UNITED STATES PATENT OFFICE.

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POLYCHROME SCREEN AND PROCESS OF MAKING THE SAME.

974,464. Specification of Letters Patent. Patented Nov. 1, 1910.

No Drawing. Application filed September 9, 1907. Serial No. 391,964.

To all whom it may concern:

Be it known that I, CHARLES L. A. BRASSEUR, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented a certain new and useful Improvement in Polychrome Screens and Processes of Making the Same, of which the following is a specification.

This invention relates to partycolored, or polychrome, grained screens intended primarily for use in color photography and to a process for making the same, and has for its primary object the production of a screen wherein the grains are flat on both sides, are thin, and touch each other at their edges.

Other objects will appear hereinafter.

It has been suggested (McDonough, United States Patents Numbered 471,186 and 471,187 of 1892, Lumiere, French Patent Number 339,223 of 1903) that such screens for making color-photographs at one exposure be made by thoroughly mixing quantities of three differently colored grains, and then dusting them promiscuously on a tacky surface. The grains necessarily adhere to the part on which they happen to strike, and remain in the positions they then have, whether that be a corner or an edge down, and, the grains being more or less irregular in shape, there results a series of irregular intervals between the colored grains. As du Hauron had already indicated in his French Patent Number 83,061 of 1868, it is necessary that the surface of polychrome screens, grained or lined, be entirely covered by the pattern; that is, that no white light shall come through between the colored grains or other areas. McDonough accomplishes this, according to his said patents, and makes the colored grains join one another by heating the plate until the particles soften and melt, which action, as he indicates, not only joins the grains but also flattens them and makes them more transparent. In the British Patent Number 9,100 to Lumiere in 1906, starch grains are suggested and these are crushed by rolling after being dampened, thus making the edges of the grains join each other. In a former patent, (English Patent No. 25,718 of 1904) the Lumieres indicate the filling up of any interstices that may remain by means of a finely divided black powder. The result in both processes is a polychrome screen, made up of an irregular mosaic of differently colored and shaped areas, which may be flat on the upper side but whose under sides are more like ground glass, or are flattened more or less without being parallel to the upper sides As such irregularity of areas increases the difficulties one has to overcome when making duplicate positives from an original negative (see my French Patent Number 364,132 of March 1, 1906), I have endeavored to carry out the requirements of my said patent by using polychrome screens made up of blocks of celluloid (as there indicated), but made by a method now to be described.

Blocks of celluloid or of an analogous plastic material are made of the desired volume. If cut from sheets, cubes can readily be obtained, with sides running from the one five-hundredth to the one one-thousandth (1/500 to 1/1000) of an inch. If cut from threads, small cylinders or prisms will be obtained, according to the section of the thread. Filaments of artificial silk impregnated with celluloid can also be used but the transparency is not equal to that of plain celluloid. Once these small particles of transparent plastic material are obtained, they are dyed of the proper colors and are then rolled between disks or plates until they assume a spherical shape. The disks may be heated, but I find that the heat generated by the friction will, in the case of such small particles of celluloid, be quite sufficient to enable them to assume a more or less spherical shape in a few seconds. Once these imperfect spheres are obtained, it is well to grade them as to size by sifting them one or more times and then to again subject them, in separate lots, to rolling in order to obtain very perfect spheres of equal diameter. Many other materials, natural grains, etc., can thus be converted into spheres, but the treatment of the material to enable it to assume the spherical shape by rolling necessarily varies with the nature of the material employed. It is possible, of course, to make polychrome screens by distributing these particles on a tacky celluloid film or glass.

And, as is the custom in making imitation Florentine mosaics and also imitation marbles, to cause the particles to join one another at their edges by submitting the whole to heat and pressure between polished metal plates, the result being a polished multicolored mosaic, the different components of which are still somewhat irregular in shape, as the tackiness of the surface prevents the spheres from rolling into contact with one another and thus acquiring that symmetry of distribution and spacing which is absolutely necessary to obtain equality of areas in the finished screens.

To overcome the above-mentioned difficulty, I prefer to proceed as follows:—A sheet of paper or similar material is thoroughly stretched on a very flat board, glass or an open frame. This paper must be coated before or after stretching with a coat of adhesive material, gum, gelatin, rubber, etc. This is allowed to dry to such an extent that it loses its adhesiveness, or, at least to such an extent that the spheres of celluloid or the like, when thrown upon it, will readily roll or run into contact with one another and will not be held in place where they happen to strike. A shallow frame of cardboard must be placed around the edge of the paper to prevent the spheres from rolling off. Once the surface of the paper has been entirely covered with these spheres of various colors, the dry and now non-adhesive material must again be rendered adhesive by moisture, (applied to the back of the paper stretched as above mentioned) heat, or by a spray of liquid, or by whatever means will soften the coating of adhesive material. The grains (spheres) will now become adherent to the paper support and if the adhesive material be again allowed to harden and dry, the surplus layers of spheres can be removed therefrom by brushing them off. The result is a paper or other support covered with a single layer of colored spheres, uniformly and symmetrically distributed. The paper bearing the spheres can now be removed from the board, glass or frame, and be transferred face down on to a thin film of celluloid, preferably flowed on a polished metal plate. The film must be almost dry before the transfer is made. But, in the case of ready-made films, it is best to spray it over with a solvent or partial solvent of celluloid so as to facilitate adhesion between the spheres and the film. As in the case of imitation Florentine mosaics, the whole is now submitted to heat and pressure, which causes the spheres to flatten out, adhere together and to the film beneath. In order to avoid any tendency for the spheres to run into each other, the sphere-covered paper can have sprayed over it a thin solution of gelatin with acetic acid, or other isolating material, care being taken to pass an absorbing roller over all to clean off that part of the spheres which is to come into contact with the film; or again, some of the spheres can be rolled in some inert powder or be coated with gelatin or like material, before being applied to the paper.

After the paper bearing the spheres has been pressed on the celluloid film, the whole is allowed to cool, and the paper is then removed by means of a suitable solvent of the adhesive material on it. Any interstices remaining in the screen can now be filled up by rubbing in appropriately colored powder of celluloid. A thin solution of celluloid is then sprayed upon the surface which has been in contact with the paper, and the film is polished between hot metal plates.

While I prefer to use a powder of the same three colors as the colors already on the plate or film, I do not limit myself to such powder.

If any interstices happen to remain between the grains, the film at such points can be daubed over with bichromated glue or gelatin. When dry, the film must be exposed to the light from the reverse side so as to expose only the gelatin behind such interstices to the action of white light and only such gelatin will become insolubilized. The excess gelatin can be removed with hot water and that which remains can be dyed of some appropriate color, thus blocking out all white light. The film, in such places, had best be sprayed over with celluloid and the sheet be refinished. The film will now be ready for the various operations necessary to put upon it a sensitive photographic film out of which is to be formed the negative or the positive.

It is obvious that the spheres can be applied directly to the celluloid film if this be perfectly flat (as on a metal plate) and it be rendered adhesive and this in turn be allowed to become almost dry before applying the spheres, but it is hard to make endless polychrome films by this method. The transfer method offers many advantages. It allows one to apply monochrome bands of the different colored spheres along the edges or at other suitable places; the uses of these bands has been indicated in prior applications of mine. It also allows one to make endless polychrome films for kinematographic purposes, or for roll film cameras, by transferring grained paper to the endless film and after removal of the paper filling up the gaps, if any, by applying similarly colored grains.

It is clear that instead of transferring the spheres from the paper to a thin film, the paper bearing the spheres may first be subjected to heat and pressure, thus flattening the spheres on both sides, and then just enough celluloid may be sprayed over the surface to give the finished film sufficient

consistency and to make sure that the mosaic will hold together. After the removal of the paper, the newly uncovered side of the film can be sprayed over with celluloid and the whole be polished between metal plates.

It is clear that the spheres may be flattened while still on the paper and afterward be transferred to the film in the manner above indicated.

When it is desired to make screens on glass, the glass must be prepared to make the celluloid adhere to it. A thin layer of bichromated gelatin is first spread on the glass and when this is dry, the back of the plate is exposed to the light for a few seconds so as to insolubilize that part of the gelatin which is in immediate contact with the glass. The plate is now washed in cold water to remove all soluble chromates. After drying, a thin solution of celluloid containing glacial acetic acid or other common solvent of gelatin and celluloid, is poured over the plate, the acetic acid will slightly dissolve the soluble gelatin and the result will be a layer of celluloid firmly welded to the underlying gelatin which is itself firmly adherent to the glass. The remaining soluble gelatin between the celluloid and the glass must be rendered insoluble by being soaked in a hardening solution. After washing and drying, it will be found practically impossible to remove the film from the plate. The plate can now be treated as if it were a celluloid film, and have the spheres placed upon it in the same way.

It is clear that this method of making polychrome screens can be applied to the production of screens for other photographic purposes. Thus, in my said patent of March 1, 1906, I describe a mosaic made up of three pure colors, and in which the sum of the surfaces of the different colors are proportioned to the time required to impress the sensitive plate in the manner described in that patent. A screen made up of minute particles and forming a perfectly homogeneous layer, such as results when the operations described herein are properly carried out, can be used not only in contact-printing as described in my said patent of March 1, 1906, but can also be used while copying with the camera, as these new screens can be used, cemented between glasses if need be, either before or behind the lens or at the diaphragm plane of the lens or closely adjacent thereto and fulfil the same purpose as the radial screen described in my said patent.

Black and white half-tone screens can also be made by means of these spheres. In such case, spheres of colorless celluloid must be mixed with an equal number of black or opaque spheres, the one requisite of the opaque spheres being that they be opaque to the rays which affect the silver salts used in copying. The black and white screens can be made of any fineness, as one hundred and fifty, one hundred and seventy five, or two hundred or more to the inch, by taking spheres of an appropriate diameter for making the same. The black and white screen had better be sealed between two glasses, but film screens can also be made for contact-printing, the spheres in such case being pressed in contact with a film of such thickness as will answer the theoretical requirements of screens when used in this manner. Half-tone screens, when made in alternate squares, are very luminous as compared with ordinary cross lined half-tone screens. The mechanical or symmetrical effect of the half-tone screen may be broken up by using grains or spheres of unequal diameters; such a screen also avoids the moire-effect arising from the use of lined screens in color-printing.

Symmetrical or pattern effects in color screens for color photography may also be avoided by having the differently colored spheres of unequal diameters, but, in such case, the quantities of each color must be so chosen as to secure equal areas (in the aggregate) of the three colors.

The spheres or grains of any shape, instead of being mixed together, can be applied to the temporary or final support by distributing machines fitted with feeding devices which will feed spheres or grains of only one color at a time and moving back and forth at such a speed that the spheres or grains fed by one feeding device will form a continuous row, the different colors being fed in different rows, thus securing more symmetrical color-distribution than in the case of first mixing the different colors and then dusting them on a tacky surface.

While the spheres are still upon the paper support and before the adhesive is rendered tacky, the spheres may be caused to pack together more closely by shaking slightly or by tapping the plate or frame, thus leading to the distribution of the spheres six about one, and to the formation of hexagons on the finished screen.

The supporting film may be made of celluloid, viscose, or other suitable material.

What I claim as new and desire to secure by Letters Patent of the United States is—

1. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in forming as spheres grains of different light-selective absorption properties, distributing said grains in a layer on a support, flattening them out and binding them together.

2. The method, substantially as hereinbe-

fore set forth, of forming grained screens for use in photographic processes, consisting in placing a quantity of grains of different light-selective absorption properties upon an adhesive substance in a dry or non-sticky condition and causing them to pack close together, rendering said substance adhesive and then drying it again, removing the surplus grains, then flattening the grains remaining upon said substance, and then placing on them a binder layer.

3. A screen for photographic processes consisting of grains of different light-selective absorption properties integral with a colorless film of the same material as the grains.

4. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in placing a quantity of grains of different light-selective absorption properties upon an adhesive substance backed by paper and in a dry or non-tacky state and causing them to pack close together, rendering said adhesive substance tacky and then drying it again, removing surplus grains, then transferring the layer to a colorless film, flattening the grains, and binding them together and to said film.

5. A screen for use in photographic processes consisting of thin flat grains of different colors forming a layer coated on one side at least with a thin layer of colorless material and integrally connected with said grains, the whole forming an endless film which can be rolled up and unrolled in film-cameras and kinematographic work.

6. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in cutting minute blocks from a colorless transparent material, dyeing the same to give them different light-selective absorption properties, distributing said blocks in a layer on a support, flattening them out, and binding them together.

7. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in cutting minute blocks from a colorless transparent material, grading said blocks to size, dyeing the same to give them different light-selective absorption properties, distributing said blocks in a layer on a support, flattening them out, and binding them together.

8. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in placing a quantity of grains of different light-selective absorption properties upon an adhesive substance in a dry or non-sticky condition and causing them to pack closely together, rendering said substance adhesive, then drying it again and removing the surplus grains.

9. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in placing a quantity of grains of different light-selective absorption properties upon an adhesive substance, causing them to pack closely together, in a single layer, and transferring the said layer to a film and binding them together and to said film.

10. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in placing a quantity of grains of different light-selective absorption properties upon a transfer surface coated with a soluble adhesive substance, causing them to pack closely together in a single layer, and transferring the said layer to the surface of the screen, by placing the transfer surface with the grains adhering thereto face down on the screen, dissolving the adhesive substance and removing the transfer surface, and binding the grains together and to said film.

11. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in placing a quantity of grains of different light-selective absorption properties upon an adhesive surface, applying an isolating material to said grains to keep them separate, and applying heat and pressure to the whole, to cause said grains to flatten, adhere together and to the surface on which they rest.

12. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in placing a quantity of grains of different light-selective absorption properties upon a transparent surface, causing said grains to adhere closely together and to the surface by application of pressure, daubing a bichromated colorless fluid substance over any interstices remaining between the grains, drying the same, exposing the surface from the reverse side to white light, removing all of the bichromated substance which has not been insolubilized by the action of light, and dyeing that which remains.

13. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting in cutting minute blocks from a colorless transparent material, forming the same into spheres, dyeing the same to give them different light-selective absorption properties, distributing said spheres in a layer on a support, flattening them out, and binding them together.

14. The method, substantially as hereinbefore set forth, of forming grained screens for use in photographic processes, consisting

in cutting minute blocks from a colorless transparent material, forming the same into spheres, dyeing the same to give them different light-selective absorption properties, grading them according to size, distributing the spheres in a layer on a support, flattening them out, and binding them together.

Signed at New York city in the county of New York and State of New York this seventh day of September, A. D. 1907.

CHARLES L. A. BRASSEUR.

Witnesses:

T. F. KEHOE,

R. W. BARKLEY.