STATUS OF ELECTRON-OPTICAL WORK and OUTLINE OF WORK FOR THE NEXT MONTH

During the past month, 10 elliptic grid tubes have been tested on Diane; all tubes produced a good crayon boy slide at a brightness of 65 F.L. or more. Two factors typically limit the brightness of the picture: (1) zero bias current and (2) loss of index. For tubes with cutoffs less than 120 volts, the tube is driven into grid conduction or whites before the red saturation begins to suffer, while for tubes with cutoffs larger than 145 volts, the tube loses index before it loses red saturation.

The maximum brightness that can be achieved on the elliptic grid tube is a strong function of the amount of overshoot that is present on the grid drive. For example, consider tube CD 447 (which was the first elliptic grid tube sent to Engineering). This tube had a cutoff of 104 volts, a zero bias current of 6 ma and a screen efficiency of 28.4. It would appear that this tube could produce a 170 foot-lambert picture before grid conduction occurred. Actually, for the window test slide, a 100 F.L. white was produced; but, at higher drives, grid current caused loss of index because of the loss of background. C. Mutschler measured the overshoot for the window test slide finding a 10 - 20% overshoot. This means that the maximum brightness one can achieve on the test slide is some 63 – 79% of the maximum available brightness. If we take Engineering value of a 25% overshoot, then the maximum picture brightness is only .57% of the available brightness.

For tubes with a cutoff larger than 145 volts, the peak brightness is limited by a loss of index on white. Measurements show that the spot contour of a tube like JWS 995 (which has a 172 volt cutoff) becomes flat-topped at the high currents while the spot contour of CD 303A (V_{co} = 133) remains bell-shaped. Index measurements show that the index output of CD 995 is 20% of the peak index signal at 3 ma. and is essentially zero at 5 ma. while for CD 303A the index output at 6 ma. is still 70% of the peak index signal.

Future Work

1. The measurements outlined on November 18, 1957 are to be finished. The data obtained to date shows that the cathode emission is space-charge limited at all drive levels. Space charge still influences spot size but it does not start to be effective (for tube 303A) until the beam current reaches 2.3 ma. Also, the index failure for tube 995 is caused by the change is spot contour.

In order to better understand the performance of tube 995, Experiment 4 (a) of the November 18, 1957 list should be performed on tube 995. Pictures of the spot contour should be taken for both filament voltages.

2. New Tubes

Two new tubes are to be designed using the present 14 x 56 elliptic grid. They are:

(a) A tube to be operated at 23 KV with a 1/2" anode cylinder which should be capable of producing a 70 F.L. picture.

(b) A tube to be operated at 27 KV with a 1/2" anode cylinder which should produce a 70 F.L. picture. This tube is different from the present tubes in that the anode-grid spacing will be decreased in order to increase the zero bias current and remove the eliminate index failure of the present high cutoff tubes.

3. Cheapening of Set

According to R. Moore, reducing the high voltage below 23 KV will probably not cheapen the set to any considerable extent. Assuming this to be true, a desirable goal for electron optical work would be to reduce the burden put on the yoke. A good preliminary experiment is to vary the beam angle at the screen by moving the focused back toward the grid. Experiments of this type are to be performed on Diane and on the spot size equipment.

EXPERIMENTS TO BE PERFORMED ON DYNAMIC SLOPE MEASURER

Before any experiments can be undertaken, check out the operation of the gear. Also determine what dc. beam current I_o in the CRT produces a light energy at the phototube equal to that produced by an Apple tube operating at 400 μamp dc.

a. Measure the dynamic gain for 6 phototubes. The last dynode to plate voltage is to be 50 volts, the over-all voltage is such as to produce a 1 ma. plate current with a CRT current of I_o. Next, put the phototube in the phototube test stand and measure the dc. current produced by the standard light source and Apple tube with 40 μamp beam current. Finally, measure the 9 mc. signal output for 4 dc. beam currents (40 μamp, 400 μamp, 1 ma., 3 ma.). Repeat the set of measurements three times readjusting the anode potential each time.

b. Put 6 phototubes in the dynamic slope measurer. Operate the phototubes with 50 volts from 6th dynode to plate and an over-all voltage such that the anode current is 1 ma. for a dc. CRT current of I_o . This anode voltage is to remain fixed during all subsequent measurements.

Set up the test conditions such that the average CRT current is I_o. Record the average plate current and gain curves of each phototube as a function of time. Pay particular attention to the initial changes.