Project Whirlwind
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: INVESTIGATION OF 7AK7 PROCESSING, EMPORIUM, PA., MARCH 2, 1948

To: Jay W. Forrester

From: D. R. Brown, T. F. Clough, and P. Youtz

Date: March 16, 1948

D. R. Brown, T. F. Clough, R. S. Fallows and P. Youtz visited the Sylvania Radio-Tube Plant at Emporium, Pa., on March 2, 1948. The purpose of the visit was an investigation of the processing which the 7AK7 gate tube is to receive.

The first part of the morning was spent in discussion with H. L. Kiser and R. W. Slinkman. Kiser stated that he had not written a reply to our letter asking for information about the gas pressure in the 7AK7 because he heard we were to visit him and preferred to give us a verbal answer. He stated that no absolute measure of gas pressure is made. He feels that they have a good system to detect any relative increase in gas pressure, however. Pirani guages are used which may be employed to give a relative indication of the pressure to which the tubes are pumped. These guages are checked at least once a day. The real criterion used, however, is the performance of the completed tube. A measurement of control-grid current is made on each tube at a voltage selected to give a good indication of positive-ion current. In the case of the 7AK7, this is -3 volts.

The 7AK7's will be made in their engineering development plant. A Sealex-type rotary-exhaust machine is used. The machine will be run at less than half normal production speed. Oil diffusion pumps are used from cathode breakdown to seal-off. This produces a much better vacuum than that usually obtained in receiving tubes. Sealing is done on the inner machine. Residual heat from the sealing process provides bake-out. We feel that the 7AK7 will receive as good a processing as can possibly be obtained in a production plant.

A general discussion of quality and long-life tubes brought up a number of interesting points. Kiser believes that quality tubes must be produced in a plant separate from a mass-production plant. The workers must be trained from a different point of view. Sylvania is setting up its Huntington, West Virginia plant to produce quality industrial tubes exclusively. He also stated that quality control must be extended to cover all tube components and all stages of assembly.

We asked Kiser what difficulties Sylvania has had due to poor contact between tube pin and socket clip. He stated that trouble has arisen in only two instances. In the first, the difficulty was due to added contact resistance in the filament circuit of 1.4-volt-filament tubes. This was

traced to inadequate buffing of the pins; their quality-control should not have released the tubes. In the second instance, some difficulty has been encountered with contact resistance in ultra-high-frequency applications, where a fraction of an ohm becomes important. For some of these applications they have used silver plated pins or used chromium plated pins. Both of these techniques are satisfactory for the ultra-high-frequency application. The normal pin is iron with a chromium addative. Kiser feels that the normal iron pins will be satisfactory for our applications. If we were to ask for silver-plated or chromium-plated pins, the present processing would have to be changed so that the pins and glass base would not be heated to as high a temperature as they are at present. Octal basing of lock-in envelopes is a simple procedure and machinery is set up for this job. Kiser recommends we go to an octal base rather than use plated pins in the lock-in tube.

Brown later talked to E. E. Overmier in the Commercial Engineering Department about pins and sockets. Overmier did not recommend the octal base because the addition of the octal base also adds two connections; a weld between the pin and a copper wire, and a soldered connection between the copper wire and the octal pin. Overmier recommended we stay with the present pins and use a socket which has clips with one wiping contact and two scraping contacts per clip. Our present socket, Cinch 51A12272, has clips of this type. A slightly better clip is used in a new socket made for Philco by Cinch, 6967.

Youtz and Clough, in a tour of the plant, saw: cathode-spray room, grid department, parts-fabrication department, stem department, mount department, production exhaust-and-test department, quality control and commercial-engineering laboratories.

We all visited the cathode-ray-tube plant and spent several hours with W. A. Dickinson. He showed us: the fluorescent-screen department, envelopes being coated with aquadag, rotary seal-in machine, rotary exhaust machines, aging racks and test racks. Assembly of the electron guns in the mount department was carefully studied. The design of electron guns was discussed with Dickinson and he furnished us with some reference material. He suggested that we visit Dr. Bowie and Dr. Rutter at Sylvania, Flushing, New York, to discuss electron-gun theory and investigate the electrolytic tank there.

Signed David R. Brown.
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