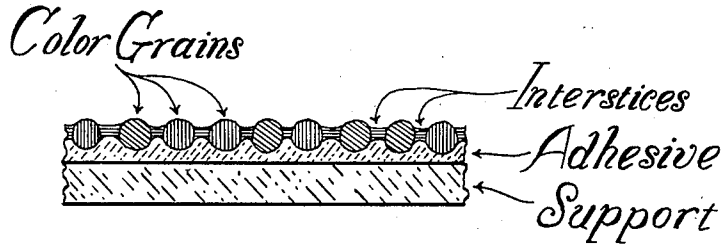
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COLOR PHOTOGRAPHY

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Cross-Sectional View Showing the Adhesive Welling up Between the Color Grains, Preventing Overlapping.

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COLOR PHOTOGRAPHY

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This invention relates to color photography and is directed more specifically to the production of a color screen of such nature and form that when coated with a sensitive layer it may be used in the making of natural color photographs directly on glass, celluloid or other transparent or translucent material, whether for still pictures or for cinematography.

It is the object of the invention to provide a practical method whereby a new color screen can be produced quickly and efficiently with freedom from the defects and without the practical drawbacks commonly met with in the past.

In order to describe the improvements embodied in the invention, it is necessary to outline some of the requirements of a color screen that are fulfilled by the invention.

First of all it is preferable that the color elements, which are formed in juxtaposition in the screen be of the correct three primary colors and be capable of being produced in extremely fine dimensions without overlapping or leaving white interstices. This latter is important as the merest trace of white light passing through the screen around the color elements is fatal to the finished picture. Therefore the color elements themselves must present an arrangement such that each element joins and is in absolute contact with other color elements. It is furthermore just as important that the color elements do not overlap, as overlapping would result in opacity or faulty color values which would impair the brilliance of the final result.

It will be readily seen that in the formation of a color screen the slightest differences in the physical and optical properties of the same may determine the success or failure of the screen in the application for which it was intended and consequently the process employed for the manufacture of the same.

This invention provides a method whereby the operation of manufacture may be performed efficiently and expediently to produce the novel color screen as hereinafter described whereby the above mentioned physical and optical requirements are fulfilled.

It is also a feature of the invention that, in the application of the color screen to celluloid, especially where the celluloid so treated is to be used in cinematography, long rolls can be coated quickly and uniformly, the application being direct on the celluloid without requiring any transferring methods from previously prepared supports as have been employed in the past, and without appreciable loss of the materials used.

In the past it has been suggested that screens for making color photographs may be produced by thoroughly mixing quantities of three differently colored grains, and then attaching them to the surface of a transparent support. Experience shows, however, that a screen prepared by this method does not entirely exclude the passage of white light because of the presence of spaces between the grains as so positioned. Various further steps have been suggested to fill these interstices to prevent the passage of white light, such as the application of a finely divided black powder, for example, charcoal dust, but it is readily seen that the presence of such powder presents certain opaque sections in the finished color screen, clearly impairing the brilliancy of the final result. Other efforts to fill these interstices have been made, including the use of heat and pressure applied to the grains after their application to a support, to effect a union between the particles. Experience has proved, however, that such means alone cannot be depended upon to fill up the interstices and recourse must be had to the use of an opaque powder, with the resultant defect set forth above. Likewise, the effects of heat and pressure in fusing finely divided color particles frequently has a damaging effect with regard to predetermined color values in the color particles, upon which uniformity of the color screen depends, this uniformity being especially important in the manufacture of film for cinematography.

Further efforts to block out the passage of all white light are revealed by a process suggested in Camiller U. S. Patent No. 1,440,373. This process comprises mixing solid colored particles with a tacky substance dyed another color and forming a paste which is applied to a support. This process naturally blots out all white color, but introduces a detrimental overlapping of the colors which as hereinbefore pointed out has a serious damaging effect in that the color values are made faulty. Further, the effect of a colored medium surrounding the colored particles is injurious upon the colors in the solid particles, for the presence of even a thin film of a different color overlying the particles changes the spectographic tint of the particle with resulting decrease in the brilliancy and color accuracy of the photograph.

The difficulties inherent in the processes enumerated and the consequent defects in the finished product are overcome by my invention whereby I produce a color screen having no opaque sections and having colors in absolute contact and in perfect relationship with each

other with respect to the physical and optical requirements above described. My color screen has a single layer of transparent or translucent solidly-colored particles of two colors positioned by a colorless adhesive, with a deposit of a third color, applied in the form of a liquid, between the particles, but not overlapping them. Overlapping is not present in my color screen because the colorless adhesive substratum, to which the mixed particles of two colors adhere, wells up, to some extent at least, between the particles when they are applied, thus forming a foundation for the colored liquid medium subsequently deposited between the particles and preventing that medium from passing beneath the colored particles. Overlapping on the upper surfaces of the colored particles is prevented by removing or draining the liquid medium therefrom after application. The third color medium is thus present only between the central portions of the colored particles and while preventing the passage of any white light, constitutes but a relatively thin layer whose contact edges do not depart from the perpendicular sufficient to have any detrimental effect. By thus preventing any appreciable overlap the spectrographic tints of my colored particles are not impaired to such an extent as to affect the final result.

I have found that when colored particles of a plurality of colors are thoroughly mixed and spread upon a colorless adhesive coated support there are white spaces intervening the adhering particles in a definite ratio to the number of particles. I have also found that this space area is of such proportion to the greatest cross-sectional area of the combined particles that when filled with a medium of another color the resulting cross sectional area proportion among the colors is of such a nature as to be highly successful in the making of natural color photographs.

My method therefore consists of the application of one color in the form of a liquid after particles of other colors have been positioned on a colorless adhesive. This liquid when applied completely fills the interstices between the particles but extends downwardly only to the colorless adhesive. I also insure that there is no overlapping above the particles by removing, as hereinafter more fully explained, such liquid from the upper surfaces of the adhering particles.

The accompanying drawing is an enlarged cross-sectional view of the color screen showing the adhesive welling up between the color grains, preventing overlapping.

It is my preference to position particles of two primary colors (such as red and green) and then use a medium of the third primary color (such as blue-violet). However, these colors may be interchanged and it readily appears that my process may be used in the making of a two color screen by applying first particles of only one color.

For individual screens to be used for certain types of photography a certain number of particles of the same color as the later applied medium may be used. This, however, is not necessary for the usual practice.

More specifically my process consists in the application direct upon glass, celluloid, or other transparent or translucent material, of a colorless adhesive substratum, which may be of gelatin. I have found that such a solution as the following is suitable, and is one that will not be affected by subsequent applications:—

Soft gelatine	g--	50
Fish glue	g--	50
Water	c. c. m--	1000

I then sprinkle or coat thereon a mixture of color grains which are dyed two of the three primary colors, and which are preferably of a substance such as gelatine powdered and sifted to a suitable size. Before coating, these two types of solidly colored grains are thoroughly mixed together in equal portions. Preference is expressed for gelatine and other colloidal substances, suitably stained, to glass covered by metallic oxides, as stained glass cannot hope to compete with gelatinous substances colored by aniline dyes, with respect to either its brilliance or spectrographic tint.

After the tacky substance has become dry any non-adhering grains are dusted off.

As a modification of this step in the process, I have found the following highly successful, especially in cinematography where long rolls of film are to be coated. The colored grains to be applied to the adhesive are mixed in a volatile liquid, such as petroleum or other oil and while the colored grains are kept in suspension by agitating, the adhesive is coated with the liquid. This coating may be accomplished by such a process as spraying or immersing. The colored grains are thus deposited on the adhesive surface and any surplus of the grains may be removed by washing, such as immersing or spraying the screen with the same or another liquid. After the color grains have been applied in this way the oil used volatilizes and the color screen is then ready for the next operation. If desired a light pressure may be applied to the screen by means of a roller or otherwise to insure the union of the color grains with the adhesive substratum.

At this stage of the process there are white spaces or interstices intervening the adhering particles. These, I fill by applying an emulsion or colloidal suspension containing the third primary color. This may be done by spray, brushing or coating. This medium is of such a nature as to not affect the layer which has been previously applied and may be collodion. As described above, this liquid does not pass beneath the particles.

My next step is to remove the liquid medium from the upper surfaces of the adhering particles. This may be done by an expert by the use of a soft cloth or pad wiped over the surface. Mere wiping, however, is not certain to successfully remove all the overlying medium and therefore I find it to be highly practical to place the surface screen after the application of the liquid medium or after wiping, in a saturated vapor chamber. By this method, because of surface tension, the liquid medium is removed from the upper surfaces of the colored particles by drainage. The screen may then be removed from the saturated atmosphere and dried.

My screen is now ready for a coating of a protective layer of varnish which serves to increase the transparency of the screen as well as to protect it from the action of moisture, chemicals, and developers which may be subsequently applied. It is preferable to use a resin varnish for this purpose and I give the following as an example:—

Manilla copal	g--	100
Carbon tetrachloride	cm--	1000

The color screen may now be coated directly

with panchromatic silver emulsion and is then ready for use in the camera, or for making reproductions, exposure being made through the support so that the light passes through the color screen before striking the sensitive panchromatic emulsion.

Having described my invention what I wish to claim and secure by Letters Patent is:—

1. A color screen comprising a support, a colorless adhesive attaching thereto a single layer of solidly-colored particles of two colors, said particles projecting through a layer of a differently colored medium.

2. As a new article of manufacture, a structure comprising a support having thereon a colorless adhesive embedding a single layer of solidly colored particles of two colors, a deposited layer of a third color filling interstices between said particles, said structure having a protective coating, and a light-sensitive layer thereon.

3. A color screen comprising a support, a colorless medium thereon, solidly colored particles bound to said support by said colorless medium, said particles being interbound by a medium of a different color.

4. A support, solidly colored particles of a plurality of colors bound thereto by a colorless medium, said particles being interbound by a substantially continuous sheet of a differently colored medium.

5. A transparent color screen comprising in vertical cross-section a support, a colorless adhesive embedding solidly-colored particles of a plurality of colors, and a layer of a hardened deposit, of a color different than that of the majority of said particles, filling interstices between said particles.

6. A transparent color screen comprising in vertical cross-section a support, a layer of colorless adhesive embedding solidly-colored particles, and a layer of a differently colored medium binding the central portions of said particles.

7. The method of making a transparent color screen, comprising coating a support with a colorless tacky substance, spraying thereon solidly colored particles of two colors, removing non-adhering particles and filling resulting interstices with an interbinding liquid medium of a different color.

8. The method of making a color screen, comprising coating a support with a colorless adhesive, spreading thereon solidly colored particles, removing non-adhering particles, applying thereto a differently colored liquid adhesive and exposing upper surfaces of said particles.

9. The method of making a color screen, comprising applying a single layer of solidly colored particles to a colorless adhesive surface and depositing an interbinding liquid medium of a color different than that of the majority of said particles, between said particles.

10. The method of making a color screen, comprising applying a colorless adhesive to a support, spreading thereon solidly colored grains suspended in a volatile oil, washing off non-adhering grains, volatilizing said oil and filling resulting interstices with a differently colored liquid medium exposing upper surfaces of said grains in a saturated atmosphere and drying.

11. The method of making a translucent color screen, comprising affixing solidly colored particles to a colorless adhesive on a support and interbinding said particles with a layer of a differently colored liquid adhesive.

12. The method of making a transparent color screen, comprising affixing solidly colored particles to a colorless adhesive surface and depositing between said particles a differently colored adhesive.

13. In the preparation of a photographic color screen, the method of filling interstices between particles affixed to a colorless adhesive surface, comprising spraying thereon dyed collodion and exposing upper surfaces of said screen in a saturated vapor chamber.

14. The method of making a color screen comprising spreading solidly colored particles on a layer of colorless adhesive, spraying thereon a differently colored pyroxylin solution and volatilizing the solvent of said solution.

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