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Van der Veer et al.

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[54] **ANIMATION METHOD AND APPARATUS**

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[52] **U.S. Cl.** **178/5.2,** 178/DIG. 6

[51] **Int. Cl.** **H04n 5/22**

[58] **Field of Search** 178/DIG. 6, 6.8; 352/87

[56] **References Cited**

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Assistant Examiner—Joseph A. Orsino, Jr.
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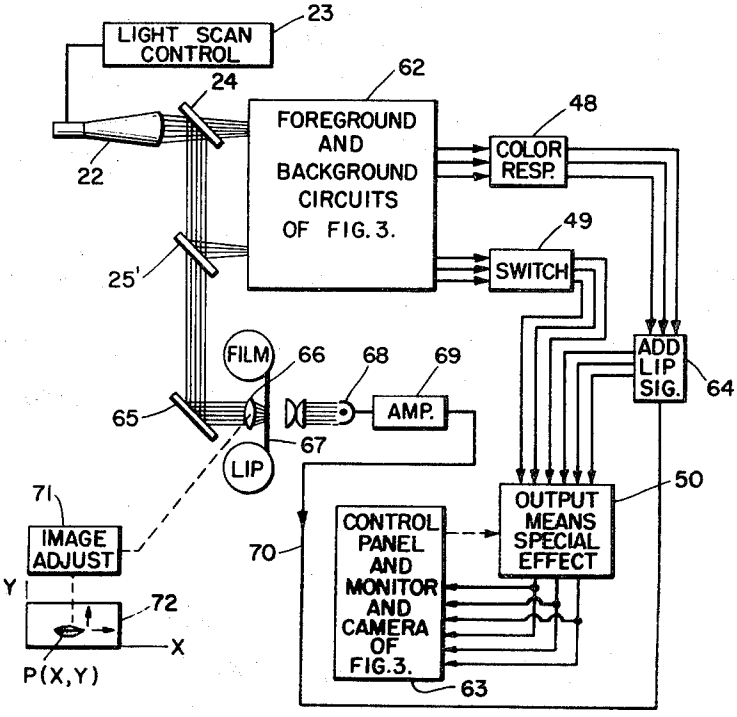
[57] **ABSTRACT**

Animating procedures are simplified by selecting stock film footage of typical foreground and background scenes, optically scanning the scenes to convert them into first and second sets of video color signals, and electronically combining the first and second sets of signals to effectively superimpose the selected foreground characters onto the selected background scenes, the resulting output video signals being converted into an optical image which may then be photographed. The superposition of the foreground characters onto the selected background is accomplished by initially providing the stock foreground film footage in the form of characters against a screen of a given uniform color, the characters themselves being of different color. The one video signal corresponding to the uniform color of the foreground scene is utilized to switch the sets of signals in such a manner that the first set of signals depicting the foreground is only provided at the output in the absence of the one video signal and the second set of signals corresponding to the background is provided at the output only when the one video signal is present.

7 Claims, 5 Drawing Figures



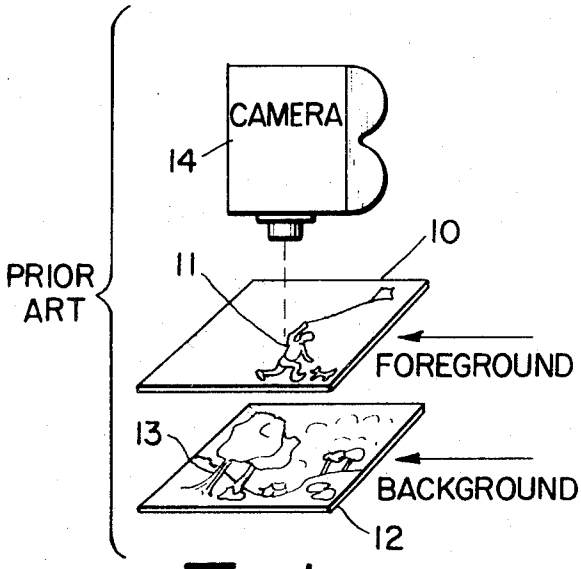


FIG. 1.

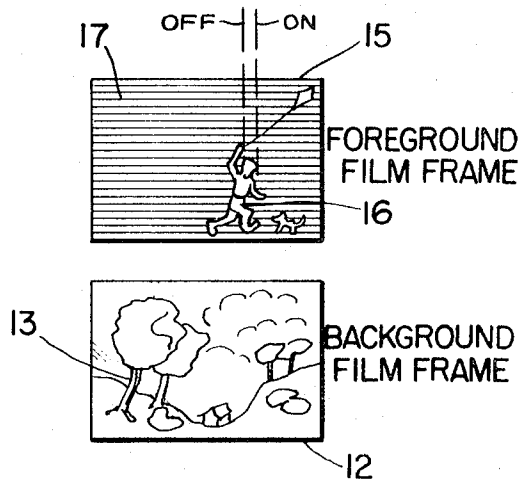


FIG. 2.

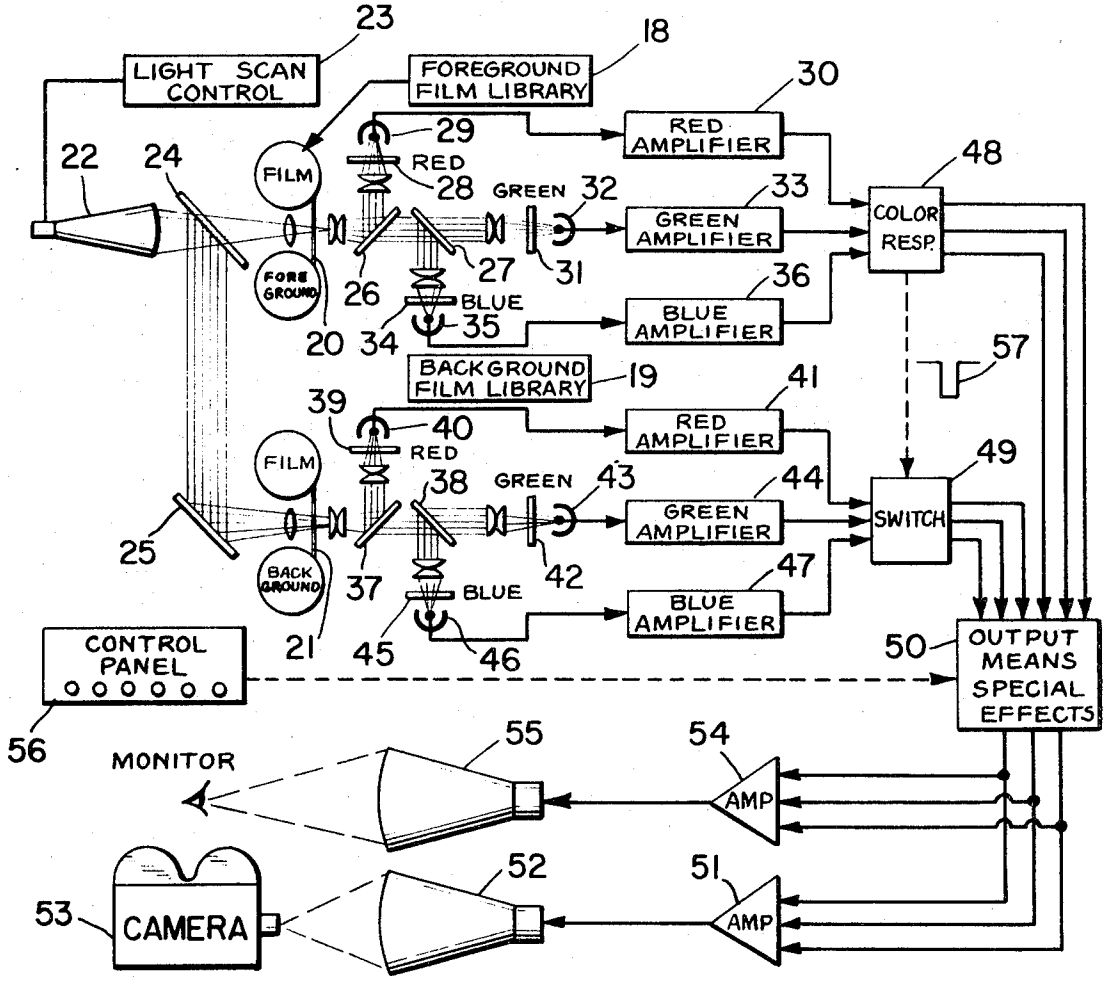


FIG. 3.

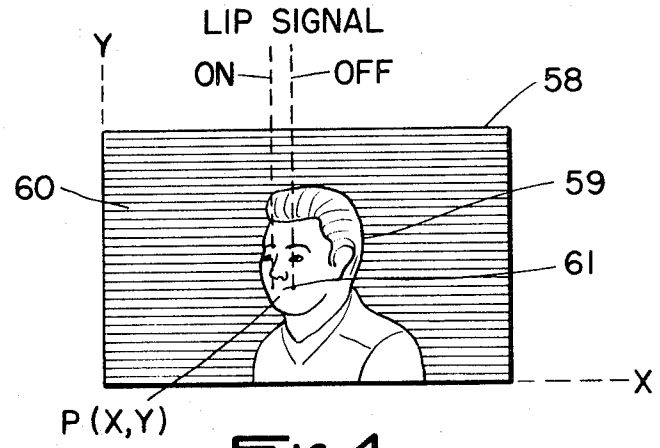

LIP SIGNAL
Y
ON
OFF
58
60
59
61
X
P (X,Y)

FIG. 4.

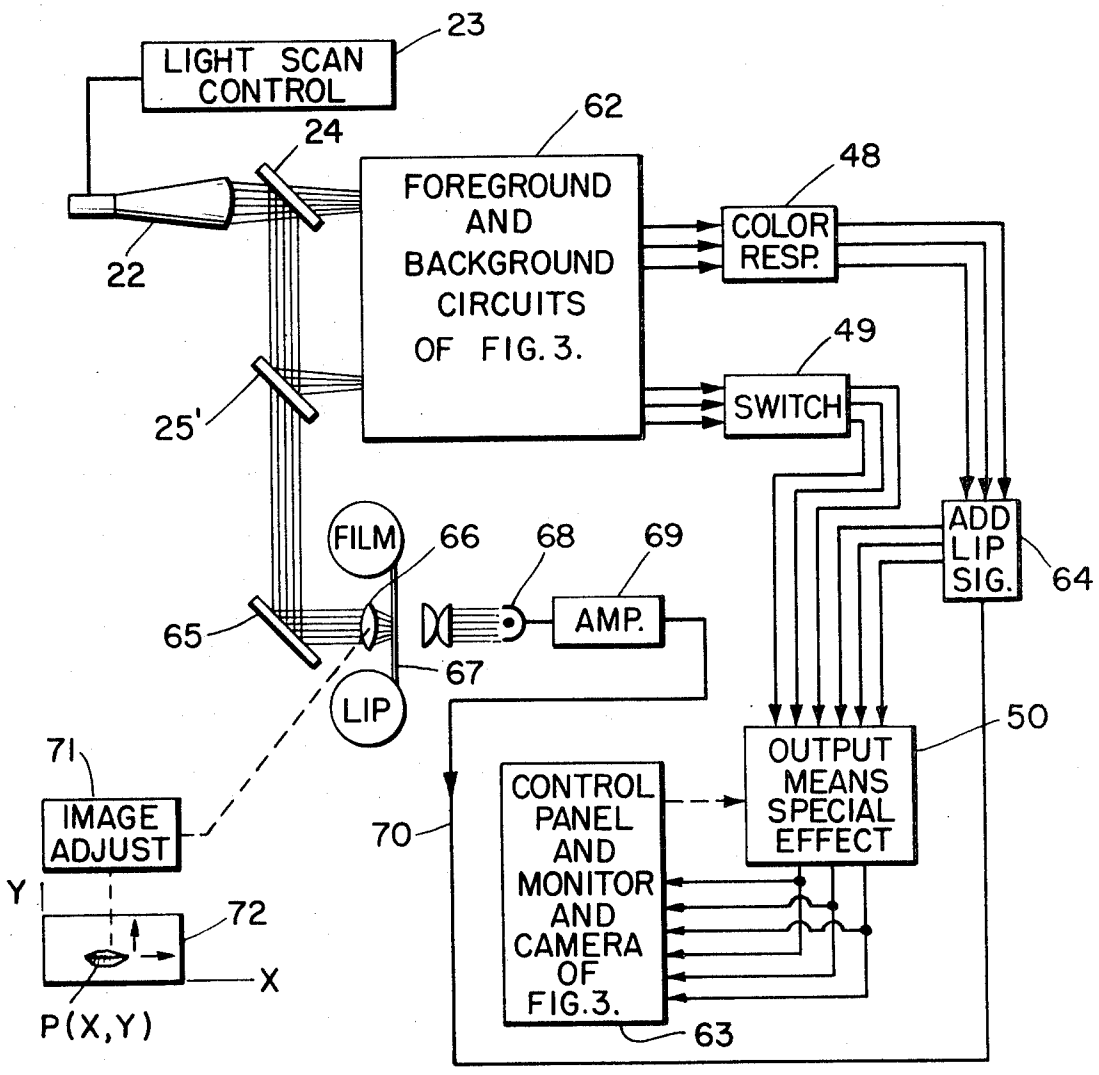

23
LIGHT SCAN CONTROL
24
62
FOREGROUND AND BACKGROUND CIRCUITS OF FIG. 3.
48
COLOR RESP.
22
49
SWITCH
25'
ADD LIP SIG.
64
FILM
66
68
69
AMP.
65
67
LIP
50
71
OUTPUT MEANS SPECIAL EFFECT
IMAGE ADJUST
70
CONTROL PANEL AND MONITOR AND CAMERA OF FIG. 3.
Y
72
X
P(X,Y)
63

FIG. 5.

ANIMATION METHOD AND APPARATUS

This invention relates generally to animating techniques and more particularly to an improved method and apparatus for facilitating the making of animated motion picture film.

BACKGROUND OF THE INVENTION

Present day animation techniques such as utilized in the production of children's series, cartoons and the like require a foreground piece of art work depicting characters on a transparent sheet to be placed on top of one or more pieces of background art on an animation stand. A single frame exposure is then made resulting in a composite picture. The size of the picture can be varied by moving the camera toward or away from the art work. The next incremental movement of the character requires substitution of another foreground piece of art work or cell and then a next film frame is exposed. Each frame requires the manual manipulation of the cells and/or the animation stand. If the cells are used again in the same way or in a different conformation it is necessary to re-shoot the action frame by frame. The entire process is clearly costly and time consuming.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

The present invention contemplates a method and apparatus for greatly facilitating the making of animated film particularly of the series type such as produced for children wherein the foreground characters and many of the background scenes are the same although the plot or story may differ. In such situations, it is possible to form a complete library of stock background scenes and in fact, such stock film footage of backgrounds are already available. Similarly, a complete library of stock foreground scenes can be prepared showing the characters in various typical situations such as stationary, moving from left to right, right to left, and forward and backward. By selecting appropriate stock footage of film from each library bank and superimposing the selected foreground on the selected background in an automatic manner, a substantial savings in manual manipulation of the various cells and the creation of new types of art work can be realized. In fact, stock film footage of movement of legs, arms, and the mouth of the foreground characters can be provided to facilitate creation of stock poses as well as usual oral phrases. In this latter respect, most of the words of the English language are formed by seven basic positions of the mouth and these separate seven positions can all be prepared on stock film footage and combined with other film footage to provide the desired composite picture without the necessity, as stated, of laborious art work.

More particularly, in accord with the method and apparatus the background film or cells may be prepared by the usual present day techniques. The foreground film or cells are also prepared in the same way except however that the art work colorwise uses only two-thirds of the color spectrum for the foreground characters, these characters being photographed against a screen of the third remaining color of the spectrum. In the formation of the foreground cells, advantage is taken of the fact that there are established characters repeating over and over again the various actions of traveling left to right, right to left, directly to and from

the camera, assuming various stationary positions and even talking. These particular actions are photographed once with the characters in two colors against a third uniform screen color. The background scenes are made on a separate film negative constituting the background stock film footage.

Complete background and foreground stock film footage is then stored in separate libraries. When it is desired to create a particular animation, all possible stock footage is pulled and suitable foreground and background scenes selected for composition. These scenes are respectively threaded into projector means in a composite analyzing apparatus. The respective scenes are optically scanned to convert the scenes into first and second sets of video color signals, respectively, one of the video signals in the first set, corresponding to the given uniform color utilized as a screen for the foreground characters in the foreground film scene, being utilized to switch the sets of signals in a manner such that the first set of signals is provided at an output only in the absence of the one video signal and the second set of signals is provided at the output only when the one of said video signals is present so that the output provides a composite video signal of the foreground characters against the selected background. This composite video signal is then optically reproduced on a television screen and may be photographed to provide a composite film negative from which a desired number of copies may be made. Lip movements may be added to the foreground characters by a similar process.

Since the respective pictures are converted into electronic or video signals, various special effects can be introduced before combing the signals to provide the final output. For example, the relative size, intensity, contrast, focus, color or any other parameters of the first and second sets of signals can be electronically controlled in each of the foreground and background scenes so that the composite displayed may be appropriately adjusted by monitoring the picture prior to final photographing of the same.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by referring to the accompanying drawings in which:

FIG. 1 is a schematic showing illustrative of the prior art technique of forming animated pictures;

FIG. 2 depicts foreground and background film frames or cells wherein the foreground film frame is created in accord with certain features of the present invention;

FIG. 3 is a block diagram of suitable apparatus for combining foreground and background scenes to provide a composite film in accord with the method of the present invention;

FIG. 4 illustrates lip movement addition on a foreground character, and

FIG. 5 shows additional apparatus for adding lip movements described in FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 there is schematically shown a typical prior art arrangement for making animated pictures. Thus there is provided a foreground piece of art work or cell 10 depicting various characters such as indicated at 11 on a transparent medium. This medium is arranged to be superpositioned over a selected back-

ground on a suitable cell **12.** The background scene may comprise trees such as indicated at **13.**

After the foreground scene **10** is positioned on the background, the foreground characters which are opaque will eclipse out portions of the background and the composite picture may be recorded on a single frame in a camera **14.** An operator will then substitute for the foreground cell **10** a next cell depicting the characters in a slightly different position and subsequent positions must be drawn by the artist each time in order to provide the various plurality of frames necessary to produce a motion picture. Of course, it is possible to use many of the same frames twice in depicting stock situations even though the overall story to be conveyed by the resulting animation or cartoon may differ. However is is still necessary to shoot frame by frame after manual manipulation of the various cells.

Referring now to FIG. **2,** the present invention contemplates, as noted heretofore, the provision of whole libraries of stock film footage or cells depicting various typical foreground and background scenes. The background film scenes or frames may be substantially the same as those already available as indicated by the similar numerals **12** and **13** in FIG. **2.** The foreground scenes or cells, however, are prepared in a unique manner in accord with the present invention different from the prior art system. More particularly, a three color method is employed wherein there is provided a cell **15** having the foreground characters appearing thereon in a two color combination as shown at **16** against a screen of a uniform third color as indicated at **17.** The three colors involved may, for example, be red and green for the characters and blue for the screen behind the characters.

Referring now to FIG. **3,** when it is desired to form an animated cartoon in accord with the invention as much of the stock film footage in the various foreground and background film libraries as possible is utilized to minimize the necessary amount of new art work. Thus there is illustrated a foreground film library **18** and a background film library **19** from which are selected various foreground and background film scenes. These are threaded into projectors schematically indicated at **20** and **21** and optically scanned by a moving light beam generated by a scanner **22** and light scan control **23.** A conventional raster pattern of scanning may be employed.

The particular foreground film scene or frame with a selected background film scene or frame positioned by the projectors **20** and **21** are scanned simultaneouly by utilizing a simple beam splitter **24** and cooperating mirror **25** to channel the scanning light beam through both film frames simultaneously.

The light from each film frame is separated into different colors each of which in turn is converted into a video signal to provide a first set of three video signals corresponding to scenes in the foreground film strip and a second set of three video signals corresponding to scenes on the background film strip. For example, with specific reference to the scanning light from the foreground film strip, this light is passed through dichroic mirrors **26** and **27** to channel three outputs of the light one of which from the dichroic mirror **26** is reflected upwardly through a red trimming filter **28** and thence photo-detected by detector **29** to provide a video signal amplified by a red amplifier **30.** The portion of the beam passing through the dichroic mirrors **26** and **27** in turn is filtered by a green trimming filter **31,** photo-detected by detector **32** and amplified by a green amplifier **33.** Finally, the portion of the light beam reflected by the dichroic mirror **27** is passed through a blue trimming filter **34** and photo-detected by a detector **35** and amplified in a blue amplifier **36.** The outputs of the amplifiers **30, 33** and **36** thus constitute a first set of three separate color video signals corresponding to the three basic colors making up the foreground film scene.

Similarly, the light passing through the background film is divided into three beams by dichroic mirrors **37** and **38,** filtered, detected, and amplified by red filter **39,** detector **40** and red amplifier **41;** green filter **42,** detector **43** and green amplifier **44;** and blue filter **45,** detector **46,** and blue amplifier **47.** The outputs from the amplifiers **41, 44** and **47** constitute a second set of three video signals corresponding to the three colors in the background scenes.

An output means including a color responsive signal generator **48** receiving the first set of video signals, a switch **49** receiving the second set of video signals and a combining or output **50** serves to effectively superposition the foreground scene on the background scene resulting in output video signals representative of a composite picture. These signals from the output means are passed through an amplifier **51** and converted to an optical picture by a television tube **52.** The composite picture may then be photographed by a camera **53.**

Monitoring of the various scenes can be effected by branch leads from the output **50** passing through an amplifier **54** to a monitoring television screen **55.** Suitable means for electronically controlling the first and second sets of video signals to vary and adjust the relative size, intensity, contrast, focus, color, and any other parameters of the composite pictures displayed is indicated at **56** in the form of a control panel connected to the output means **50.**

Essentially, the color responsive signal generator **48** provides a control signal schematically shown at **57** to the switch **49** in response to the presence of one video signal in the first set corresponding to the uniform third color in the foreground film scene to close the switch **49** and pass the second set of video signals from the output means **50.** In the absence of the one video signal corresponding to the uniform third color, the switch means functions to block the second set of signals so that only the first set depicting the characters is passed from the output means. This particular switching action will be better understood by now considering the overall operation of the system.

OPERATION

In operation, assume that it is desired to combine the selected foreground film strip **15** shown in FIG. **2** with the background film strip **12.** These selected stock cells or frames are positioned by the projectors **20** and **21** in the system of FIG. **3** and both frames are simultaneously scanned by the scanner **22.**

Referring to the foreground film frame **15** of FIG. **2,** the raster light scan pattern would start at the upper left hand corner and scan the entire film frame from left to right progressively from top to bottom in a rectangular pattern. Since the scanning light spot is scanning only the uniform third color background **17** which in the example is the color blue, there will be detected through

the blue filter 34 and photo-detector 35 one of the three sets of video signals corresponding to the foreground scene. The color responsive generator 48 is designed to be responsive only to a change in the video signal representing this third blue color. Thus, approximately half way down the pattern of scan of the frame 15 of FIG. 2, the head of the character 16 will be encountered so that the video signal representing the uniform third color 17 will abruptly change since the character 16 is made up of two different colors. This change in the signal triggers the color responsive generator 48 to provide a signal such as 57 which functions to open the switch 49 and thus blank out the second set of three signals representing the background scene. Video signals corresponding to the foreground character 16 will be passed directly from the output means.

When the scanning light reaches the end of the head on the horizontal line as depicted in FIG. 2 the signal 57 will function to turn the switch 49 on; that is, close the switch so that the second set of three video signals corresponding to the background scene on the film frame 12 will be passed through the output means.

The background scene will continue to be passed so long as there is present the one video signal corresponding to the uniform third color blue of the foreground scene.

It will thus be evident that the resulting output signals from the output means 50 will constitute composite video signals representing a composite picture of the foreground character on the selected background. This composite picture may be photographed by the camera 53, the projectors 20 and 21 successively positioning frames so that animation results.

The switch 49 would normally be an electronic switch operable in response to the leading and trailing edge of a gating signal such as 57 the width of this signal being a function of the horizontal dimensions of the foreground character.

The composite picture is also visually viewable on the monitor screen 55 while the projectors 20 and 21 are operating. Desired visual effects may be introduced by the control panel 56 by simply changing the gain of the signals to adjust the intensity and contrast. Also, control of the relative sizes of the respective three sets of signals can be effected electronically as well as other special effects.

Each of the sets of signals may be run through the system separately and viewed on the monitor screen and the various points where they are to be combined can be noted or controlled.

Finally, it should be understood that the principles of superposition as described can be utilized to prepare stock film of various positions of the character including the position of the mouth which might include the seven basic positions forming normal words. Such positions as well as those of legs and arms can be prepared on stock film and introduced at key points, the conversion of the optical images into electronic images allowing substantial latitude in producing a desired composite picture with a minimum of any necessity for creating new art work.

An example of the foregoing is shown in FIGS. 4 and 5 wherein a system for inserting lip movements is illustrated.

More particularly, with reference to FIG. 4 there may be provided a foreground film scene 58 similar to the foreground film 15 of FIG. 2. In this scene, the foreground figure 59 is again formed of a two color combination against a back screen 60 of a uniform third color. However, it will be noted that the face portion below the nose of the character 59 is blank as indicated at 61. Essentially, this blank area may be filled in by superposition of video signals representing lip movements at a point P having co-ordinates given as X_1 Y_1.

Referring specifically to FIG. 5, there is shown the system of FIG. 3 with the additional equipment necessary to insert lip movements. Thus, the large block 62 represents the foreground and background circuits of FIG. 3 and the large block 63 represents the control panel, monitor and camera structures of FIG. 3 receiving signals from the output means and special effects block 50.

The additions to the circuit of FIG. 3 are shown in FIG. 5 at 64 which constitutes a means for combining an additional lip position video signal to the foreground signals fed into the output means 50. Still referring to FIG. 5, these additional video signals may be provided by scanning a stock film incorporating various lip positions to simulate the seven basic positions assumed by the lips in forming words. This film is scanned with a light beam in exact synchronism with the light source 22 and for simplicity it is shown as being derived from the light source 22 by making the mirror 25 of FIG. 3 a beam splitter 25' thereby passing the scan pattern to a mirror 65. A separate light scanning means could be provided suitably synchronized to the light scanner 22 if desired.

As shown, the scanning light passes through an optical system 66 and then through a selected film frame67 depicting a desired lip position. The light pattern is detected by a photo-detector 68, the resulting signals being amplified by an amplifier 69 and passed through a line 70 to the lip signal circuit block 64 for addition to the foreground signals prior to being fed into the output means 50. The combining of the lip signals on the line 70 with the foreground signals could take place within the block 50 but is shown separated out for rendering the description more clear.

It is important that the lip signals on the line 70 be introduced at the proper point in time that the raster light scanning pattern is at the point P in the image of FIG. 4. Since the face portion is clear as shown at 61, there is no need to remove the foreground signal at the time of introduction of the lip signals. The lip signals themselves may correspond to black and white light or could be colored signals if desired.

One simple means for introducing the lip signals at the proper point in time is to adjust the position of the film image of the lips in an X, Y co-ordinate position so that it will be scanned by the light spot from the mirror 65 at precisely the proper point in time for superposition on the blank facial area 61 of FIG. 4. This adjustment of the image position can be accomplished by moving the physical film itself or the projection optical system 66 for the light scan, such adjustment being indicated by the block 71. As schematically shown at 72 below the block 71, the lip images are positioned at the co-ordinate X_1,Y_1 corresponding to the point P on the image of FIG. 4.

It will be evident that the present invention thus provides a vastly improved method and apparatus for making animated pictures wherein the long hours of labor associated with prior art systems can be substantially reduced.

What is claimed is:

1. A method of making animated pictures comprising the steps of:

a. preparing foreground films of characters and the like in a two-color combination against a screen of a uniform third color to provide a foreground film library of foreground film stock of typical movements of the characters;

b. preparing background films of typical background scenes to provide a background film library of typical backgrounds;

c. scanning selected foreground and background films simultaneously with a moving light source;

d. separating the scanning light passing through each film into three separate colors;

e. photo-detecting the colors to convert them into three electronic signals respectively for the three colors associated with each film so that there are provided a first set of three electronic signals derived from the foreground film and a second set of three electronic signals derived from the background film;

f. passing only the second set of signals from an output in response to the presence of a signal corresponding to said uniform third color in said first set of signals and terminating the passing of said second set of signals and passing only the first set of signals from said output in response to the absence of said signal corresponding to said uniform third color in said first set of signals;

g. providing stock film images depicting various given positions of a person's lips;

h. Scanning a selected lip film image showing a given lip position in synchronism with said moving light source;

i. photo-detecting the light information from the scanning of said selected lip film image to provide a video lip signal;

j. adding said lip signal to said first set of electronic signals corresponding to scenes on the foreground film strip;

k. controlling the relative positions of the selected lip film image relative to the scanning light so that said lip signal will be generated at a point in time to superimpose the same over a foreground character's face at the normal location of the mouth;

l. displaying the signals from said output on a television screen; and

m. photographing the pictures displayed on said television screen to provide a composite film combining the lip film image with scenes on the selected foreground and background films.

2. The method of claim 1, including the step of monitoring said composite film and electronically controlling the relative size, intensity, contrast and focus of the first and second set of signals to thereby enable adjustment of the foreground and background scenes so that the composite picture displayed may be appropriately adjusted to provide desired effects prior to final photographing of the same.

3. The method of claim 2, in which said foreground film stock includes characters that are stationary, moving from left to right, right to left, and forward and backward.

4. The method of claim 3, in which said foreground film stock includes different arm and leg positions so that movements of the arms and legs may be reproduced in the foreground character when making said composite film.

5. An animating apparatus for making animated pictures on film including, in combination:

a. a plurality of different foreground film strips showing typical movements of foreground characters in a two-color depiction against a screen of a uniform third color;

b. A plurality of different background film strips showing typical backgrounds;

c. light scanning means;

d. first and second projection means for simultaneously positioning selected foreground and background film strips for scanning by said light scanning means;

e. first and second sets of color filter and photo-detecting means receiving respectively light information from the scanning of said first and second film strips to convert the light information into sets of three video signals corresponding to three different colors so that there results a first set of video signals corresponding to scenes on the foreground film strip and a second set of three video signals corresponding to scenes on the background film strip;

f. an output means receiving the first and second sets of video signals;

g. switch means responsive to the presence of the video signal in said first set corresponding to said uniform third color to pass said second set of video signals from said output means, and responsive to the absence of said one video signal to block said second set of video signals from said output means;

h. stock film means depicting various given positions of a person's lips;

i. means synchronized with said light scanning means for scanning a selected lip film image showing a given lip position;

j. photo-detecting means receiving light information from the scanning of said selected lip film image to provide a video lip signal;

k. a lip signal circuit connected to receive said lip signal and add it to said first set of video signals corresponding to scenes on the foreground film strip;

l. means for controlling the relative positions of the selected lip image relative to the scanning light so that said lip signal will be generated at a point in time to superimpose the same over a foreground character's face at the normal location of the mouth;

m. video display means connected to said output to optically convert the output signals to a composite picture showing the foreground characters in the selected foreground film strip against the background scene on the selected background film strip; and

n. camera means positioned to photograph said composite picture to provide a composite film from which duplicates may be made.

6. An apparatus according to claim 5, including means for electronically controlling said first and second sets of video signals to vary and adjust the relative size, intensity, contrast and focus of the composite picture displayed by said video display means.

7. An apparatus according to claim 6, in which the typical movements of said characters include arm and leg, movements.

* * * * *