

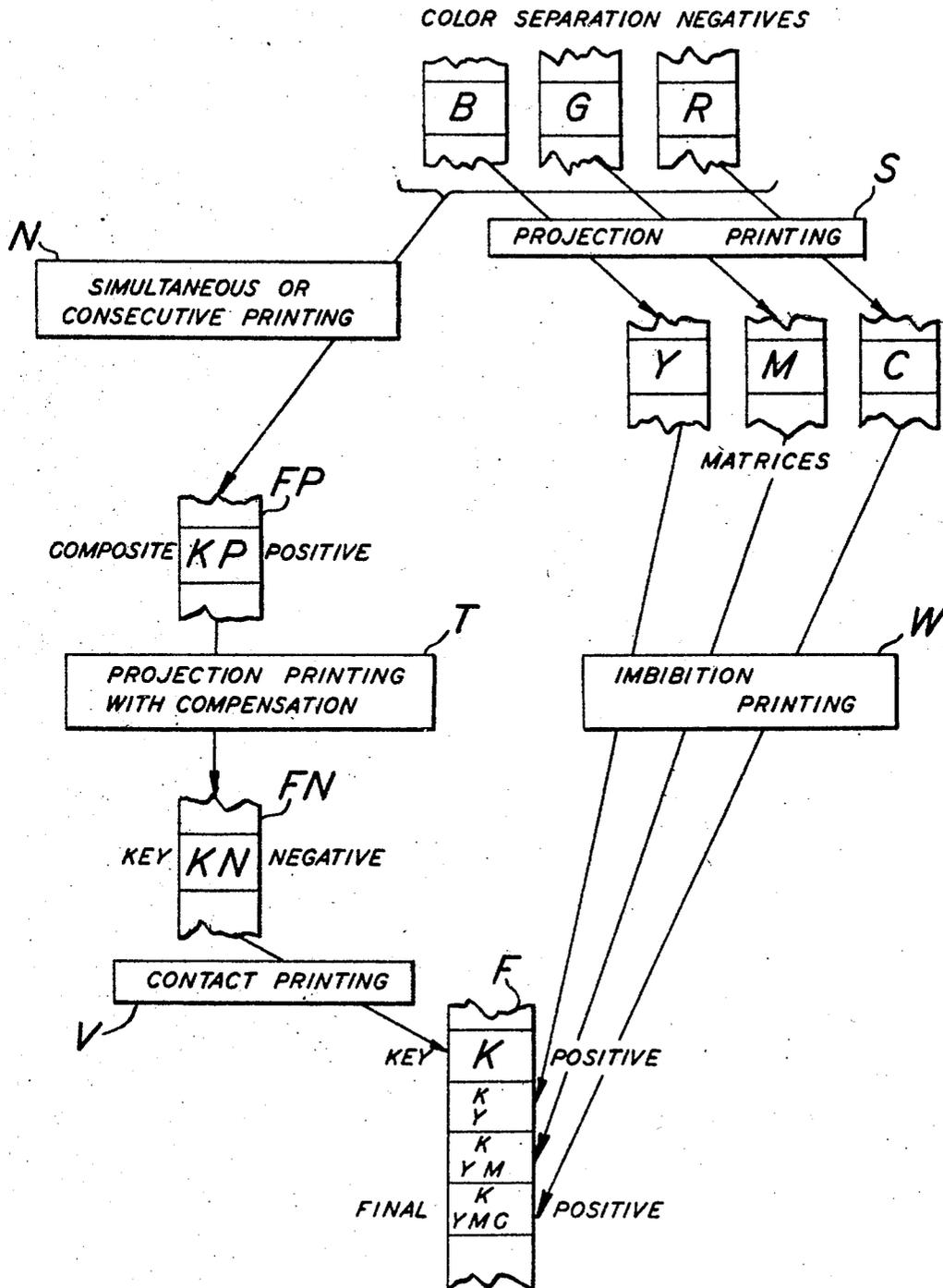
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COLOR PHOTOGRAPHY WITH KEY PRINT

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## COLOR PHOTOGRAPHY WITH KEY PRINT

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In the art of color photography it is very difficult or perhaps impossible to attain with two or more superposed colored prints alone the whole range of neutral tones, the darker portions of the color prints especially being unsatisfactory if obtained only by superposing prints in colored inks or dyes. It is, therefore, general practice to print with the color positives a so-called "key print" in black or gray, which imparts vigor to the reproduction, and can also be relied on to supply details which cannot always be fully brought out with color prints alone.

Similar problems are present in color cinematography, and it has therefore been proposed to supplement positive color films with key prints. However, most techniques of making films in natural colors involve quite complicated treatments in various baths which cause the films to change their dimensions, thereby making it difficult to maintain the precise register between the various prints, which is an indispensable prerequisite for the successful production of composite color films. This difficulty is also present in processes employing positive gelatine matrices made from the original color aspect negatives which are dyed and either used directly or for making so-called "imbibition prints", whereby the dye is transferred to positive blank films which receive in superposition the various dye imprints from the matrices and which may be provided, prior to the dye transfer, with a photographically produced black and white silver key print. It has, however, been found that films may shrink as well as expand during the treatment they undergo according to this method, so that key print and color prints cannot be properly correlated.

It is, therefore, the principal object of the present invention to provide a method permitting the correct registration of a photographic key print with color reproductions in dye. Another object is to provide a process whereby during the manipulation of films with records of components of the final positive print, the size of certain records can be rectified in order to compensate for deformations of the strip material which supports the emulsion material during the processing of the various component records.

In still another aspect, the invention provides a method for compensating film record size differences by means of projection printing, by permitting the copying of the final key positives by contact printing.

These and other objects and advantages of the invention will be apparent from the follow-

ing description of an embodiment of the invention illustrating its genus. The description refers to a drawing, in which the figure represents a flow diagram schematically representing the process according to the invention.

Although the new process can be used with a different number of color records, in the embodiment to be described three color separation negatives B, G, R, representing the blue, green, and red components or color aspects of the object field, or three color records and one key negative, are taken, for example by means of an arrangement described in my Patent No. 1,889,030 of November 29, 1932, for Multicolor photography with bipacks, and developed and finished in the customary manner. From any of these prints, or from a separately exposed key print record, or from all or any of the three color records combined with each other and/or the key negative, an auxiliary positive is made. In the present embodiment as illustrated in the drawing, a composite key record positive KP is preferably obtained by simultaneously or consecutively exposing a positive film FP to different color aspect negatives with the aid of a projection printer, care being of course taken that the exposures are in exact register.

From the composite positive, an auxiliary negative, herein referred to as key negative KN, is then printed on film FN, preferably on a projection printer for reasons which will become apparent hereinafter.

The key negative KN is then copied onto the final positive film F. The printing preferably takes place on a contact printer of conventional design. The final positive is then developed and fixed in the customary manner, and bears now a series of silver key records K.

In the meantime, gelatine matrices Y, M, C, have been made from the three color separation negatives B, G, R, respectively. These matrices may be of any suitable type, either flat of the so-called "hydtype" kind, or gelatine reliefs, preferably made by the process described and claimed in Patent No. 1,919,673, granted July 25, 1933. These matrices are then passed through baths where they imbibe dyes of hues complementary to the taking colors blue, green, and red, namely, yellow, magenta, and cyan respectively, in amounts varying with the hardness of the gelatine and/or the height of the relief representing the color aspect records. The matrices are then consecutively brought into pressurable contact with the positive film F, in correct register with the key print K already contained in the

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gelatine emulsion of film F, preferably on a machine according to Patent No. 1,707,710 of April 2, 1929 to Daniel F. Comstock, for Method and apparatus for imbibition printing, where the dyes are transferred from the matrices to the positive film. After leaving the machine, film F has impressed thereon a record P comprising the positive key print K and the positive color record Y, M, C and is ready to be shown with the aid of any conventional motion picture projector.

The process as above described encounters the difficulty that commercially available films undergo considerable changes in dimensions during the various treatments involving the wetting and drying of the film base. Especially the film stock used for making the color record matrices changes its dimensions during the wetting process in the dye tanks (step W of the drawing), either by expansion or contraction, depending on the nature of the material used. Whereas the longitudinal change in dimension can in most cases be neglected or taken care of by the registering organs of the transfer apparatus, for example the steel pin belt of the imbibition machine according to the above identified patent, it becomes necessary to compensate for the lateral shrinkage or expansion of film in order to obtain the necessary perfect register between key print and color prints. It will be understood, however, that both longitudinal and lateral shrinkages and/or expansions can be taken care of by the present method.

According to this method, an optical compensator or anamorphoser of suitable design, but preferably of the type described in divisional application Serial No. 706,028, filed Jan. 10, 1934, is employed with one of the projection printers used at steps N, S or T of the process, as indicated in the drawing. Preferably, step T is utilized for this purpose, since it is at that time possible to compensate for dimensional changes in any of the steps N and S, where such changes are most likely to occur. This arrangement has the further advantage that it requires the least possible number of compensating projection printing steps and permits the printing of the final key positive on a contact printer. Since the printing steps N, S, T have to be performed only once for each negative record, but the printing of the final key must be repeated for each positive film, it is of importance that the more complicated and expensive projection printing is confined to the first mentioned steps, whereas the simpler and less expensive contact printing is preferable for the many times repeated step V. Further, each of steps N and S actually involves, in the preferred embodiment of the process, three printing steps which, if one of these steps were utilized for optical compensation, would involve a threefold increase of the possibilities of error of compensation, whereas the introduction of a composite positive and a key negative according to the present invention permits compensation during a single step with the resulting advantages.

Since the changes of film dimensions vary a great deal dependent on a large number of circumstances, and may even change from shrinkage to expansion and vice versa, it is very important to employ a compensating device which can be easily and exactly adjusted for varying degrees and directions of changes in film dimensions. A new compensator arrangement especially suited for this purpose will now be described as employed for lateral compensation, although it is understood that it may be anal-

ogously used for longitudinal compensation, or that two compensations may be used in series in one or different projection printers for compensation in both directions.

It will now be evident that by employing a device permitting dimensional correction of the record in cooperation with lens system L of the projection printer used for carrying out the compensating printing step or steps (for example, step T, or step S), the film shrinkage can be compensated for in a simple manner effective in varying conditions, and that, with the method according to the present invention, it is always possible to obtain precise register between a photographic key print positive and a series of superposed color records.

It will be further evident that, if one color record or an initially exposed key negative is employed for making the key print, it will not be necessary to make a composite key positive. However, although it would be feasible to print directly from the original key negative onto the positive film F, compensating each time for dimensional changes, it will be nevertheless preferable to make an auxiliary key positive corresponding to KP, and therefrom a duplicate negative KN, and to compensate during the printing of KN from KP.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the printing of an auxiliary positive key record, the printing of an auxiliary key negative from said auxiliary positive, the photographic copying of said key negative upon the emulsion of a positive film and the printing by imbibition of color positives from said matrices upon said positive film in register with one another and with said photographic copy.

2. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the photographic printing of an auxiliary positive key record, the photographic printing of an auxiliary key negative from said auxiliary positive, the printing of a photographic copy of said key negative upon the emulsion of a positive film, the printing by imbibition of color positives from said matrices upon said positive film and, during one of said photographic printing steps, the compensation with optical means of film distortions occurring during other steps of the process, in order to obtain register between said photographic copy and said color positives.

3. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the printing of an auxiliary positive key record, the printing upon a projection printer of an auxiliary key negative from said auxiliary positive by optically compensating for record distortions occurring during other steps of the process, the printing of a photographic copy of said key negative upon the emulsion of a positive film and the printing by imbibition of color positives from said matrices upon said positive film, in register with one another and with said photographic copy.

4. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the printing of an auxiliary positive key record, the printing of an auxiliary key negative from said auxiliary positive by changing the lateral dimensions of the key record, the photographic copying of a black and white key positive from said key negative upon the emulsion of a positive film and the printing by imbibition of color positives from said matrices over said key positive, said change of dimensions being adjusted to provide register between said key positive and said color positives.

5. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the printing of a composite positive from said negative records, the printing of an auxiliary key negative from said positive, the photographic copying of said key negative upon the emulsion of a positive film and the printing by imbibition of color positives from said matrices upon said positive film in register with one another and with said photographic copy.

6. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the photographic printing of a composite positive from said negative records, the photographic printing of an auxiliary key negative from said positive, the printing of a photographic copy of said key negative upon the emulsion of a positive film, the printing by imbibition of color positives from said matrices upon said positive

film and, during one of said photographic printing steps, the compensation with optical means of film distortions occurring during other steps of the process, in order to obtain register between said photographic copy and said color positives.

7. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the printing of a composite positive from said negative records, the printing upon a projection printer of an auxiliary key negative from said positive by optically compensating for record distortions occurring during other steps of the process, the printing of a photographic copy of said key negative upon the emulsion of a positive film and the printing by imbibition of color positives from said matrices upon said positive film, in register with one another and with said photographic copy.

8. The method of producing photographic films in natural colors which comprises the taking of negative color separation records, the making of a gelatine matrix from each negative record, the printing of a composite positive from said negative records, the printing of an auxiliary key negative from said positive by changing the lateral dimensions of the key record, the photographic copying of a black and white key positive from said key negative upon the emulsion of a positive film and the printing by imbibition of color positives from said matrices over said key positive, said change of dimensions being adjusted to provide register between said key positive and said color positives.

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