitted light.

In order to allow the use of rotary presses, the series of lines can be drawn on cylinders.

In use, the screen produced by one of the methods described above, and protected by an impermeable varnish is covered with an emulsion which is sensitive to colors and is placed in the plate or film-carrier or frame of any suitable photographic apparatus, the emulsion being turned toward the inner face of the said carrier or frame in such a manner that the rays of light pass through the screen before reaching the said emulsion. A view will be taken in the ordinary manner and developed, then the negative so obtained will be converted into a positive and after fixing one will have a photograph having all the natural colors. At the same time, one can employ the following process when it appears to be more advantageous by reason of its permitting the production of a large number of prints: Instead of spreading the emulsion on the screen itself, there is placed in the carrier or frame, in the ordinary manner, a sensitized plate to which the screen is applied by putting the colored surface of the latter against the emulsion on the plate. The view is taken, then the plate is developed after having been separated from the screen. The selectively acted upon negative thus produced, when fixed, will enable an indefinite number of black positives to be obtained which, when suitably placed against similar screens, will immediately exhibit by transmitted light all the colorations of the model. Theoretically this adaptation or fitting of the screen to the positive should be made in such a manner that each of the small colored figures should coincide with the point of the image which it has selected, but since these thousands of figures or devices are similar to each other, are of equal dimensions and are symmetrically distributed over the whole surface of the screen, by reason of the regularity of the work done by the ruling machine, the registration may easily take place with an infinity of positions.

The transparent support of the improved screens serving for the selection may be colored slightly yellow so as to moderate the activity of the blue-violet rays.

The successive crossing of the two series of lines thus avoids the complications of registration in the manufacture of the screens. Moreover, the successive soakings each time exactly filling up the spaces produced, it follows that all the small color-compartments are automatically juxtaposed without any space being left between them,

a condition which is especially advantageous in the production of phototypes in which the selective effect is produced by light filtration.

The perfect regularity of the screens enables them to be applied to any positive produced by a similar screen, and consequently to enable the prints to be multiplied indefinitely.

Claims:

1. A method of preparing polychromatic screens, consisting in applying to a transparent support, a first series of lines, in a greasy solvent, in coloring the intervals between these lines with a colored liquid which will not affect the greasy colors and capable of entering the support, in impressing a second series of lines crossing the first ones, and in coloring the intervals with a colored liquid which will not affect the greasy colors and capable of entering the parts of the support not covered by greasy lines.

2. A method of preparing polychromatic screens, consisting in applying to a transparent support sundry of the colors in series of intersecting lines and in coloring the intervals after the drawing of the lines of each series by means of pigments whose vehicle is nonmiscible with the vehicle of the pigments of the other colors.

3. A method of preparing polychromatic screens, consisting in applying to a transparent support, the pigments of sundry of the colors, in a greasy vehicle, and in series of intersecting lines, and afterward coloring the intervals between the lines with a color whose vehicle is nonmiscible with the greasy vehicle, and capable of entering the support.

4. A process of preparing polychromatic screens, consisting in spreading over a transparent support a layer of transparent material, then applying sundry of the colors in a greasy vehicle, in series of intersecting lines, and afterward coloring the intervals between the lines with a color in a vehicle nonmiscible with the greasy vehicle and capable of penetrating the transparent layer covering the support.

5. A process for the manufacture of screens with polychromatic divisions for color photography consisting in applying on a support two colors in a greasy vehicle, in two series of intersecting lines, and in filling the intervals between the grooves with a third color in a vehicle nonmiscible with the greasy colors and capable of entering the support.

6. A process for the manufacture of screens with polychromatic divisions for color photography consisting in drawing parallel tracks over a plate, in inking the latter by means of a color in a greasy vehicle, in transferring by means of this plate thus inked colored lines on a sheet of transparent material, in transferring in the same manner colored lines of a second color and in such a way that they intersect the lines of the first color and in finally coloring the empty spaces by spreading over the whole surface the third color in a vehicle nonmiscible with the greasy vehicle and capable of entering the support.

7. A process for the manufacture of screens with polychromatic divisions for color photography consisting in spreading over a glass plate a transparent layer of gelatin, in applying to the latter successively two of the selected colors in a greasy vehicle in two series of intersecting lines, and in spreading over the surface the third color in a vehicle capable of entering the transparent layer.

8. A process of preparing polychromatic screens, consisting in spreading over a transparent support a layer of transparent material containing fine granular material, in applying sundry of the colors in a greasy vehicle, in a series of intersecting lines, and afterward coloring the intervals between the lines, with a color in a vehicle capable of penetrating the transparent layer.

9. A process for the manufacture of screens with polychromatic divisions for color-photography consisting in spreading over a transparent support a transparent layer containing in suspension very fine colorless grains, in successively transferring over the latter two of the selected colors, in a greasy vehicle in intersecting lines, and in applying over the surface the third color in a vehicle capable of entering the transparent layer.

10. A process for the manufacture of screens with polychromatic divisions for color photography consisting in spreading over a transparent support a transparent layer with which a solution of starch is mixed, in applying the two selected colors, green and orange red, in a greasy vehicle in two series of intersecting lines, and in immersing the work in a solution of iodin to act in the empty spaces left between the greasy colors so that the starch will turn to blue-violet.

11. A method of preparing polychromatic screens, consisting in applying to a translucent support, colors in fine intersecting figures, and afterward coloring the intervals between the figures by means of colors whose vehicle is nonmiscible with the vehicle of the first colors.

12. A method of preparing polychromatic screens, which consists in applying sundry of the colors to the screen in definite figures, and afterward coloring the intervals between the figures with a color whose vehicle is nonmiscible with the vehicles of the first colors.

13. A method of preparing polychromatic

screens, which consists in applying sundry of the colors to the screen in small intersecting figures, and afterward coloring the intervals between the figures with a color whose vehicle is nonmiscible with the vehicles of the first colors.

14. A method of preparing polychromatic screens by aid of greasy colors, which consists in applying sundry of the colors in a greasy vehicle to the screen in definite figures, and afterward coloring the intervals between the figures by means of colors whose vehicle is nonmiscible with the vehicle of the other colors.

The foregoing specification of our improvements relating to the manufacture of screens for use in color-photography signed by us this 21st day of December 1906.

LOUIS DUCOS DU HAURON.
RAYMOND DE BERCEGOL.

Witnesses:
HANSON C. COXE,
MAURICE H. PIGNET.