Blanking in the Operation of a Camera Tube

by
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This Note describes and compares methods of achieving retrace blanking in camera tubes. The information applies to most camera tubes in regular use including vidicons, S-T vidicons, vistacons (PbO), image orthicons, image isocons and SIT tubes.

Methods of Blanking

During retrace ("flyback") periods in scanning a camera tube, it is necessary that the readout beam be prevented from reaching the target. This retrace blanking can obviously be accomplished by switching off the beam. With this method, a blanking voltage pulse is applied to the control grid (grid No.1) of the electron gun. During blanking time, the pulse must change the grid-No.1 voltage to a more negative value, at least to the cutoff point, thus requiring a fairly large pulse amplitude. Seventy-five volts are usually sufficient for cutoff although unusual operating conditions or tube characteristics can alter the requirement.

An alternate method, often referred to as cathode blanking, accomplishes the desired result **without switching the beam off.** In this method, a pulse applied to the cathode shifts the cathode potential in a positive direction by a small amount (ten to twenty volts usually suffices). This small shift in cathode voltage results in a net cathode-to-target (scanned side) potential which is negative at the target and which, therefore, repels all of the approaching beam electrons. Thus the blanking objective is accomplished.

Cathode blanking is distinguished from grid blanking by at least two features:

1. A much smaller amplitude of pulse voltage need be generated for cathode blanking.
2. The beam is **not** cutoff by cathode blanking. Because the beam is not cutoff, the generation of switching transients in the electron gun electrode circuitry is reduced. On/off switching, when reflected back into power supplies, places extra demands on supply regulation and transient response.

The use of cathode blanking requires that care be taken to assure that the cathode potential is returned during the active scanning interval to a well-established reference potential. Any fluctuation in cathode voltage during scan becomes a corresponding variation of net target voltage, which is usually undesired.

In types such as the return-beam vidicon or the classical image orthicon in which the output signal is derived from the returning beam, cathode blanking (or its equivalent) is practically mandatory. In these types the output signal is the change (or modulation) of returning beam current. For even the extreme case (totally dark to greatest highlight), the signal depth of modulation is usually much less than 50%. If beam blanking is employed in such tubes, the blanking component of the output will consequently have at least twice the amplitude of the greatest picture signal. This amplitude would no doubt overburden the video amplifiers. Moreover, the polarity of such a "blanking" component is towards the "whiter-than-white". In these types, therefore, the beam should not be shut off to accomplish blanking. (The isocon mode of return-beam readout, is not subject to all the foregoing difficulties and can, as a consequence, be operated in a beam-blanked mode if need be.)

Camera Blanking and the Transmitted Signal

The universal (and meritorious) practice in TV camera design is to mix a blanking pulse with the picture signals at a point following the various video processing and amplifying stages. Such high-level blanking results in a stable, noise-free combination signal which can be readily handled by simple display units. The duration of these (system) blanking signals is often dictated by system requirements, e.g., broadcast standards, etc.; the duration frequently includes time slots for "VITS" (Vertical Interval Test Signal), remote control signals, and the like.

The system blanking signal should **not** be the camera-tube blanking waveform. Preferably, the camera-tube blanking pulses should be of shorter duration and timed so as to delay onset of tube blanking. The effect of such timings can be seen in **Figure 1**. The inner area (ABCDA) is that seen on the display kinescope tube as established by the system blanking signal. The total area (EFGHE) represents active camera-tube scanning time. The margin between the two areas allows "unseen" space for such conditions as **bright-frame effects** (usually encountered when an optical mask is omitted) and waterfall (an aptly named crawling edge effect usually associated with the use of camera tube and magnetic designs which are not matched with each other). It is recognized that the dictates of economics sometimes makes the scheme illustrated in **Figure 1** unattractive. In such cases, the edge effects can be masked by overscan in the display unit!

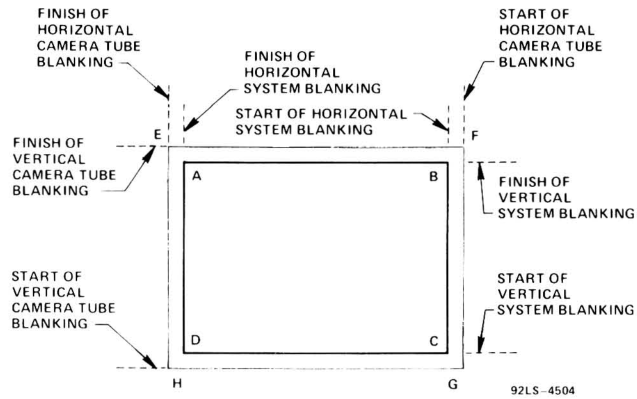

Figure 1