SUBJECT: Motorola Trip Report

TUBE: 23"-92° Rectangular Color Tube

PERSONNEL:

Motorola	CRT
K. Horn	V. C. Campbell
D. O'Fallon	P. J. Librizzi
D. Lindeman	F. A. Romano
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Syracuse, New York
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GENERAL:

The purpose of the meeting was to discuss:

(a) Possible design and manufacturing relationships so as to establish a base for generating a color program

(b) Manufacturing and design assumptions

(c) Competitive action

(d) Present 23" tube technology

(e) View 23" tubes screened with a 70° correction lens (tube was not available)

RELATIONSHIPS:

Discussions were held with K. Horn on various aspects of the 23" rectangular color tube and possible relationships for the completion of design work and the manufacture of such a tube.

K. Horn indicated that they have contacted Manufacturer A who would be willing to produce 100 tubes per day starting in July so that Motorola could ship sets by September 1. It was disclosed that "A" does not have color facilities in place but that color equipment was available for purchase within the industry (Thomas was mentioned as a possible source). It was stated that with "A", Motorola would have to assume the design and process responsibility since little engineering was available. Horn felt G-E would be a better supplier since engineering would be available for the project. Three possible arrangements were discussed, namely:

(a) Motorola assumes tube design and process responsibility

(b) Motorola assumes tube design responsibility and Manufacturer X assumes process responsibility

(c) A joint design responsibility with Manufacturer X assuming process responsibility

Having concluded they want this tube, they have further concluded that they must be prepared to lead the way. Consequently, they have set up a Color Task Force headed by Dick O'Fallon to resolve the tube design problems prior to July 1. The engineers associated with this work have been relieved of their current duties and are assigned as follows:

D. O'Fallon - Optics, Bulb Design
D. Kurtz - Optics
D. Lindeman - Mask Mounting, Jigs
B. Rhinewald - Mask Mounting, Jigs
A. Balackus -

MANUFACTURING AND DESIGN ASSUMPTIONS:

Several important assumptions have been made by Motorola which affect the tube maker, namely:

(a) Initially the glass will be a 23" monochrome bulb cut, ground, and fritted after the screen and mask have been assembled to the facepanel. The tubes will then be exhausted at monochrome rates and temperatures.

(b) Neck seal and gun orientation with respect to the phosphor dots will be provided by externally jigging each bulb.

(c) Performance and life must be competitive. Initially, however, they will provide 8 magnets to correct for color purity at the edge of the tube.

(d) In the event tube design problems have not been resolved by July, the production schedule would be modified. Motorola is not interested in the tube maker having excessive shrinkages.

(e) Assuming satisfactory bulb processing, a new bulb design with appropriate face curvatures would be evolved so as to minimize color purity problems and allow removal of the magnets. This design would come at some later date after experience has been gained in tube processing.

COMPETITIVE ACTION:

K. Horn mentioned visiting Manufacturer B who has continued color development for the past six years and claims to have seen 17", 19" and 23" rectangular color tubes not requiring correction magnets. He then demonstrated an engineering sample of a 17"-90° tube made for Motorola by Manufacturer B. This tube had good purity and convergence although the brightness appeared low. Also the mask was similar to that used in the 23" tubes so that resolution was limited.

Karl stated that Zenith will sell 100,000 70° sets in 1962. In the meantime they probably will get a commitment from Manufacturer B (Rauland) to get into color within two years and provide rectangular tubes. Sylvania was considered to be in trouble financially for 1962 and their action limited.

We discussed briefly RCA's response to the introduction of the 23" tube. Karl felt they were capable of dropping their tube prices $20-$25 so as to maintain leadership in the high volume low price field. Motorola would continue in the high price field and by virtue of their styling hope to come out on top. The thought was given that RCA would announce a 90° round color tube in May or June of this year.

PRESENT TECHNOLOGY:

To my knowledge no inventions have resulted from Motorola's color effort to date. Their work has been an extension of aperture mask knowledge and has resulted in color tubes starting with monochrome glass. They have chosen this course to reduce bulb prices but have consequently altered tube making processes which may well add to the final cost of the tube thru shrinkages. A discussion of their present position follows:

CONVERGENCE:

Yoke and convergence circuits, although similar to the 70° round tube, have been modified to allow for convergence of 90° tubes. The tubes demonstrated were comparable in 70° tubes.

GLASS:

Motorola has been working with Corning since our last visit on December 18, 1961. Corning claims that 23" bulbs, cut ground, and fritted are as strong as the round tubes. (Hudson is the Corning contact). Tubes processed by Motorola continue to implode (8 out of 10) however during exhaust. These tubes have been pinned (at National Video) and masks mounted -Corning's test tubes do not have pins or mask. Consequently much of the problem may be due to strains introduced by pinning. They are trying to resolve this difference. Initially Motorola used a 440°C frit supplied by Kimble (CV-137) but have since gone to a Corning frit.

National Video has been used to film, aluminize, exhaust, gun seal, etc., the screens prepared at Motorola. Karl indicated a $100,000 payment to National Video for a 41 day developmental period.

MASK-FRAME:

The rectangular aperture masks are supplied by Buckbee Mears at a price around $35. This covers tooling, etc. The masks are hydroformed over a bakelite mandrel. No attempt has been made to coat the masks at this time. Both the frame and mask are made of cold roll steel.

ELECTRON GUN:

Currently using the RCA 70° gun but hope to redesign for a smaller color base and improved spot size so as to improve convergence and brightness.

GUN SEAL:

Use of monochrome bulbs may result in a neck sealing problem since the 1-1/8" neck must be replaced by a 2"-neck. The neck must be perpendicular to the screen and the gun oriented with respect to the phosphor dots. This will necessitate an external referencing system which is not included on the mono bulb.

SCREENING:

I Were settling screens in the past

1. Conventional BaAc-KWG settling and decant process
2. Drying of screen
3. Photo resist application $(NH_4)_2G_2O_7$ + albumin or gelatin
   a) probably by spray gun or whirler
   b) drying in dark warm box
4. Exposure on BH6 quartz cone collimator light source: 6 minutes for blue and green and 12 minutes for red
5. Develop H_2O + aerosol
   a) 5 minutes or more
6. Dry
7. Inspect and measure dot size
8. Repeat steps 1-7 for other 2 colors

II Slurry screens recently

1. Welding positioner slurry application (or some whirling device
   a) PVA, $(NH_4)_2Cr_2O_7$, phosphor
   b) flow out, partial drain, spin
   c) calrod heaters to dry
2. expose
3. Develop H_2O + aerosol
4. Dry
5. Inspect
6. Repeat 1-5 for other colors

III Comments

Evidence of brightly fluorescent lighted room, with amber acetate foil over fluorescent lights(as a safe light shield) would indicate 5 minutes developing time was due to light striking of panels. This requires forced development and generally poorer quality.

Their red dots were poorly loaded and the color was not saturated - i.e., too thin?

Photo Resist being used is "Unicote" (from Pitman Sales, Boston). This is a lithographic supply house and the photo resist line comprises dichromated albumin and gelatins. These leave a high ash residue in screens and consequent lowered light output as compared to PVA or KPR, etc.

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