TRIP REPORT

Plant Visited - Rauland, Inc.
Chicago, Illinois

Date - May 19, 1953

Persons making visit - R. H. Berg
C. E. Buchwald
W. L. Jones

Persons contacted - F. A. Zartler - Works Manager
J. S. Bailey - Plant Superintendent

FACTORY, PERSONNEL AND PRODUCTION

The factory floor area amounted to 52,500 sq. ft. including space for service shops. A small portion of the manufacturing area is devoted to production of argon thyratrons. A request for a new plant is now before the Board of Directors and they expect to have the new plant in about 18 months. The warehouse is 85,000 sq. ft. in the present plant and 122,000 sq. ft. in a new warehouse.

Personnel totals about 1000 people of whom 650 are direct labor. They are down about 125 people from their normal complement because of a tight labor market. The production workers are represented by an AF of L Union with whom they have had good relations. The machinists, however, were on the verge of a walkout when we were there. To partly overcome labor shortage, Rauland is using 21 part-time workers.

The rates of pay range from $1.20 to $2.10 per hour with exhaust operators getting $1.40 to $1.65 per hour. Second shift bonus is 10¢ per hour and third shift 15¢. Since May 1st they have been running 5 days per week for the 1st and 2nd shifts (8 hours each) and 6 days (6½ hours) for the 3rd shift. The capacity of the plant is 3,400 to 3,500 tubes per day.

According to posters around the plant the 2,000,000th picture tube was made during March 1953, which was their highest production month, having produced 74,810 tubes. November 1950 was the next highest with an output of 71,539. At the present, 50% of the production is 19" or smaller. The ratio of glass to metal is 3 to 1. On 21" glass, the ratio of spherical to cylindrical is 3 to 1. During March, 1270 27" metals were made. About 50% of the glass bulbs are Corning, 50% ASP.

The safety practices appeared to be below our standards. Conveyors were not guarded; platforms were flimsy; lighting was poor and R.F. coils were exposed. The factory was so crowded that very few tubes in process were stored in racks. Most of the storage was on conveyors which totaled 5800 ft. costing $10 per foot without hangers. As an example, they have a 375 hanger conveyor used for storage ahead of exhaust which they would like to increase to 750.

MOUNTING

Rauland is using King getters (36R129 and 36R56 - six and nine 16 mg. pellets) mainly because of the convenience in flashing the ring type mount. They want more gettering and plan to go to heavier pellets.

The glassing operation was carried out in a conventional fixture with automatic fire control and bead preheating. Gun elements were banded instead of pinned with two on G-1, one of G-2, two on A1, one on focus anode and two on the top structure. Because of the bands, mounts are of the two bead construction. Rauland has plans to go to multiform glass.

A novel approach to the heater insertion and welding operation was being used. The welders at the heater lead welding positions were laid on their side so that the mount was held in a vertical position. The heater was dropped into the cathode cup and then withdrawn slightly before the weld was made. To reduce oxidation of the heater legs, nitrogen was flooded over the weld. The flow was controlled by an electrically operated valve.

The G-1 aperture is .036". Eyelets are not used on stems leads. Replaceable cathodes were used in all mounts. For the G-4 lead on electrostatic guns a stamped pre-shaped strap was used in place of the conventional wire lead. Rauland is using a 220 nickel sleeve with a 225 nickel cathode cap and Baker R-500 carbonate mix.

WATER

Rauland was using a standard water treatment consisting of sodium hypochlorite pre-treatment, followed by sand bed carbon filters before deionizing. They had been using micro-metallic filters but because of the maintenance difficulties had discarded these units. Although the pre-treatment equipment was rated at 12,000 gallons per hour, they were experiencing no difficulty in operating it at 27,000 gallons per hour. The deionizing capacity was 40,000 gallons per hour total from the two units.

BULB WASH

Bulbs are being washed in a 42 position Better Built inline machine using 10% hydrofluorid acid in 8 positions followed by caustic rinse, tap water and finally deion water rinse. The acid pumps are stopped during index. New 16" and 17" bulbs are washed in a Peters-Dalton rotary machine using a similar schedule. They have tried ammonium bifluoride but were not satisfied with the results. Presently rework bulbs are washed in booth set-ups. They have an Entwhistle machine on order for rework and are planning to take a novel approach to the problem of ventilating the acid positions. The plan is to exhaust the acid tanks and rely upon ventilating the acid positions by the air flow which will take place through the acid return pipe.

SCREENING

Facilities for screening include two conveyors, one 3 wide for 16" and 17" rectangular glass and one 4 wide for all other sizes which are run intermixed (up to six types at a time). Before loading on the conveyors each tube is rinsed inside with deionized water and the face plate swabbed with ethylene glycol to prevent silicate from adhering.

Cushion water and electrolyte are added on the upswing by timing the flow. To secure better control air pressure is regulated at 5 pounds. The kasil and phosphor suspension is automatically dispensing into bottles and poured by hand. The quantities of materials are determined by a series of timers controlling the valves. These timers are in turn controlled by a set-up of push buttons located in front of the operators. The funnel and tips depend upon what type of tube is being screendd and is chosen by the operator as the tube appears under the dispensing position. Dispensing bottles are rinsed after each use.

All of the dispensing funnels on the larger conveyor had a valve located immediately above the dispensing tip. The dispensing tip for the 21" tube was so designed that the spray struck the cushion water in a circle about 10 inches in diameter. After dispensing the phosphor kasil mix, a quantity of rinse water was added to the funnel. After approximately half of the rinse had flowed from the dispenser the valve was closed and the remeinder of the rinse water allowed to remain in the dispenser. When the next tube was being screened, this rinse water was dumped before the phosphor kasil was added. In the case of the smaller size conveyor, no dispensing tips were used on the funnels.

For 21" size 14 litres of cushion water is used. The electrolyte is 180 cc. of 1.6% barium nitrate. Temperature of the cushion water is held at 8°C. below room temperature for glass bulbs and 15°-16° for metal.

Phosphor is prepared by ball milling 1 pound in 500 cc. of water for 10 minutes with ½" pebbles. The slurry is then diluted with 1500 cc. of water. DuPont Paterson 1619 is used for 16" and 2569 on 24" metal and large glass sizes. The suspension is stored in a glass cylinder with a spherical bottom with a propeller for continuous agitation. The chamber is pressurized at about 10 lbs. in order to maintain even flow as the level drops. For the 21", 150 cc's of kasil #1 diluted 1:1 is used. Settling time is 16½ minutes for 16" and 17" conveyor and 17½ minutes on the large conveyor.

Screen drying is either vacuum or air combined with white light inspection. They plan to eliminate vacuum drying and install blowers using steam heated air.

For screening 24" & 27" tubes they are installing a 4 position double sided tilt table in addition to the 6 or 7 two position tables they now have. These tables are also used for filming. Bulb preparation losses run 8 to 10% on small sizes and 18% to 24% on large sizes.

INSIDE PAINTING

Dagging operations are carried out by the brush method at 16 bulb rotating positions, using a paint of their own formulation. They have plans to replace these machines with indexing turret set-up which they expect will reduce the amount of labor by 50%. Rags used in dagging operations were washed in Bendix washers located in the painting area.

FILMING AND ALUMINIZING

The only tubes that Rauland was aluminizing at the present time was the 24CP4A. Filming was carried out on tilt tables using a slight tilt to the tube during the dispensing. They felt that this improved attachment of the film to the bulb wall and reduced the number of tears during pour-off. Their lacquer is made from 24 grams of 16-20 second nitrocellulose and 580 cc's of butyl and ethyl acetates mixed in the proportions of 345 cc's of butyl and 138 cc. of ethyl using dibutyl phthalate as the plasticizer. For the 24" size 1.6 cc. of lacquer is dispensed. No pre-saturation is used. Drying time is 4 to 6 minutes. Cushion water is at room temperature.

They have ten bench positions for aluminizing so placed, however, that only every other head can be used for 21" size or over. The tungsten filament is W-shaped and is only used once. For the 24" tube, 200 milligrams of aluminum is evaporated. They mentioned that Sheldon has been trying to get aluminizing information from them.

BAKE OUT

After air dry, the bulbs are loaded into a 12-foot wide surface combustion lehr for bakeout. No air flush is used. The complete cycle requires 2 3/4 hours. The lehr is divided into seven heat zones, set at the following temperatures: 350°, 430 ° 425°, 390°, 340°, and 310°. The control system for the lehr is fairly complex. In addition to separate controllers for each zone, there is a spare controller which can be switched to replace a defective unit. In addition, there are two temperature indicators which can be used to check temperatures and the main controllers. If the temperature varies more than 10°C above or below the operating point, flashing lights are turned on to attract the attention of the M.A. In the case of failure of any of the components, the whole lehr is shutdown automatically. On Sundays the unit is used to heal bump checks.

They also have available an older Ross oven which they use for metal tube bakeout. After removal from the lehr, they are cooled for 48 minutes on an overhead conveyor system before U.V. inspection. In the case of metal bulbs, the screens are checked by vacuum. The lehr losses are .8% for the glass bulbs (2% on rework) and 3 to 3½% for metal bulbs.

The lehr capacity is 180 per hour on large sizes. The Ross oven will handle 180 per hour also but can be pushed to 225 per hour.

METAL BULB SEALING

Seven to ten single position machines, each with an annealing oven, are available for face plate and funnel sealing of metal bulbs. The units have automatically timed fire set-ups and an operator handles two machines.. For 19" bulbs or under both seals are made at the same time.

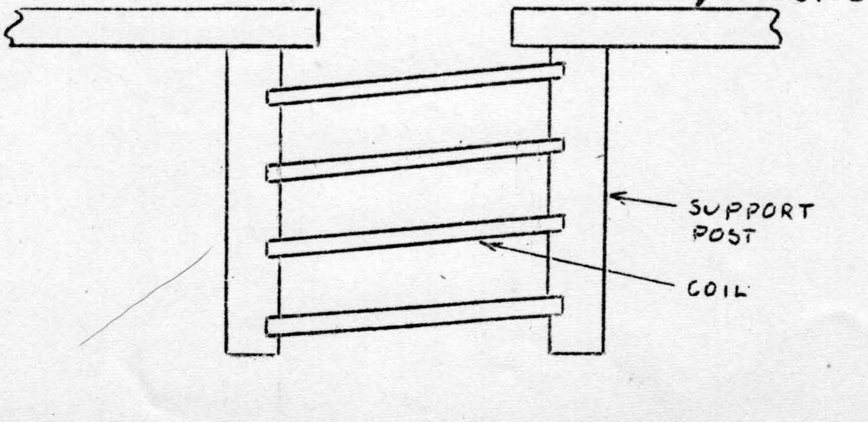
GUN SEAL

Facilities include one 12 head machine capable of handling up to and including 17" tubes on every head operating at 163 per hour. 21" and over can be handled on every other head. A second 8 head machine was operating at 84 per hour. A third machine, 8 head, handled metal types at 67 per hour. Stems were pre-heated. The seal-in heads were spring loaded and equipped with screw type neck clamps having narrow brass block jaws.

The fire set-up was conventional up to the cut-off which was cam controlled and was so set that it turned a bushy yellow about 10 seconds before index. The next position had no fires. Following the blank position were three positions of yellow bushy fires with the final position on the machine equipped with a radiant burner. This position was monitored by a thermocouple to assist in fire settings. With this arrangement they claimed that their gun seal shrinkage had been reduced considerably and that they now run 0.3% scrap. Scrap to seal loss runs 15 to 17% consisting mainly of glass problems.

EXHAUST

Rauland exhaust facilities included one DP1 Inline equipped with 113 buggies of which 16 are out of the oven. The output is 94 per hour for all sizes up to and including 19" metal. For sizes 21" and above, the facilities totaled 212 bench positions, operating on a $2\frac{1}{4}$ hour cycle for 21" and 24" tubes and on a 3-hour cycle for 27" tubes. The Inline was operated by two men, one tipping off and the second loading. No cathode current drawn during exhaust. To insure good heater contacts the stem leads were welded to the leads on the buggies. The ovens were circulating air type. They stated they averaged about 5 implosions per day on this machine. The exit temperature is 135°C. R.F. is applied at 14 positions (9 minutes) during exhaust. The R.F. coils were wound from aluminum ribbon supported by three notched posts from a flat top support made of transite.



Exhaust (cont'd)

In the case of the bench positions, the sequence of operations was automatically controlled. The ovens were gas-fired. The diffusion pumps were so mounted that during tip-off they were lowered rather than using the scheme of raising the tube. The 21" cycle was approximately as follows: the tube is loaded and pumped for 5 minutes. The oven is then fired and the temperature raised to 400° in approximately 25 minutes and held there for 25 minutes. The fires are then turned off and after 10 minutes the oven is raised 2" and allowed to remain in that position for 10 minutes. Every 5 minutes thereafter it is raised an additional 2". After the first two inches the R. F. heating of the gun is started. After 6 minutes of R.F. cathode activation is begun, and follows the schedule listed below:

TIME	Ea
1 min.	5
2 "	5
2 "	5
2 "	6
2 "	6
2 "	7
2 "	8
1 "	10
1 "	11
1 "	12

After 6 minutes of activation, the R.F. is discontinued. Following the completion of activation pumping is continued for 10 minutes before tip-off. The tube remains in the oven for 15 or 20 minutes before removal at a temperature of approximately 125°C. The implosion rate on the benches is high, running about 12 per day. Exhaust losses for other reasons amount to an additional 5%. Rauland is increasing their capacity by building more bench stations.

TUBE FINISHING

Threading, base bake and soldering are performed on the conveyor without removing the tubes from the hangers. Operators are on chairs equipped with rollers on a track so that they can follow individual tubes. A clamp applied to the neck of the tube held the base on during 6 to 7 minutes baking by infra-red strip heaters located on each side of the conveyor. After baking the clamps are removed and returned to threading operators on a small belt conveyor.

The leads are trimmed and soldered using a flux pot, solder pot and water rinse mounted on a circular base which can be raised and moved along with the tube. A small mirror was also appropriately located to permit inspection of the soldering job.

Tube Finishing (cont'd)

After base soldering, a gas check is performed on all tubes using a limit of .015 at 400 microamperes. Information on this test is transmitted to exhaust by intercom. Two rejects in a row from the same buggy is the signal for maintenance.

Getter flashing is performed by removing the tubes from the convgyor and placing face down on a table. A funnel shaped sleeve is slipped over the tube base and neck which contains the R.F. coil. A switch in the funnel is actuated when it is seated against the base turning on the R.F. The cycle is timed automatically. Two funnel lengths are used, - one for electrostatics and one for electromagnetics. No filament voltage is applied during getter flash.

After getter flash the tubes are loaded onto the aging conveyor. The first step is a high voltage treatment between all base pins and the anode. The cycle consists of 10 pulses of ½ second on ½ second off of 45 to 47 KV. D.C. Following this grid cathode leakage is burned out using a condenser discharge.

Aging was carried out on the conveyor line which had every 9th hanger equipped with a power supply which fed the other 8 hangers. Only A.C. was picked up from the rail. The schedule was as follows:

Time	Ea	G1	G2
1	8	0	0
1	11	0	0
1	8	0	0
27	8	≠ 5	≠ 250

Pre-heating for test was performed on the same conveyor without a dead spot after aging and consisted of operating the tube with a Ea of 5 volts, a G-1 voltage of ≠5 and a G2 voltage of ≠250.

Rauland had tried carousel type test sets but had discarded them due to the problem of stray pick-up. They were now using nine two-position stationary test sets with loading by a bulb handler from the rear. Test losses averaged 10 to 12% of which 60% are recoverable. No monoscope test is made. Gas ratio limit is 0.15.

On the way to outside painting, the necks of all tubes are washed with soapy water and wiped dry with a clean cloth. The tubes are warmed on the conveyor by infra-red lamps prior to outside painting in two water curtain spray booths with Stewart 3Y333 paint. No anti-corona material is used around the anode button. After painting, drying is performed with 12 infra-red lamps mounted along the conveyor.

On the way to pack, a two-piece label is attached to the tube containing the serial number, tube type, warning notice and warranty date. The latter is perforated into the label by a gumming and perforating machine made by Cummins Business Machine Company of Chicago. When the tube is packed, half of the label is removed and attached to the carton.

They use approximately 30% pallet pack. A unique carton storage rack is used for single cartons at pack.

QUALITY CHECK

Quality sample checking is performed on the test line. All life test are performed at 18 KV and 300 microamperes regardless of the tube type in TV chassis...some of which have external hi-voltage supplies. Total number of life positions is 85.

Life testing, Preship testing, Return Tube and return tube rework are all performed in the new warehouse and we were not shown these operations.

MISCELLANEOUS

Mr. Callaghan, in charge of Design, reports that by adding an external ion trap to the IMF tubes they can get additional brightness on tubes of their own manufacture as well as on tubes they purchased from us. He is not altogether happy with the IMF tubes.

No metal aluminized tubes were in production although we saw several flat faced 12" and 16" metal aluminized radar types.

NOTE: This report includes information obtained from R. H. Berg's notes.

C. E. Buchwald
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rn

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