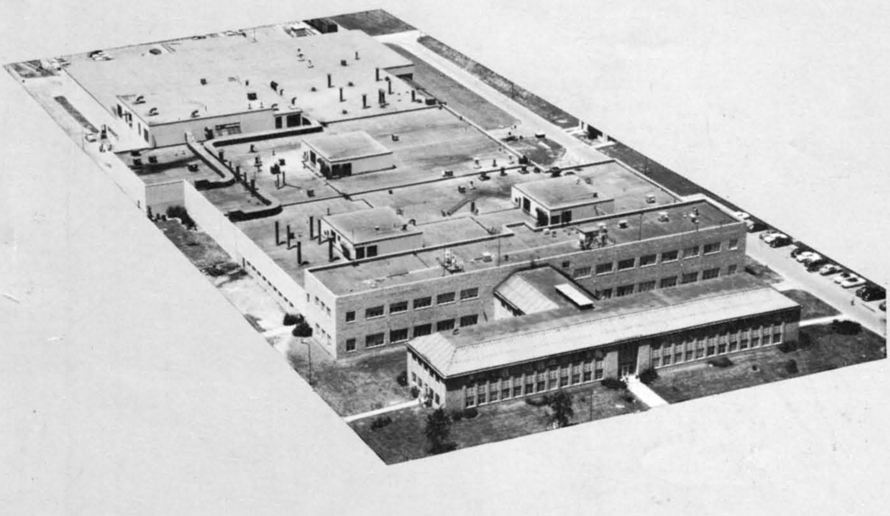
CATHODE RAY TUBE DEPARTMENT

GENERAL ELECTRIC CO.

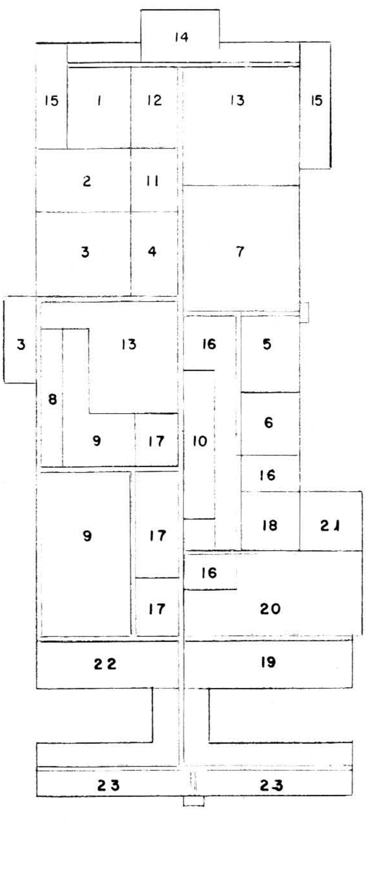


ELECTRONICS PARK, SYRACUSE, N. Y.

The Cathode Ray Tube Department has its headquarters in the beautiful campus atmosphere of Electronics Park, Syracuse, New York. Building #6 houses the main offices, Engineering and Manufacturing facilities, with other Manufacturing locations in Joliet, Illinois and Augusta, Georgia.

More than five million tubes have been shipped by the Department. Production in Syracuse began in 1949. The chief product is picture tubes for television sets but, in addition, an Industrial and Military section produces a variety of radar indicator tubes and other special tubes used by industry and the military. The following pages will provide an insight into the very complex manufacture of picture tubes. Our goal continues to be that of supplying our customers with advanced designs of better than ever picture tubes with an awareness of our responsibility in serving consumer, industry, and our national defense.

PLANT FLOOR PLAN



1 RECEIVING WHSE.
2 WASH AREA
3 SCREEN AREA
4 FILM AREA
5 INSIDE PAINT, INSP.
6 ALUMINIZE
7 BAKEOUT
8 GUN SEAL
9 EXHAUST, G.F., BASE
10 SPARK, AGE, TEST
11 OUTSIDE PAINT, INSP.
12 PACK AREA
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17 PARTS, MOUNTS
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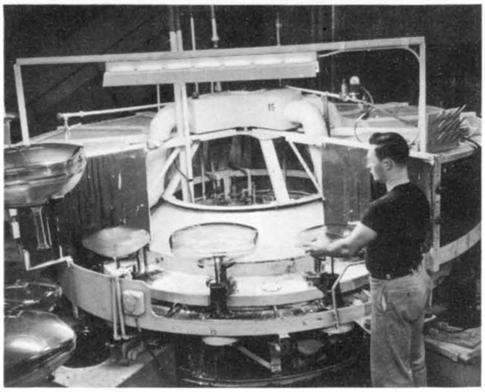
19 I&M OFFICE, DEV. AREA
20 I&M MANUF. AREA
21 I&M WAREHOUSE
22 FACILITIES AREA
23 C.R.T. GEN. OFFICES

bulb preparation

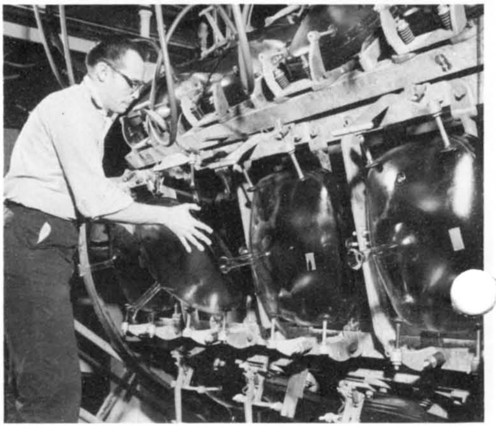
bulb wash



Newly received bulbs, carried by monorail conveyor from the receivi area, are loaded on a rotary bulbwa machine with a minimum of operator effort. During the washing cycle, the bulb indexes over a series of hot-water, caustic and dilute-acid jets that spray the entire inside of the bulb. The final indexing position rinses both the inside and outside surfaces with hot water, thus completing the preparation of the bulbs for transfer to the overhead conveyor that carries them to the screen settling process.

bulb screening

In the screening operation, the conveyor loader places the bulbs on the screening belt in a horizontal position and securely locks them in place with a quick-acting toggle clamp. As the bulbs travel to a neck-up position on the top side of the conveyor, a measured amount of electrolyte and demineralized water solution is dispensed into each bulb. After a predetermined time, properly proportioned quantities of phosphor in a binder solution are dispensed through stainless steel tubing. The spray nozzle used for this operation was especially designed to provide proper distribution. The bulbs move along the entire length of the 40-ft screen conveyor in approximately 50 min. during which time the phosphor material settles on the tube face where it is held in position by the action of the binder and electrolyte. Prior to reaching the pour-off end of the conveyor, most of the liquid is siphoned out; care must be exercised to avoid disturbing the phosphor screen. At the extreme end of the conveyor, the bulbs pass over the pour-off sprocket and return to the unload position, neck down, on the under side of the conveyor. A carriage with



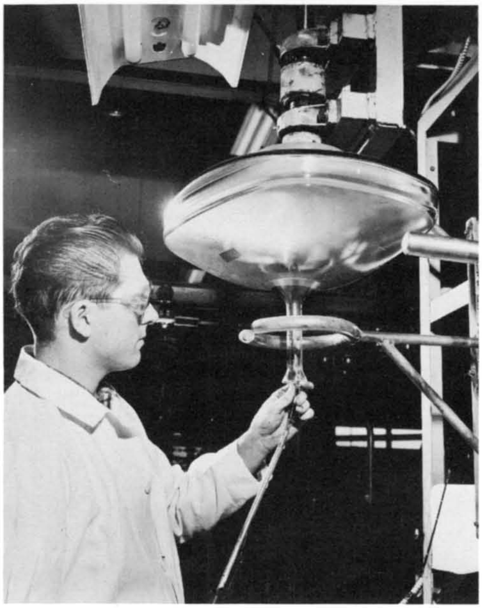
drying rods and an air manifold is mounted on tracks under the conveyor and is synchronized to travel with it. The rods are raised into the bulbs and about 100 cu ft per hour of heated, filtered air is forced into the bulb to dry the screen coating. These rods have especially designed tips that provide proper air currents, pattern, and volume.

The screens are inspected after leaving the screening conveyor by means of a light source that shines on the screen. Dirt spots, holes, and other defects are readily visible.

filming

Bulbs must be filmed prior to aluminizing. This is accomplished through the use of semi-automatic equipment. Bulbs are "prewet" by loading over a stainless steel rod which squirts quantities of high purity, deionized water up to the screen. The bulb is then transferred to a similar station where instead of water, an accurately controlled quantity of lacquer is shot to the screen. Centrifugal action causes this lacquer to evenly coat the screened surfaces. Succeeding operations permit drainage of excess lacquer, and "trimming" of lacquer from the bulb funnel. The film is then air dried by low pressure, dehumidified, heated, filtered air.

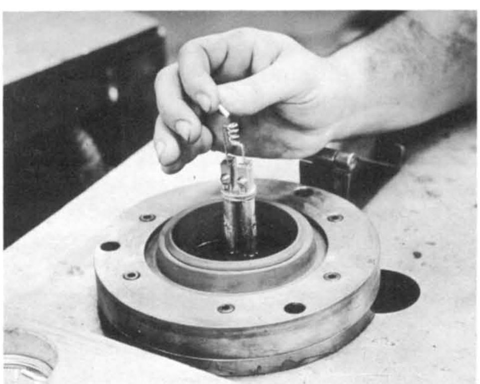
inside paint



The operator places the bulb face against a live vacuum chuck in the bu'' rotating machine and marks the prop paint dimensions on the neck using a special gage. The special knee-action type paint applicator is then inserted into the rotating bulb and, by skillful use of the applicator controls, a uniform coating is applied to the cone and neck. After drying the inside paint, the bulbs are transported by overhead conveyor to the baking station.

aluminizing

Rotary aluminizing machines are employed to deposit the mirror-like coating on the inner surface of the bulb. The bulb, resting on a vacuum tight rubber seal to prevent air leakage, is loaded over electrodes carrying a tungsten heater coil and aluminum slug.

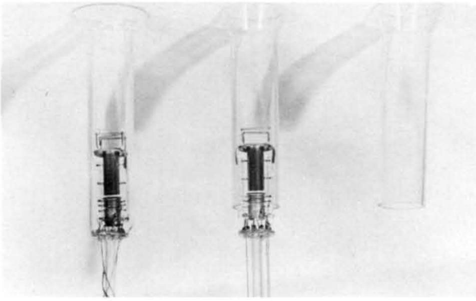


Each bulb is evacuated by means of mechanical and oil diffusion pumps in order to insure an even distribution of the vaporized aluminum. As the filament is heated in the vacuum, the aluminum slug melts, vaporizes, and then condenses on all surfaces inside the bulb. The bulb then moves to other positions of the machine where filtered air is let in slowly and evenly to prevent harm to the screen. The bulb is then unloaded, another aluminum slug is inserted into the coil, and the head is ready for another bulb.

bake

All the bulbs are baked at about 800° F in gas fired ovens. This baking removes moisture and volatile substances deposited during previous processing.

electron gun mount

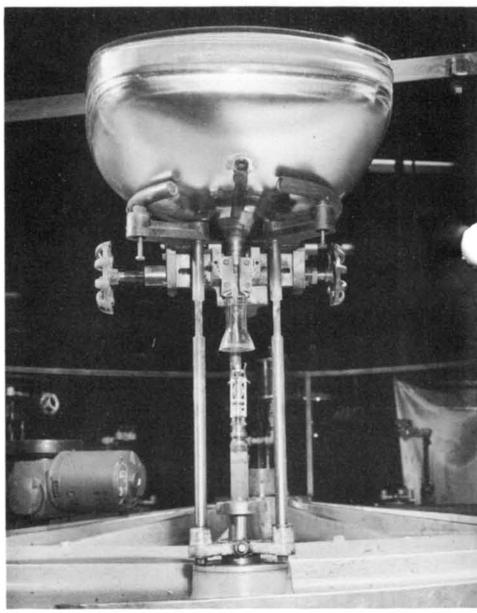


The electron gun mount consists of two major parts – the electron gun and the stem. The gun is that portion of the tube supplying the electron beam that activates the screen to produce the television picture. The stem is used for supporting and supplying voltage to the gun.

final assembly

gun seal

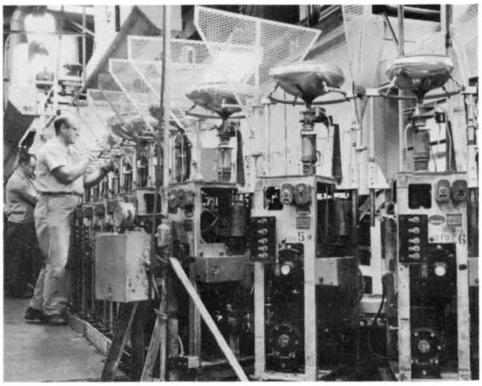
Sealing the mount into the bulb neck is accomplished by using combinations of gas, air, and oxygen in a series of fires that pre-heat, melt, cut off, and anneal the glass in the area around the neck-stem seal line.

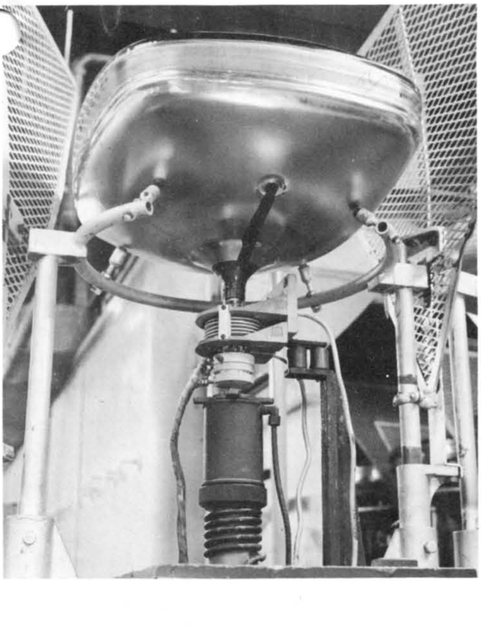


The sealing machine is a 10-ft dia. rotating table with eight evenly spaced heads, each of which carries a bulb and mount holder concentrically aligned. The table indexes 16 times for one complete revolution, providing two load positions, 12 fire positions and two unload positions. The bulb holder is continuously revolving as it indexes into each fire position to allow the bulb neck to be equally heated on all sides. The mount, placed in the sealing pin, is moved upward as the machine indexes and inserted to the proper height. This positions the flange of the stem inside the neck directly opposite the needlepoint flames that fuse them together. After the seal is made, the waste glass, or cullet, is cut off by means of sharp fires. In succeeding positions, the area around the point of seal is annealed and the bulb is unloaded from the machine in the final position. The overhead conveyor delivers the bulb to the next process.

exhaust

The operator positions the bulb on the exhaust buggy bulb holder, carefully threading the tubulation into the port of the pumping system. An air-tight seal around the tubulation is formed by a compression fitting. The mount lead wires are attached to the activation terminals to provide filament and other voltages during the process. All air and gases are removed from the bulb by simultaneously subjecting it to a pumping, heating, and activation cycle. This is done during travel through a 175-foot long "U" shaped oven on one of approximately 120 buggies driven by means of a conveyor-chain mechanism. The bulbs reach a temperature in the oven of approximately 800°F to drive out the entrapped gases contained in the glass and bulb coating materials. The metal gun parts are degassed by means of radio frequency bombardment of the grid, and by applying voltages to the grid. Gases driven out by these techniques are removed by the oil diffusion pumps in the buggy.





After evacuation of all gases, it is necessary to seal or "tip-off" the exhaust tubulation projecting from the stem seal. By trade definition, a bulb becomes a tube when it has been exhausted and tipped. Originally, this was a hand operation, but automatic tipping machines have replaced the hand method and provide more uniform processing. These are small electrical radiant tipping ovens that supply a controlled localized source of heat, resulting in an improved tip and simplification of the process.

Other finishing operations include attaching the base, getter flashing, and aging to prepare the tube for final testing.

test

The finished tubes are 100% inspected for electrical and mechanical performance under conditions that duplicate actual operation. The monoscope pattern, used to check for proper focus and other characteristics, is similar to the test pattern used by television stations. Each test set has the pattern piped directly to it from the factory distribution equipment. The slightest imperfections in screen coating or operational characteristics are reason enough to reject the tube and necessitate complete reprocessing.

Statistical quality control inspection and test stations between final test and packing help maintain the quality level required in this highly competitive field. In addition, the product is life tested on expensive, carefully maintained equipment to assure shipment of products consistent with General Electric Company's high quality standards.