

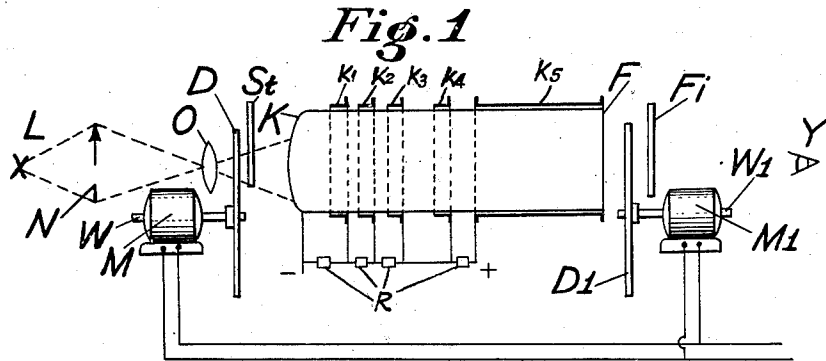
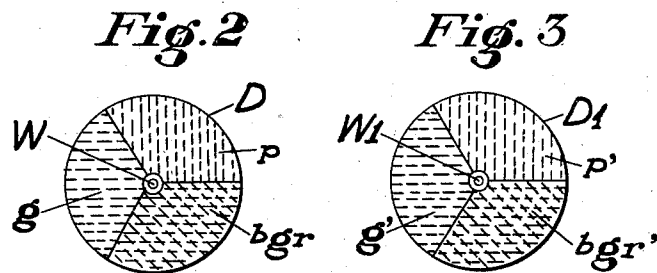
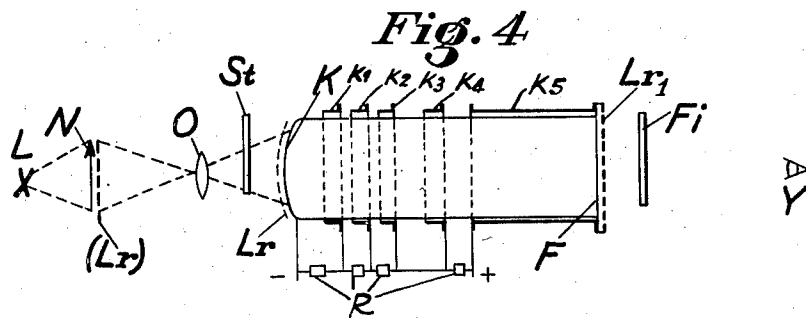
May 1, 1945.

F. BIEDERMANN

2,374,916

APPARATUS FOR THE REVERSAL OF COLOR PHOTOGRAPHIC NEGATIVES

Filed Feb. 17, 1942



Inventor:
 FRIEDRICH BIEDERMANN
 By *Alfred H. ...*
 Attorney.

UNITED STATES PATENT OFFICE

2,374,916

APPARATUS FOR THE REVERSAL OF COLOR
PHOTOGRAPHIC NEGATIVESFriedrich Biedermann, Munich-Unterhaching,
Germany; vested in the Alien Property CustodianApplication February 17, 1942, Serial No. 431,280
In Germany July 9, 1940

6 Claims. (Cl. 250—41.5)

My present invention relates to an apparatus for the reversal of color photographic negatives. This application is a continuation-in-part of my application Ser. No. 365,455, filed November 13, 1940, Patent 2,295,628, which in turn is a continuation-in-part of my application Ser. No. 327,047, filed March 30, 1940, which in turn is a continuation-in-part of my application Ser. No. 242,627, matured into Patent 2,214,072, dated September 10, 1940.

The known apparatus for the reversal of black-white-negatives consist of an image-converting tube which as an essential part exhibits besides a photo- or glow cathode a control electrode provided with a light-sensitive layer. The electrode controls the emission of electrons starting from the cathode so that a certain amount of electrons corresponding to the brightness is removed for each part of the image. Since this amount of electrons does not fall on the fluorescent screen, a negative is hence converted into the corresponding positive.

In order to apply such an apparatus for estimating the adaptability for copying a color negative, it is necessary to register the color value of the color negative to be tested by constantly scanning it with the aid of several filters dyed in certain primary colors.

It is an object of my present invention to provide an improved apparatus for the reversal of color photographic negatives to be estimated by an electric process.

A further object of my invention is to provide such apparatus comprising two similar filter sets dyed in the primary colors and arranged in such a way that filters of the same color are in the beams of light during the same time interval.

A still further object of the invention is to arrange the filter sets in the form of rotatable discs driven by a common synchronous motor.

Other objects of my invention will appear from the detailed description following hereinafter.

Reference is made to the accompanying drawing in which

Figure 1 represents the view of a reversal apparatus according to the invention,

Figures 2 and 3 represent views of filter discs used, and

Figure 4 represents the view of a reversal apparatus and line screens employed therein.

In accordance with my invention two similar filter sets dyed in the primary colors are arranged in such a way that one filter set is positioned between the color negative and the photo-

cathode and the other in the path of rays with

regard to the observer in such a manner that in scanning the image filters of equal color are simultaneously in the path of rays. Preferably the two filter sets are constructed as rotatable filter discs divided into evenly large filter sectors corresponding to the number of the primary colors. In order to reach a synchronous movement the filter discs are driven by a common motor or two motors synchronously kept in any way. Instead of the rotatable filter discs there may also be used dyed line screens one of which is arranged behind the negative or in front of the photo-cathode and the other on the fluorescent screen. In order to compensate spectral deviations of the light source or of the fluorescent light of the screen suitable filters may be placed in the path of rays. Moreover for removing inaccuracies of color of the negative there may be provided control filters which are also inserted into the path of rays of the copying apparatus in copying the negative.

In Figure 1, a filter disc D mounted on a shaft W driven by the motor M is arranged in the path of the rays emitted by the source of light L and penetrating the color negative N between the lens O and the light source. The photo-cathode is herein shown with a series of spaced electrode elements, K1, K2, K3, K4 and K5, and a plurality of resistors R. The filter D (Figure 2) consists of three sectors equal in size of angle and dyed in three primary colors as, for instance, yellow *g*, purple *p*, and blue-green *bgr*. A second filter D₁ is in the path of rays of the observer Y in front of the luminescent screen F and is constructed as a disc filter (Figure 3) having three color sectors *g'*, *p'*, and *bgr'* (yellow, purple, blue-green) likewise equal in size of angle in the same manner as the filter D. The filter D₁ is mounted on the shaft W₁ driven by the motor M₁. In order to guarantee a synchronous rotation of the two filter discs they are driven either by a common motor or as shown in Figure 1 by two motors M and M₁ connected with a common network or synchronously kept in any other way. The filters D and D₁ are so positioned in the path of rays that in scanning the image the same filter colors of the both filter discs always are in the path of rays simultaneously. In the example represented in Figures 1-3 the color negative N is illuminated three times during a rotation of the filter discs D, D₁, each time in a primary color. For compensating spectral deviations, for instance, of the source of light L or of the fluorescent light of the screen F a suitable compensating filter F_i may be inserted into the path of

light. In order to compensate the inaccuracies of color recognized in observing the reversed image of the color negative N, i. e., the color positive on the screen F, control filters St may be inserted into the path of rays, for instance, between the filter disc D and the photo-cathode K. The position of the control filter or filters yields, for instance, the correction of color necessary for the copying of the color negative. The position of the control filter or filters St necessary for the best color reproduction may immediately be used for copying by operatively connecting the mechanism for adjusting the control filter with a corresponding correction filter of the color copying apparatus for instance.

Another modification is shown in Figure 4. This apparatus is distinguished from that of Figure 1 by the fact that instead of the filter discs D, D₁, there are employed corresponding line screens Lr, Lr₁, one of which is placed directly in front of the photo-cathode K or behind the negative N and the other on the fluorescent screen F. The screen lines of the screen Lr correspond to those of the screen Lr₁ and are dyed in primary colors as, for instance, yellow, purple, blue-green. Other combinations as, for instance, red, blue, green may of course also be used. In this apparatus compensating filters F_i for compensating spectral deviations of the light source L and of the fluorescent light of the screen F and control filters St for correcting the color values of the negative may be arranged as already described above as to the apparatus according to Figure 1.

I claim:

1. Apparatus for the reversal of photographic color negatives which comprises an image-converting tube provided with a photo-cathode, a control electrode having a light-sensitive layer and controlling the electrons emitted by said cathode, and a fluorescent screen, an objective between said cathode and the color negative to

be reversed, and two filter sets dyed in identical primary colors, one of said filter sets being arranged in the ray beam path between said negative and said cathode and the other filter set in the ray beam path of the observer in such a manner that identical filter colors always are simultaneously in the ray beam paths in scanning said negative.

2. Apparatus for the reversal of photographic color negatives which comprises an image-converting tube provided with a photo-cathode, a control electrode having a light-sensitive layer and controlling the electrons emitted by said cathode, and a fluorescent screen, an objective between said cathode and the color negative to be reversed, and two filter sets arranged as rotatable discs divided in identical filter sectors corresponding in number to the primary colors, one of said filter sets being arranged in the ray beam path between said negative and said cathode and the other filter set in the ray beam path of the observer in such a manner that identical filter colors always are simultaneously in the ray beam paths in scanning said negative.

3. An apparatus as in claim 1 in which the filter sets are line screens, the screen lines of which are colored with the primary colors.

4. An apparatus as in claim 1 in which at least one control filter is positioned between the negative and the cathode for correcting the color values of the negative.

5. An apparatus as in claim 1 in which at least one compensating filter is positioned in the ray beam path from the fluorescent screen to compensate for spectral deviations.

6. An apparatus as in claim 2 in which at least one control filter is positioned between the negative and the cathode for correcting the color values of the negative and at least one compensating filter in the ray beam path from the fluorescent screen to compensate for spectral deviations.

FRIEDRICH BIEDERMANN.