[Second Edition.]

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in Multi-colour Photography.

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 823, North Steward Street, Hollywood, California, United States of America, 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:—

One of the many proposed solutions of the problems of color photography is the utilization of superimposed emulsions by using one incident light path (mono-packs, bi-packs and tri-packs). Another solution is the dividing of the incident light into as many divisions as color aspects are desired. Either of these solutions has certain disadvantages if the recording of more than two color aspects is required, these disadvantages being well known to those skilled in the art and consisting mainly in difficulties of obtaining proper registering, sharp definition and sufficient light intensity.

The present invention combines the advantages of the systems of color photography mentioned above and it is its main object to provide an arrangement whereby normal and identical emulsions can be used for the records for which this is desirable; which does not necessitate the use of special and abnormal emulsions; which permits color separation without special sensitizations; and which permits the incorporation of a key record without substantial changes of the three color system.

The taking process employed by the invention is of the type in which the image-bearing beam is divided, by suitable light-dividing means, into two components, one of these components is used to expose two emulsions (of a bi-pack, e.g.) and the other component is used to expose at least one other emulsion. The main feature of the invention consists in forming the blue and red records in one component light beam and the green record in the other beam whereby the red and green records may be exposed in like emulsions preferably both panchromatic and cut from the same stock. By forming on these like emulsions the two images which contribute mainly to building up the gradation, or, in other words, supply the " body " or " substance " of the final picture (the gradations of the yellow positive being rather weak), and which must therefore be carefully balanced in exposure and development (e.g. the red and green records) the desired balance may be obtained uniformly and with facility. This can not be accomplished by recording the red and green aspects in the same light path for various reasons, chiefly because it has thus far been impossible to prepare a green-sensitive film satisfactory for bi-pack use in front of a red sensitive film. But even if this could be accomplished the emulsion would have to be thin and relatively transparent and since its color selection must depend upon sensitization rather than filters, it would be radically different from the red-sensitive film and the two could not be properly balanced in exposure and development throughout varying conditions such as are encountered in cinematography.

Other objects of our invention will be apparent from the following explanation accompanied by a drawing in which:

Fig. 1 is a diagrammatic section showing an embodiment of the present invention; and

Fig. 2 shows a modification of the present invention in the same manner as Fig. 1.

In order that the invention may be more easily understood a specific embodiment thereof will first be described. It is diagrammatically shown in Fig. 1, where O represents an optical system of any suitable construction, and P a light splitting device comprising a partly reflecting and partly transmitting surface M, which divides an incident light beam L into two divisions S and R as indicated by arrows. 1, 2 and 3 are suitable supports, for instance, cellulose films, bearing emulsions 11, 12 and 13. 11 is an ordinary silver bromide emulsion, blue sensitive only, requiring no special treatment and of a

[*Price* 1/-]

kind which can easily be obtained with the required thin and transparent characteristics as necessary for the front film of a bi-pack; 12 and 13 are panchromatic emulsions of usual characteristics. The heavy line RD represents a layer of dye, in this instance a surface layer of red filter dye which transmits only the range of radiation required for the red image to be recorded upon emulsion 12. G is an ordinary green filter inserted between the optical system and emulsion 13 and transmitting only the range of radiation required to record the green aspect upon emulsion 13. It is understood that film 3 and filter G can be placed in the direct rays and films 1 and 2 in the reflected rays.

In certain cases it becomes desirable to add to the three records of a three-color photographic process a fourth so-called key print, usually reproduced in gray or black which has the main purpose of giving definition to the colored picture and in certain cases to supply the deep shadows. Our invention lends itself well for the production of colored pictures with key prints and a four-color system of this kind will now be described, referring especially to Fig. 2. O, P and M is again an optical system; 1, 2, 3, and 4 are supports, a fourth support 4, having been added to 1, 2 and 3 of Fig. 1. Emulsion 14 upon support 4 may be a panchromatic emulsion which is thin and transparent enough to transmit as much light as possible to the back emulsion 13. A green surface dye GD is applied to emulsion 14, having the purpose of admitting to emulsion 13 only the radiations suited for recording thereon the green aspect, the surface dye filter GD replacing separate filter G of Fig. 1. Y is a yellow filter which absorbs radiations in the same manner as filters which are used with orthochromatic emulsions for ordinary black and white pictures.

Emulsions 11, 12 and 13 are of the same nature as the corresponding emulsions of Fig. 1; 12 and 13 being identical panchromatic emulsions, if possible slittings from the same stock, and 11 is an ordinary blue sensitive transparent emulsion. It is of course necessary that the key print be as definite in sharpness as possible and that the definition is preserved through the process. For this purpose it is desirable to print key positives by means of contact printing which does not cause loss of definition and does not build up graininess. With our arrangement, as shown in Fig. 2, it is possible to use contact printing in spite of the fact that the reflected image is reversed, because the key emulsion is exposed through the back which compensates for the reversal of the image by reflection.

A further advantage of our arrangement arises from the fact that it is desirable to have for the purpose described key prints of a gamma of approximate unity and that the same gamma is desirable for photographic sound records which are now used with a large number of films. In making sound motion pictures the sound track is therefore printed together with the key print thereby making unnecessary any differentiation in the character of picture and sound records. The negative sound record (ordinarily made on a separate negative) may be printed on the positive film along with the aforesaid key pictures and this combined print developed to approximately a gamma of one after which the film may be fixed, washed, dried and the color aspects applied by imbibition.

According to our method of recording the red and green aspects in different light paths, we are enabled to use substantially identical emulsions of a normal type for these two aspects, and require a special emulsion only for the blue aspect, this emulsion being special only in its transparency and in its surface coating. We are also enabled to balance, with uniformity and facility, the color values of the two records which are most important and most difficult to balance.

Still another advantage of having the red and green records on identical emulsions and therefore well balanced, arises from the fact that the human eye is much less sensitive to variations of blue and yellow light than to variations of red and green light. This circumstance is most likely connected with the fact that the blue and yellow components of daylight as well as of artificial lights vary considerably more than the red and green components. For this reason it does not matter very much if the blue and yellow records of a motion picture film are not particularly well balanced with respect to each other or with respect to the red and green records. However, the red and green records have to be well balanced as the eye is very sensitive to changes of these colors and irregularities of the relative values of red and green are therefore to be avoided. The arangement of the present invention with identical emulsions for the red and green color aspects takes care of these facts in a simple manner and assures the proper balance of colors also with respect to this phenomenon.

Having now particularly described and ascertained the nature of our said inven-

tion and in what manner the same is to be performed, we declare that what we claim is:—

1. In the art of natural color photography with component records of more than two different color aspects, certain of which are exposed with a component light beam in superposition at one aperture in front and back emulsions, whereas others are exposed at another aperture with a second component light beam, the method of maintaining uniform balance between the red and green records, characterized by forming the blue and the red records in one component light beam and the green record in the other beam, whereby the said red and green records may be exposed in like emulsions.

2. The art of color photography according to claim 1 further characterized in that said like emulsions comprise substantially identical panchromatic emulsions.

3. The art of color photography according to either of the preceding claims further characterized in that the blue record is formed in said front emulsion and the red record in said back emulsion.

4. The art of color photography according to any of the preceding claims, further characterized in that a record exposed at the other aperture is used as a key record.

Dated the 4th day of June, 1931.
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Chartered Patent Agents.

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2nd Edition

Fig. 1

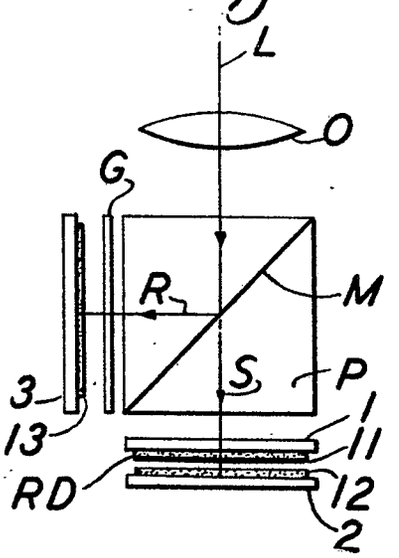
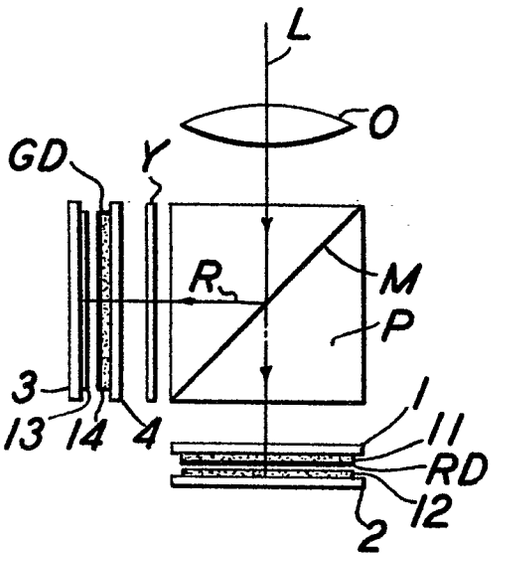


Fig. 2



Malby & Sons, Photo-Litho.