TRIP REPORT

PLANT VISITED - Sylvania Electric Products
Ottawa, Ohio

DATE - May 21, 1953

PERSONS MAKING VISIT - R. H. Berg
W. L. Jones
C. E. Buchwald

PERSONS CONTACTED - Gordon Fullerton - Plant Manager
Earl Wood - Supervisor of Process Engineering
Fred Larson - Supervisor of Chemical Engineering at Seneca Falls

Factory, personnel and output

The Ottawa plant has a manufacturing area of 125,000 sq. ft. with a warehouse of 50,000 sq. ft. An additional area for both manufacture and warehouse of 50,000 sq. ft. is under construction. The total personnel amounts to 1,000 - 400 are direct workers on picture tubes and 200 on government work. They are represented by the IBEW - AFL Union with whom management has had good relations. Process engineering is composed of 20 graduate engineers assisted by 5 technicians and 5 hourly-rated assistants. Engineering coverage is provided for all three shifts.

They reported an output of 4200 per day, including 1700 - 21" tubes with the remainder mostly 17". They are operating 3 shifts - 6 days per week. The third shift, however, is only on bottleneck operations.

MOUNTING

All of the mount assembly operations were carried out in a large, well-lighted, air conditioned room. Sylvania purchased gun parts pre-studded and assembled guns with no unusual techniques except that the G_1 cathode assembly was gauged for spacing before further assembly. A standard air gauge with a specially designed fixture was used on this operation. About 25 K-G_1 shorts are picked up per day. For close control of this dimension this is a rapid and accurate method. Approximately 15 to 20% of their production was electrostatic. Thirty-two milligrams of Kemet getter was used but Sylvania would like to go to 80 mg. of getter. Cathode cap material was 499 nickel and the triple carbonates were their own manufacture. Mount shrinkage is running about ½%. The first grid aperture is 31 mils and second grid is 40 mils in Sylvania guns. Multi-form glass is used on the top structure of electrostatic guns. Ceramic rods are used on the lower Es and Em structures.

WATER

Process water is obtained from Sylvania's own wells. The water is given a standard treatment of sandbed-charcoal filtering followed by deionizing and degassing. However, because of the exceptional hardness of the water, a second deionizer is used before water goes into the factory.

BULB WASHING

Facilities consist of 2 Peters Dalton rotary washers operating on a 15 second index. 10% hydroflouric acid is used for 2positions followed by 10% Na OH rinse. Washing is completed with one tap water rinse and 2 deion water rinses. Rework bulbs are given a preliminary washing on bench positions before rewashing in the rotaries.

SCREENING

Screening operations are carried out on four RCA type conveyors. Two handle 21" bulbs 3 wide. A third conveyor has two lines of 17" and 2 lines of 12" while the fourth handles 3 lines of 17". Two new conveyors were in the process of being installed which will handle sizes up to 27". When these units are in production the estimated screening capacity will be 600 bulbs per hour. Only one of the conveyors was equipped with automatic drying but they plan to add it to all conveyors. Because of the deep cushion used, some water must be pumped off before decanting. Presently only one of the conveyor has an automatic siphon. Plans, however, include the addition of this feature to all of the conveyors.

The electrolyte used by Sylvania is acetic acid. Of the ten plants which we visited, this was the only one using this type of electrolyte. For the 21" bulb they were using 7 grams of their own phosphor and 280 cc's of 10% kasil. The total cushion water amounted to 30 liters (55° F). The quantity of acetic acid used was such as to give a pH of 6.7. The acidity of the solution was monitored hourly by immersing the pH electrodes directly into the bulbs on the screening conveyor. Any necessary adjustments to maintain this pH were made in the quantity of acetic acid being dispensed. They claimed that the screen had greater wet strength as a result of using acetic acid. However, they felt that dry strength was poorer. They ball-milled the phosphor to get proper wetting. Kasil was diluted to 10% strength by using proportional pumps to feed the storage tank from which the solution was pumped to dispensing tanks above the conveyor. Both the acetic acid and the kasil solutions were filtered through micro-metallic filters between the storage tanks and the dispensing positions. The phosphor suspension volumetrically metered and dispensed during the flow of acid and silicate solution. No tips were used on the dispensing funnels. Settling time is 25 to 28 minutes. Pour-off requires about 5 minutes.

After screening the face is washed with ammonium bifluoride and spray rinsed to remove any kasil slop. Screened bulbs from conveyors not equipped with drying tubes are dried on 10 eight position racks having individual blowers. After transfer to the conveyor line, the screens are inspected for holes, tears, distribution, etc. under white light.

INSIDE PAINTING

Inside paint is applied by hand with 8 single position coaters and two three position coaters. The material used is Dixonac diluted in an undetermined manner. After painting, the inside of the neck is swabbed clean using 5% hydrofluoric acid and rinsed with deionized water. Operators were on piece work and the productivity was very high. Sylvania stated that inside painting was the most unsatisfactory operation in the whole plant.

BULB BAKE

Baking is carried out in two surface -combustion 12 ft. wide lehrs involving a 2½ hour cycle of which 30 minutes is at or above 380° C. As tubes are loaded into the lehrs, the code is branded by hand on the neck so that the lehr bake fires in the brand. Following cooling the bulbs are given U.V. inspection and a vacuum spot check. Overall bulb preparation losses were stated to be 2½%, half of which is reclaimable. Major reason for the loss was stated as due to kasil slop. Lehr breakage was stated to be ½%.

GUN SEAL

Mounts are preheated before sealing into bulbs on the four machines, two of which handled 21" tubes (8 heads each) and two handled 17"(1-8 head, 1-16 head). The output per machine was stated as 75 per hour. Tongs were used to handle all mounts. The ones in use were sugar tongs lined with silicone rubber pads. Seal-in through pack scrap to seal ratio was stated as 12% with the major difficulty being seal defects. (First three weeks of May 11.8%). Electrostatic types averaged 2% higher scrap. An unusually large kitty was maintained ahead of sealing using cartons and pallets for storage.

EXHAUST

Exhaust facilities included 5 16-head machines and two RCA type in-lines for 17" and 20" and one DPI in-line for 21". The rotary machines operated at a rate of 12 per hour on 20" and 15 per hour on 17" and smaller. The RCA type in-lines ran at 34 per hour on 20" and 40 per hour on 17" and smaller. The DPI in-line was equipped with 126 buggies and had an output of 110 21" tubes per hour.

Exhaust schedules were based upon a heating rate of 25° C per minute. Maximum temperature was such as to assure a temperature of 380° C on the inside of the center of the face.

Considerable stress was given this point as they claimed that 365° C was the critical temperature for the release of water vapor from the glass. For the rotary machines 20 minutes of RF was used on 20" tubes and 16 minutes of RF for 17" tubes and smaller. On the RCA inlines 20" tubes were given 14 minutes of RF and 17" twelve minutes. On the DP1 in-line 21" tubes received 16 minutes of RF. Heater current was 0.8 amp. during RF and 0.9 amp. after RF. Exit temperature was 125° C. No cathode current was drawn on exhaust.

Buggy performance was checked by measuring gas ratio immediately after tip-off (38 second preheat). If an individual buggy produced poor results 3 times in succession, it was removed for maintenance. An elaborate chart was maintained indicating the performance and disposition of every buggy. After maintenance and before returning buggies to an in-line they were given a 45 minute warm-up.

Implosions amounted to 0.3 to 0.4%. To maintain this figure all tubes were inspected for bump checks before exhaust. In case of an implosion the buggy involved was removed and sent to maintenance for checking.

Exhaust port rubbers were doughnut shaped "O" rings in a compression mounting slightly different than the usual arrangement. Sylvania reported excellent results with this type of seal. Using smooth, well-glazed tubulation the "O" rings last 30 to 90 days. A reduction in the number of broken tubulations was also reported. Cost was quoted as 3½ cents each. Mr. Larson agreed to furnish us details. They are now installing a new 150 buggy inline with clearance for 27" tubes - DP1 type construction but of their own manufacture - 1500 KVA connected load.

TUBE FINISHING

Pumped tubes were based and baked on a conveyor. A high voltage treatment consisting of 10 cycles of 1 second on and 1 second off of 35 K.V. D. C. was given before getter flash. Following getter flash the base pins were soldered using a counter weighted holder which swung in an arc over the flux pad, solder pot, rinse water and gauge positions. The tubes were then transferred by racks to mechanical inspection on either of two aging conveyors.. The aging cycle lasted 45 minutes. The first 30 minutes involved only a heater voltage of 8.5 volts. For the last 15 minutes the heater was reduced to 7.5 volts and 290 volts d.c. was applied to G_2 with G-1 tied to the cathode.

Current was supplied to the aging conveyor hangers through tightly coiled springs about ¼" in diameter. These springs wiped in an aluminum angle track mounted with the V downward. The arrangement appeared simple and foolproof. No holding between aging and testing. Immediately before the testing stations the aged tube entered a section of track arranged to permit gas ratio checking. Final test is carried out on four sets. No monoscope pattern is used.

Tubes are given an infra-red preheat before outside painting which is Joseph Dixon with Dow Corning 772 Silicone added. Ethylene dichloride is used as a solvent. Dri-film is applied with a sponge rubber circular stamp around the anode button. One automatic rotary spray machine and three hand spray booths handle the full production. They are using about 50% pallet pack. This section is well equipped with lift-trucks, wide aisles and large open areas. Tubes are held seven days after initial test whenever practical. All tubes are checked for gas and emission prior to outside paint and pack.

QUALITY PLAN

Immediately following the production test sets are located two quality sets on which 40 tubes per production operator per hour are checked. This amounts to nearly 100% retest. Two tubes per type per day are life tested for 400 hours. Two tubes per month are run to 1000 hours. Life facilities consist of 84 rack positions and 24 TV chassis.

MISCELLANEOUS

A novel safety device was being used to protect the wrists of bulb handlers. It consisted of a wire mesh of about window screen quality made up into a cuff of about 10" length.

They have a large well equipped salvage section having 6 reneck lathes and a six foot annealing lehr. Sylvania admitted that they are losing heavily on old bulbs purchased from the field.

All aluminizing work is being done at Seneca Falls where they are lacquering 30 to 50 tubes per day - 24" and 27" tubes at the present time.

NOTE: This report includes the notes of R. H. Berg

C. E. Buchwald

W. L. Jones

7/30/53

cc: RH Berg - BTW
CE Buchwald
VC Campbell
CH Dichter
HR Hemming (2) - BTW
WL Jones
RE Lee
RA Norman (2)
AN Reagan
LE Record
PE Sullivan - BTW