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Contract No. W-7405-eng-48

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SUMMARY OF RESEARCH PROGRESS MEETING OF JULY 26, 1951

Bonnie E. Cushman

October 19, 1951

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Berkeley, California

SUMMARY OF THE RESEARCH PROGRESS MEETING OF JULY 26, 1951

Bonnie E. Cushman

Radiation Laboratory, Department of Physics
University of California, Berkeley, California

October 19, 1951

I. The 184-inch Cyclotron Magnet. James Vale

Recently the 184-inch cyclotron has been shut down because of overheating in the upper coil tank. The safety limit of 55°C. has been reached quite frequently. When the heat exchanger for the upper tank was opened, a green deposit 1/10"-1/8" thick was found on the tubes, which was obviously reducing the heat transfer. After the oil was drained from the coil tank a 1/4 inch. deposit was seen on the cover plate. Some trouble was experienced in removing the deposit since it was not water soluble, and attempts to scrape if off were not too successful. The material was analyzed to be a copper soap which had evidently started forming at the time of the 1946 fire in the coil tank. The reaction was autocatalytic, the copper salts formed being even better catalysts than the copper of the tank and tubing. International Cementers Corporation recommended cleaning the tank with a mixture of kerosene and other light gasoline fractions. Four thousand gallons were circulated in the tank for 14-24 hours and this method cleaned the system quite throughly. The oil now used in the exchanger is Remco CI which has an inhibitor in it to avoid future oxidation. The time to change the oil is when it becomes acidic since then, and especially if there is any moisture in the system, the copper will go into solution and react with the oil components to form the deposit. The tank temperature is now less than 45°C.

II. Progress of Photomultiplier Development at RCA. Louis Wouters.

1. Photocathode Tube

The current difficulty with this tube is obtaining uniform activation of the photosensitive surface. Antimony is used as the base of the surface and after assembly and pump down of the tube a cesium pellet is introduced and the tube is baked out to vaporize the Cs onto the surfaces. However the Cs does not deposit uniformly over the Sb. The variation from point to point is now about 50 per cent the results are getting better. See Fig. 1.

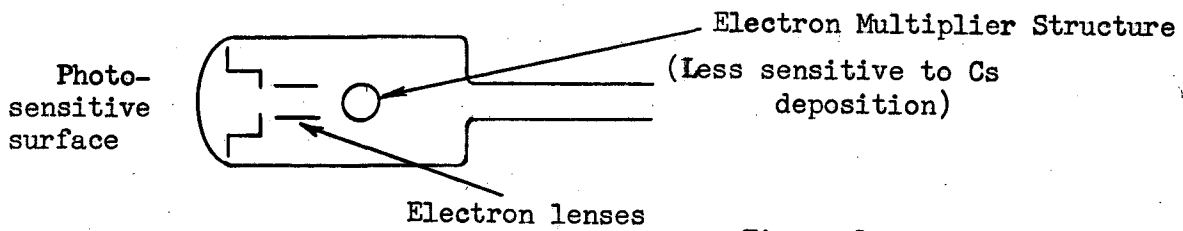

Figure 1.

2. High Output Tube

One of the problems met in tube development is that the assembly cannot be heated after the antimony is put on, so it must be sealed later. This high output tube, a linear type electron multiplier, is 1-1/2 inch. in diameter and 8 in. long (Fig. 2).

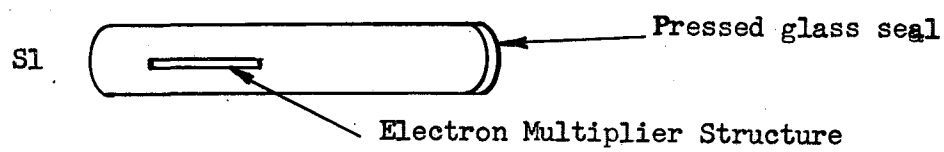

Figure 2.

It has a fairly high Cs pressure (10^{-5} mm) and with a high density of electrons a large number of positive ions are formed which will strike back and make more electrons (regenerative-positive ion feed-back). The effect has a fairly slow onset time, though, and one can get around it by pulsing the tube, although this too is limited. By keeping the stage voltage low and using the structure without space charge limitation, the effect can be avoided.

One new linear tube has 14 electron multiplier stages with 10^9 amplification. It will give 1 amp. peak output current at 0.5 kV. 1100 V are used between the last dinode and the collector (which has a large area and gives the high output). The geometry of the tube is such that the high field at the last stage doesn't distort the fields in preceding dinodes. The beam time spread due to oscillation at the collecting anode has been eliminated and it is also hoped to reduce the spread in transit time down to 10^{-10} sec. by improving the shape of the electrodes.

The photocathode tubes should be ready in a few months and the high output tubes a month or so later. About six of each should be available within a year.

3. Some work is being done on pulse height selector tubes.

4. Another problem is the non-proportionality of the present photomultiplier tubes. With small pulses a change in voltage gives a linear change in current, but at high currents the electrons will spread out (which they don't at low currents) so those which hit the insulating ends do not get multiplied.