W. F. Hopkins
B. A. Kafka
V. Von Campbell #6, Rm 13

October 4, 1956

Mr. E. A. Whitmore, Manager
Kentucky Glass Works
Lamp Division
General Electric Company
Russel Cave Pike
Lexington, Ky.

Dear Mr. Whitmore:

Enclosed are notes concerning my observations at Kimble and Corning. These will be reconciled with Mr. Von Campbell's and Mr. Hopkins' notes in the near future.

Very truly yours,

D. W. PUGSLEY, MANAGER
PARTS & SPECIAL PRODUCTS ENGINEERING
TELEVISION RECEIVER DEPARTMENT

DWP:jjs

PICTURE TUBE BULB MAKING AT KIMBLE

I Faceplate

1. Faceplates are pressed

   a. Large rotary turret is used containing 11 moulds.
   b. Glass comes out of the tank into a purifier at 2200°--it comes out of the purifier at 1980°.
   c. Glob of hot glass is dropped into every other mould one at a time.
   d. Machine rotates twice for each faceplate.
   e. Plunger operates in second active position.
   f. Machine indexes in each position for about 10 seconds.
   g. Plunger is sprayed with oil in third active position to remove build-up of fluoride.
   h. Cleanliness was stressed.
   i. Shear mark is thrown up on the edge.
   j. Faceplates are removed manually.

2. Annealed and cooled
   a. On long belt conveyor 10-12 wide

3. Inspected (100%)

   a. Rate of rejection at this point varies greatly, from 30% to 100%. Stated to average about 60-70%. Chill wrinkles caused by temperature variations in glass and mould.

4. Polished

   a. Manually polished with rotary wheels.

5. Rouged

   a. Rouging is mechanized.

II Funnels

1. Funnels are spun

   a. Large rotary turret is used containing 8 moulds.
   b. Glob of hot glass is dropped into one mould at a time.
   c. Machine rotates once for each funnel.
   d. Machine stops in each indexed position for about 10 seconds.
   e. Arms reach inside of funnel while spinning to shape and notch.
   f. Funnels are removed manually.

2. Funnel neck cut off

   a. Funnels manually placed in an 8 position turret
   b. Rotated continually with flames played on.
   c. Funnel automatically cut off in neck region.
   d. Removed manually.

3. Cooled

   a. Placed on 8 position turret.
   b. Cooled by forced cold air.
   c. Excess glass at faceplate end breaks and falls off.

4. Neck sealed on

   a. Funnel is placed on a lathe.
   b. Neck tubing sealed on.
   c. Manually removed.

5. Anode button sealed on

   a. Funnel placed on turret.
   b. Spot is heated.
   c. Hole is punched.
   d. Button is placed in position.
   e. Button further heated, glass sags.
   f. Button pushed back into place.
   g. Cooled.
   h. Removed.

6. [redacted]

III Bulbs Assembled

1. Faceplate is spliced to funnel.

   a. Electrically sealed. Operation appears to be identical to that at Corning.

IV Inspection

1. 100% inspection under various lighting conditions.

V Miscellaneous

1. The faceplate pressing machine is a standard purchased machine.

2. 55 moulds and 1 plunger are required to keep one faceplate machine in operation. 3 moulds and 1 plunger are changed--on the fly--every 8 hour shift. One set of moulds and plungers costs about $75,000.

3. When removed the moulds are stripped of chrome, ground, repaired, replated, and polished.

4. A crew of 30 people, 30,000 sq. ft. of space, and much tool room equipment is used to maintain the moulds.

5. Plant has 500,000 sq. ft. including a huge warehouse.

6. At one time they had a 750,000 inventory of bulbs.

7. Have 3 200 ton/day gas electric ovens and 1 320 ton/day gas oven. One gas electric oven is on standby.

8. Gas electric oven most costly, but most versatile.

9. Make 40% of industry bulbs.

10. Glass solder technique well along.

11. Owens Illinois Tech. Center has about 500 employees . Elaborately equipped.

PICTURE TUBE BULB MAKING AT CORNING

I Faceplates

1. Faceplates are first pressed

   a. Large rotary turret is used containing 11 moulds.
   b. Glob of hot glass is dropped into one mould at a time--goes into alternate moulds.
   c. Machine rotates twice for each faceplate.
   d. Plunger enters in second active position.
   e. Machine stops in each indexed position for about 5-6 seconds.
   f. Faceplates are removed manually.

2. Annealed and cooled

3. Inspected (100%)

4. Polished

   a. 80% of the faceplates are manually polished with rotary wheels.
   b. Approximately 15-20 people used on this operation.
   c. Appeared to average about 1 minute per faceplate.
   d. Polishing will be mechanized in about 1 year.

5. Rouged

   a. Rouging is mechanized.
   b. Two large merry-go-rounds are utilized having about a 100' travel- multitude of buffing wheels.
   c. Faceplates loaded and unloaded by hand.
   d. Messy operation--liquids all around.

II Funnels

1. Funnels are spun

   a. Large rotary turret is used containing 8 moulds.
   b. Glob of hot glass is dropped into one mould at a time.
   c. Machine rotates once for each bulb.
   d. Machine stops in each indexed position for about 5-6 seconds.
   e. Various arms reach inside of bulB while spinning to shape and notch.
   f. Funnels are removed manually.

2. Funnel neck cut off

   a. Funnels manually placed in an 8-10 position turret.
   b. Rotates continuously with flames played on .
   c. Funnel automatically cut off in neck region.
   d. Removed by hand.

3. Cooled

   a. Manually placed on a belt conveyor--3 wide.
   b. Cooled in long funnel (perhaps some annealing is also done here).
   c. When removed at other end of funnel the excess glass at the faceplate end falls off having been previously scored.

4. Neck sealed on

   a. Funnel is placed on an 8-10 position turret by hand.
   b. Neck tubing automatically sealed on.
   c. Manually removed and carried to button inserting position.

5. Anode button sealed on

   a. Funnel is placed in 8-10 position turret.
   b. Turret stops in each indexed position approximately 4-5 seconds.
   c. Spot heated by flames.
   d. Hole punched in glass.
   e. Button placed in position .
   f. Cooled.
   g. Funnel removed by hand.

6. ~~Annealed~~

   ~~a. Annealed in long lehr~~.

III Bulbs Assembled

1. Faceplate is spliced to funnel

   a. Faceplates and funnels are chucked on a lathe.
   b. Pressed together--aligned.
   c. Spun--perhaps 40-60 RPM.
   d. Flames played on edge of seal.
   e. When hot, a current is arced into the bulb which travels around the seal area. This is accomplished by means of two electrodes placed 180° apart. (All metal must be kept at least 2 1/2" from the seal to avoid arcing to it.) 60 cycle current is used.
   f. Operation requires about 3 minutes.

2. 21 such sealers are in operation.

3. Annealed

IV Inspection

1. 3 100% inspections are performed in the plant (presumably 1 on each funnel, 1 on each faceplate, and 1 on completed bulb).

2. Inspection consists of examining under various special lighting conditions.

V Miscellaneous

1. Faceplate moulds cost $40,000 to $60,000 (presumably per set)

2. Two 750,000 16.per day glass furnaces are used.

3. Some thermal shocking is done now (in the lehrs). This will be extended to 100% in ths future. 20 feet has been added to each lehr for this.

4. Plant has 600,000 sq.ft. (2 floors and basement).