PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements relating to Optical Systems.

We, TECHNICOLOR MOTION PICTURE CORPORATION, a corporation of Maine, United States of America, of 110, Brookline Avenue, Boston, Massachusetts, United States of America, assignees of JOSEPH ARTHUR BALL, a citizen of the United States of America, of 110, Brookline Avenue, Boston, aforesaid, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to achromatic optical systems, and more particularly to systems adapted for use in color photography involving three (or more) different color aspects of the same scene. As is well-known, the effects of chromatic aberration are particularly objectionable in three-color photography and apochromatic lenses have been deemed essential for the purpose. However, the manufacture of such lenses is extremely difficult, involving the use of three or more kinds of glass in a single element, etc., and their design imposes restraints in other directions to such a degree that they can be used only at relatively small apertures, which is unsatisfactory in the art of cinematography, particularly color cinematography.

Objects of the present invention are to produce an optical system especially adapted for three color photography, which substantially eliminates noticeable effects of chromatic aberration and which at the same time eliminates the necessity of apochromatism.

This invention is based upon the principle that if a camera for making three or more color records be provided with a lens which is achromatic with respect to the two colors of longer wave length, the resultant multi-color picture will be free from objectionable effects of chromatic aberration even though the light component or components of shorter wave length be substantially affected by chromatic aberration. Thus, in three-color photography, using red, green and blue light components for the respective exposures, by making the lens achromatic with respect to the red and green components, the resultant three-color picture has satisfactory achromatism for most purposes, including average cinematographic requirements, even though the record formed with the blue component is substantially affected by chromatic aberration. Indeed a considerable lack of registration in the blue record is not serious. That one record may be substantially affected by chromatic aberration without noticeably affecting the three-color composite is due to the fact that the positive record exposed with blue light, which is colored yellow, contributes little or nothing to the definition of the composite picture.

Since methods of correcting lenses for chromatic aberration are well-known, and since there are innumerable lens designs to which this invention may be applied, it is not only unnecessary to describe the various applications but such description would uselessly encumber this disclosure, the invention consisting broadly in an optical system in which the lens elements (including prisms if used in such manner as to produce a lens effect as disclosed, for example, in British Patent No. 131,422 are achromatic with respect to the colors transmitted by the filters chosen for the two light components of longer wave length, such as red and green in three-color processes, and in forming three or more different color records in which the effect of chromatic aberration is confined chiefly to the record or records exposed with the light components of shorter wave length. Likewise, the many camera arrangements for dividing the light into component parts and for shuttering the light while advancing the cinematographic film form no part of the present invention, a typical example being shown in the British Application No. 10,333, filed April 1, 1930. (Serial No. 350,112). However, in producing motion pictures, the light for exposing the respective records should be collected along the same optical axis, that is, from the same point of view, and the records, particularly the red and green records, should be exposed concomitantly.

Throughout the Specification and claims all references to red, green, blue, etc., are to be understood to refer to colors or hues in which these particular colors are largely involved, that is ranges of shades in the regions of these colors, such as red-orange, blue-green, blue-violet, etc., and not necessarily pure colors; also that the particular ranges of wave lengths chosen for any particular use depends upon the judgment of the designer and that the invention is not limited to any particular ranges of wave lengths. However, for the purpose of illustration, typical examples of colors which have been found particularly suitable for cinematographic pictures are those transmitted by Wratten filters No. 25, No. 58 and No. 49 for red, green and blue ranges, respectively.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The method of producing three-color cinematgraphic pictures which are free from objectionable aberration, of the type in which the different color components of light (e.g. red, green and blue) from the object-field are concomitantly focused on suitable film areas, characterized in that the focusing lens elements are corrected for chromatic aberration with respect to the color represented by the two components of longer wave length (red and green, e.g.), whereby the effect of chromatic aberration is substantially confined to the third component of shorter wave length and is therefore rendered unobjectionable without the use of apochromatic lenses.

2. Apparatus for practicing the method of claim 1 characterized in that the three components are focused with the same lens combination achromatized as aforesaid.

Dated the 9th day of August, 1930.

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