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DIRECT COLOR ENLARGING APPARATUS

Filed Aug. 1, 1957

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FIG. 1.

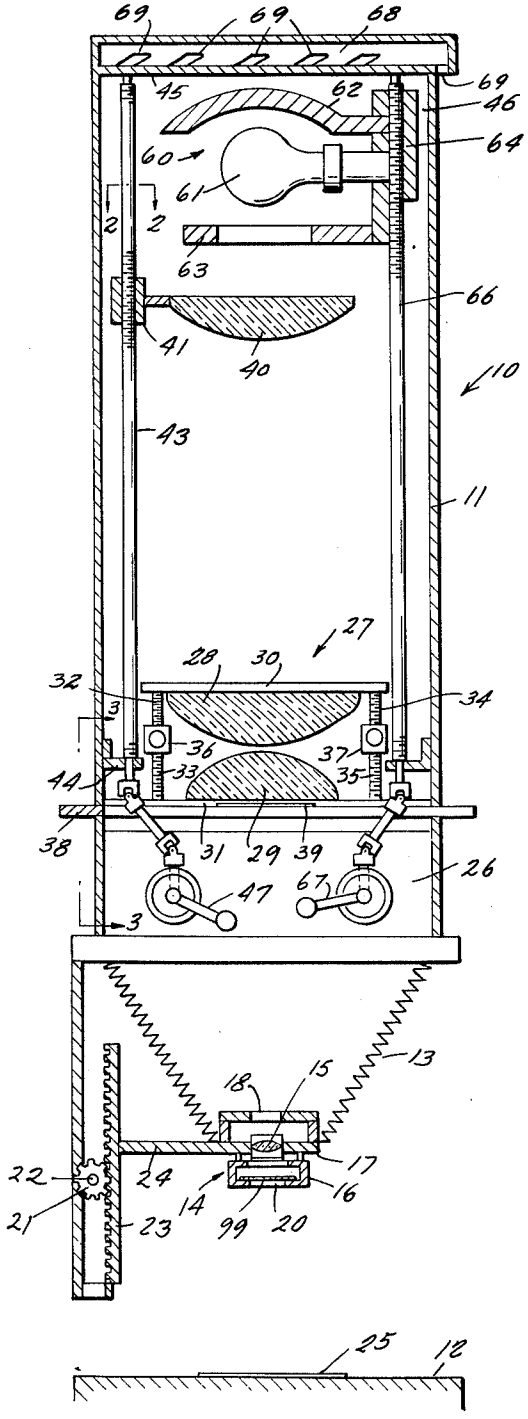


FIG. 2.

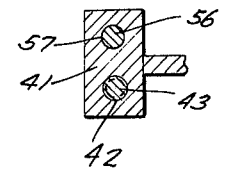
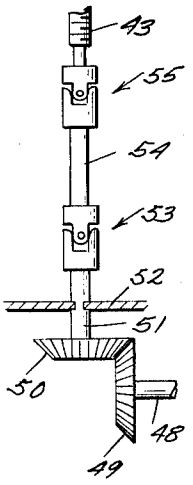


FIG. 3.



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DIRECT COLOR ENLARGING APPARATUS

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This invention relates to a photographic enlarging apparatus which is utilized with the Eastman Kodak Three-Color Photochemical System for the production of color separations directly from a color transparency and more particularly to an improvement in the construction of the light source and condenser elements whereby a more flexible apparatus is provided which will separate transparencies of greater size than heretofore possible.

Prior to the development of the Three-Color Photochemical System, otherwise known as the Eastman short-run process, the production of color separations for use in color lithography was an involved process requiring separating, masking and screening to be performed in individual steps. The short-run process combined these steps into a single operation. However, the enlarging apparatus utilized with this process was limited in that color transparencies separated thereby were limited in size to approximately 5" x 7", because of the construction of the light source and condensing lenses. A light source of exceptional brilliance is required since the light must penetrate a heavily masked transparency, a color separation filter and a contact screen, onto a slow type film. The apparatus was also limited in that it was necessary to change the light condensing elements in order to obtain a different size separation from a given transparency or in order to obtain a given size separation from different sized transparencies.

The instant invention provides an enlarging apparatus wherein a single set of condensing elements is utilized to handle a wide size range of transparencies and is capable of producing a wide size range of separations from a given sized transparency. Further, the apparatus is capable of utilizing transparencies of much greater size than heretofore possible.

My enlarging apparatus comprises an elongated housing with the conventional bellows, image lens, shutter mechanism, and filter holder secured to a first end thereof. A pair of stationary plano-convex condensing lenses, arranged in the conventional manner with their curved surfaces facing one another, are disposed within the housing at the first end. Also disposed within the housing are a movable condensing lens and a light source, with the movable lens being interposed between the light source and stationary lenses.

The light source and movable lens are each movable independently of the other along the optical axis for a substantial distance, usually exceeding the diameter of the largest condensing lens. Separate adjusting means extending externally of the housing are operatively connected to the light source and movable lens to affect the independent movement of each depending upon the illuminated field required for the specific size of the transparency being utilized and the size of the color separation desired. This arrangement makes for a more efficient utilization of the illumination available from a given light source.

In the prior art enlarging apparatus all of the condensing lens elements were generally stationary members. Any movement thereof was limited to a short distance for initial set-up purposes after which the lenses remained permanently positioned. No adjusting means extending externally of the housing was provided to position any of the condensing lenses. While some prior art constructions provided means external of the housing to move the light source, the adjustment achieved thereby was over a very short distance.

Accordingly, a primary object of my invention is to provide an enlarging apparatus, for the production of color separations directly from a color transparency, which is more flexible than prior art apparatus of this type and will utilize larger size transparencies than heretofore possible.

Another object is to provide an enlarging apparatus in which a movable condensing element is interposed between the light source and a plurality of stationary condensing elements.

Still another object is to provide an enlarging apparatus in which the light source and a condensing element are each movable independently of one another for a substantial distance along the optical axis.

A further object is to provide an enlarging apparatus having separate adjusting means, extending externally of the housing, for the light source and a condensing element disposed within the housing.

A still further object is to provide a construction for an enlarging apparatus, for the production of color separations, wherein separate cooling means for the light source is not required.

These as well as other objects of the instant invention shall become more apparent after reading the following description of the accompanying drawings in which:

FIGURE 1 is a side elevation partly in cross section illustrating the photographic enlarging device of the instant invention.

FIGURE 2 is a section taken through line 2—2 of FIGURE 1 looking in the direction of arrows 2—2.

FIGURE 3 is a section taken through line 3—3 of FIGURE 1 looking in the direction of arrows 3—3.

Referring to the figures, enlarging apparatus **10** comprises an elongated housing **11**, preferably vertically mounted to a frame (not shown) above vertically adjustable horizontal base plate **12**.

Extendable light tight means in the form of bellows **13**, carrying lens assembly **14**, is secured to housing **11** at the end **26** nearest base plate **12**. Lens assembly **14** includes objective lens **15** and colored filter holder **16** both mounted on lens board **17** having aperture **20**. Shutter mechanism **18** is positioned above lens assembly **14** and secured thereto. Pinion **21**, rotatable about fixed pivot **22**, mates with rack **23** which is secured through extension **24** to lens assembly **14** to move the same vertically and thereby focus the image on light sensitive film **25** upon which the color separation is formed.

Stationary condenser assembly **27** is positioned at end **26** of housing **11** and comprises two plano-convex lenses **28, 29** positioned with their curved surfaces facing one another. Upper and lower supports **30, 31** carrying lenses **28, 29** respectively are interconnected by threaded shafts **32–35** and nuts **36, 37** which comprise means for moving lens **28** a limited distance to fix the initial spacing between fixed lenses **28** and **29**. Transparency holder **38** carrying color transparency **39** and a mask therefore is removable mounted below stationary condenser assembly **27** adjacent to the flat surface of fixed lens **29**.

Movable condenser lens **40** is carried by block **41** having threaded opening **42** whose threads are in mating relationship with the threads of lead screw **43**. Lead screw **43** is journaled in suitable openings (not shown) in bracket **44** and partition **45** which extends across housing **11** near the top end **46** thereof.

Hand crank **47** is mounted externally of housing **11** on one end of stub shaft **48**, which extends through the wall of housing **11** and carries bevel gear **49** at the other end thereof. Bevel gear **50**, in mating relationship with bevel gear **49**, is mounted on one end of stub shaft **51** which is journaled in bracket **52** secured to housing **11**. Link

54, having universal joints 53, 55 mounted at the ends thereof, interconnects stub shaft 51 to lead screw 43.

As crank 47 is rotated this motion produces a corresponding rotation of lead screw 43 which in turn causes block 41 to move vertically. Guide shaft 56 extending parallel to lead screw 43 is received by opening 57 in block 41 to prevent rotation of block 41 as lead screw 43 is rotated. In this manner movable condenser element 40 may be moved for a substantial distance along the optical axis in accordance with the relative sizes of the transparency 39 and color separation 25.

Light source assembly 60, positioned between partition 45 and movable condenser lens 40, comprises incandescent light source 61, reflector 62, and removable diffusing disc 63 all mounted to block 64. A threaded opening in block 64 mates with lead screw 66 so that light source assembly 60 is movable for a substantial distance along the optical axis independently of the movement of movable condenser lens 40.

Hand crank 67, mounted externally of housing 11, is operatively connected to lead screw 66 through a gearing and universal joint mechanism substantially identical to elements 48–55 to affect rotation of lead screw 66 and the accompanying movement of light source assembly 60. Suitable provisions, such as flexible leads or rigid bus bars and brushes (not shown), are provided for supplying electric power to light source 61.

Partition 45 forms a chamber 68 at the top of housing 11. Vents 69 communicating with chamber 68 permit ventilation for convection cooling of light source 61 while preventing light spill.

Operation of enlarging apparatus 10 proceeds as follows:

(1) Holder 38 carrying masked color transparency 39 is placed in position.

(2) Film 25 together with a contact screen (not shown) is placed on base plate 12 and positioned thereon by a suitable registration means (not shown) many of which are well known to the art.

(3) Light source assembly 60 and movable condenser lens 40 are independently moved, by rotating cranks 67, 47 respectively, to predetermined positions along the optical axis.

(4) Pinion 21 is rotated to adjust lens assembly 14 thereby focusing the image on film 25.

(5) A suitable color separation filter 99 is inserted in holder 16.

(6) Film 25 is then exposed for a predetermined time interval to the light from light source 61 which is gathered by reflector 62, spread by diffusing disc 63, concentrated by movable condenser element 40 and further concentrated by lens 28, 29 of stationary condenser assembly 27. The concentrated light then passes through the mask and transparency, mounted on holder 38, which grades the light in accordance with the image thereon. Colored filter 99 permits only a limited color range of light to pass therethrough and strike film 25 to produce the color separation after film 25 undergoes a suitable developing process.

(7) Further color separations from the same transparency are made by merely changing the colored filter 99 and film 25.

Thus, I have provided an enlarging apparatus in which the light source and a condensing element are each independently movable of one another for a substantial distance along the optical axis by means extending externally of the apparatus housing. By so doing, the enlarging apparatus is capable of providing the particular illuminated field required for a specific size of a transparency and of utilizing larger sized color transparencies than heretofore possible. Color separations may be utilized and separations produced therefrom without the necessity of changing any one or all of the condensing elements from 35 mm. to 10" x 10" transparencies.

It should be apparent to those skilled in the art that while my enlarging apparatus has been illustrated as being vertically mounted it will work equally well when horizontally mounted.

In the foregoing, I have described my invention only in connection with preferred embodiments thereof. Many variations and modifications of the principles of my invention within the scope of the description herein are obvious. Accordingly, I prefer to be bound not by the specific disclosure herein but only the appending claims.

I claim:

1. An enlarging apparatus for the production of color separations of various sizes comprising an elongated housing, a lens assembly, a stationary condenser assembly, a light source assembly, a movable condenser lens; said lens assembly including an objective lens and a color separation filter; said lens assembly being operatively connected to said housing at a first end thereof; said stationary condenser assembly including a first and a second plano-convex lens element disposed within said housing in the region of said first end with their convex surfaces facing each other and operatively positioned in close proximity; said movable condenser lens comprising a plano-convex element whose convex surface faces said stationary condenser assembly; said movable condenser lens and said light source assembly being disposed within said housing; said stationary condenser assembly being interposed between the movable condenser lens and said lens assembly; said movable condenser lens being interposed between said light source assembly and said stationary condenser assembly; a transparency holder removably insertable between said stationary condenser assembly and said lens assembly; means operatively connected to said lens assembly for adjustment thereof relative to said stationary condenser lens assembly; said light source assembly including a light source, a reflector means, and a diffuser means; a first means extending externally of said housing and operatively connected to said movable condenser lens; said movable condenser lens being movable responsive to said first means for a substantial distance along the optical axis of said movable condenser element; a second means extending externally of said housing and operatively connected to said light source assembly; said light source assembly being movable responsive to said second means for a substantial distance along the optical axis of said movable condenser lens; said first and said second means each being operable independently of one another; said housing being constructed to prevent light spill from said light source.

2. An enlarging apparatus for the production of color separations of various sizes comprising a housing, a lens assembly, a stationary condenser assembly comprising a plurality of lens elements, a movable light source, a movable condenser lens; bellows means operatively connecting said lens assembly to a first end of said housing; said stationary condenser assembly being disposed within said housing in the region of said first end; said light source and said movable condenser lens being disposed within said housing; said stationary condenser assembly being interposed between said condenser lens and said lens assembly; said movable condenser lens being interposed between said light source and said stationary condenser assembly; said movable condenser lens and said plurality of lens elements cooperating to concentrate light emanating from said source and direct this light through a transparency positioned between the stationary condenser assembly and the objective lens assembly whereby said objective lens assembly images the transparency external of said housing; said light source and said movable condenser lens cooperating with one another and each being movable independently of one another for a substantial distance along the optical axis of said movable condenser lens to thereby vary the size of the illuminating beam of the light source from a relatively small area to a relatively large area whereby any transparency from a wide size

range of transparencies may be utilized to obtain a wide size range of separations.

3. An enlarging apparatus for the production of color separations of various sizes comprising a housing, a lens assembly, a stationary condenser comprising a plurality of lens elements, a movable light source, a movable condenser lens; extendable light tight means operatively connecting said lens assembly to a first end of said housing at a first end thereof; said stationary condenser assembly being disposed within said housing in the region of said first end; said movable light source and said movable condenser lens being disposed within said housing; said stationary condenser assembly being interposed between said condenser lens and said lens assembly; said movable condenser lens being interposed between said light source and said stationary condenser assembly; said movable condenser lens comprising a plano convex lens having its flat surface facing said light source; said condenser lens and said plurality of lens elements cooperating to concentrate light emanating from said source and direct this light through a transparency positioned between the stationary condenser assembly and the objective lens assembly whereby said objective lens assembly images the transparency in a plane external of said housing; said light source and said movable condenser lens cooperating with one another and each being movable independently of one another for a substantial distance along the optical axis of said movable condenser lens to thereby vary the size of the illuminating beam of the light source from a relatively small area to a relatively large area whereby any transparency from a wide size range of transparencies may be utilized to obtain a wide size range of separations.

4. The enlarging apparatus of claim 3 further comprising independently operable first and second means extending external of the housing and operatively connected to said light source and said condenser lens, respectively, for effecting independent movement of said light source and said condenser lens to desired positions along the optical axis of the condenser lens.

5. An enlarging apparatus for the production of color separations of various sizes comprising an elongated housing, a lens assembly, a stationary condenser assembly comprising a plurality of lens elements, a light source assembly, a movable condenser lens, said lens assembly including an objective lens and a color separation filter; an extendable light tight means operatively connecting said lens assembly to a first end of said housing; said stationary condenser assembly including a plurality of lens elements disposed within said housing in the region of said first end; said movable condenser lens and said light source assembly being disposed within said housing; said stationary condenser assembly being interposed between said movable condenser lens and said lens assembly; said movable condenser lens being interposed between said light source assembly and said stationary condenser assembly; a transparency holder removably insertable between said stationary condenser assembly and said lens assembly; means operatively connected to said lens assembly for adjustment thereof relative to said stationary condenser assembly; said light source assembly including a light source and a reflecting means operatively positioned to gather light emanating from said light source and direct same through a transparency positioned between the stationary condenser assembly and the objective lens assembly whereby said objective lens assembly images the transparency external of said housing; said light source assembly and said movable condenser lens cooperating with one another and each being movable independently of one another for a substantial distance along the optical axis of said movable condenser lens to thereby vary the size of the illuminating beam of the light source from a relatively small area to a relatively large area thereby enabling concentrated light to reach said lens assembly at various positions of said lens assembly so that any transparencies from a wide size range of transparencies may be utilized to obtain a wide size range of separations.

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