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Color Television System Using Single Gun Color Cathode Ray Tube

An uncomplicated color television system has been designed for displaying a color picture on the face of a single gun, current-sensitive cathode ray tube (CRT). This two-primary color and single-gun system provides quality differential color and variation in brightness for specific colors by varying the current and by controlling the duty cycle of the electron beam. The number of video amplifiers, deflection circuits, and guns required to display a color TV picture is reduced, and a less complex tube is required. This information should interest photographic interpreters and radiologists, as well as engineers in the TV industry.

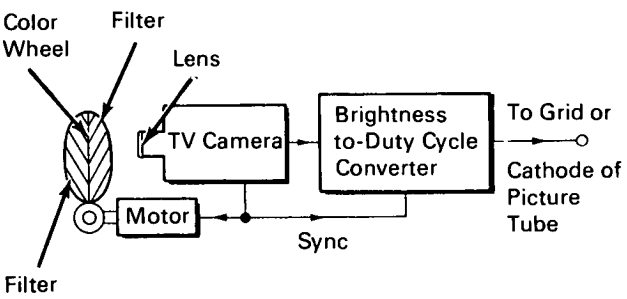

Figure 1. Color TV System

The system is illustrated in Figure 1; components include a color wheel having a pair of filters. The wheel is rotated by a motor in front of the lens of a monochromatic TV camera whose video output is applied to a brightness-to-duty cycle converter. The motor and brightness-to-duty cycle converter are controlled by the vertical retrace pulse of the TV camera. The output from the brightness-to-duty cycle converter is applied to the grid of a single gun color CRT to control the color and brightness of the picture. The single gun CRT can produce at least a limited range of colors at substantially constant accelerating voltage. The brightness of a normal phosphor varies linearly with beam current up to the point where the phosphor saturates. Certain phosphors are susceptible to poisoning agents or to reduction in the normal amounts of activator and will thus yield nonlinear behavior. Zinc cadmium sulfide (ZnCdS) activated with silver (Ag) and poisoned with a few parts per million of nickel will yield a response curve where there is essentially no emission at low current levels; at high current levels, the response becomes supralinear. By selecting a ZnCdS:Ag with high cadmium content so that it has a red-orange emission, and mixing it with the green-emitting Willemite, essentially all of the emission at low current levels is from the Willemite; at higher current levels, the red-orange emission from the ZnCdS:Ag effectively swamps out the green. Intermediate current levels would produce intermediate hues.

Since these phosphors are also excitable by ultraviolet radiation and exhibit similar nonlinearities under these conditions, it is possible to utilize a screen coated with the phosphors as a means for the direct conversion of a monochromatic transparency into a hue scale.

Figure 2 illustrates the brightness-to-duty cycle converter used in the system. The amplified video signal controls a Schmitt trigger. The level of the Schmitt trigger is such that an output signal is generated only when the video signal is above a predetermined level. The square-wave oscillators have gate inputs which are connected to the separate outputs of a flip-flop. The flip-flop changes state for each field of a frame of a TV picture and the square-wave oscil-

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lators generate alternate output signals. However, no output signals are generated when the Schmitt trigger output is at zero. The square-wave oscillators generate different level signals—one level represents one color

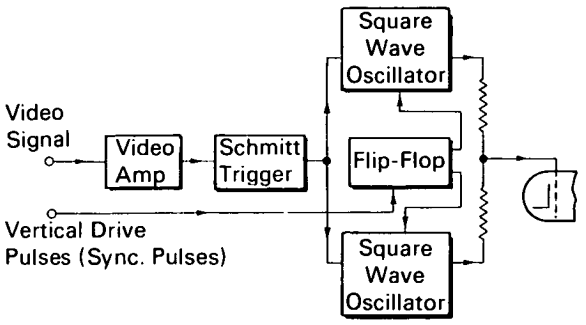

Figure 2. Brightness-to-Duty Cycle Converter

and the other represents another color. The duration of the output signal from the square-wave oscillator controls the brightness signal; thus, both color and brightness are controlled. An alternate method can be used where conventional three color signals are converted to two color signals and applied to a brightness-to-duty cycle converter of a special type. This brightness-to-duty cycle converts the two color signals into a single output signal suitable for application to the grid of a single gun, current-sensitive CRT.

Note:

Requests for further information may be directed to:

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Patent status:

This is the invention of a NASA employee and a patent application has been filed. Inquiries concerning license rights may be made to the inventors, Mr. Edwin H. Hilborn and Mr. Ernest E. Gaiser, through NASA Headquarters.

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