

MU: The Last Tube Factory In America

By Eric Barbour

While attending the Winter NAMM show in Anaheim this past January, a fellow named Charles Alexanian appeared at my booth and offered to give me a tour of the MU factory in Oceanside, Calif. Such a rare opportunity can't be passed up, since I already knew that MU was probably the last factory in North America capable of making glass vacuum tubes without depending on numerous outside parts suppliers. The few other firms with equipment for making tubes, such as Richardson Electronics, Groove Tubes, or Western Electric, are either semi-inactive or dependent on outside suppliers for subassemblies.

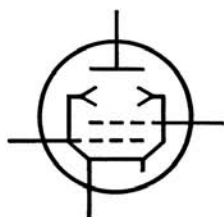
One evening Charles and I drove down to MU's building in an older industrial area of Oceanside. MU is currently owned by Ronalee Elsberry, daughter of the firm's late founder, Harold Ulmer. She was good enough to show me virtually all of the manufacturing equipment and tooling, and I took as many photos as possible. Charles, who is good friends with



PHOTO 1: Assemblage of all items made at MU Inc. including X-ray tubes.



PHOTO 2: Eisler 8 head sealer (octal size bulbs). Annealing ovens to left of sealer. (Photos by Eric Barbour; captions supplied by Ronalee Elsberry).



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Roni and also interested in manufacturing power triodes for audio use, has been showing prototypes of his glass directly-heated triodes to possible customers. He also helped me with this brief history.

PAST PRODUCTS

Ulmer originally worked at Hughes Aircraft's old vacuum tube facility (Vacuum Tube Products), which was shut down in the late 1950s. He bought some of the old tooling from VTP and started production of specialized tubes, mostly for military contracts and with the help of some former VTP employees. Much of the green-painted equipment in the photos came from VTP. One of Ulmer's major engineering R & D jobs, after he became in-

dependent, was work on the notorious Charactron tube for Convair Aviation, which also made specialized tubes at the time.

The Charactron was one of the most complex CRTs ever made, with an etched metal mask that could be used to shape the electron beam into alphanumeric characters for display along with graphics. Charactrons were used as direction displays in the massive SAGE computer-air defense system. During this time, MU also manufactured Nixie display tubes. Charles tells me that MU still has the special equipment to make Nixies. Ulmer died in September 1997, leaving the business to his daughter, whom he had trained in the complex and obscure business of manufacturing vacuum tubes and

who has actively helped manage the company since 1970.

MU made a variety of odd glass tubes over the past 40 years, from the 2C53 high-voltage triode to the tiny vacuum diodes used in Hewlett-Packard 410 series AC voltmeters with built-in RF detectors. Some of the other tubes they made regularly included the 3D21 pulse-power tetrode and its later version 7403, the 6303 radar-clipper diode (a big seller), a version of the 596 rectifier, and several other tubes usually seen only in obscure military equipment such as pulsed radars. MU also made the "e/m" tubes that Cenco Scientific Co. sold to schools for many years, which allowed science students to determine the mass of the electron by direct observation. MU made a ver-

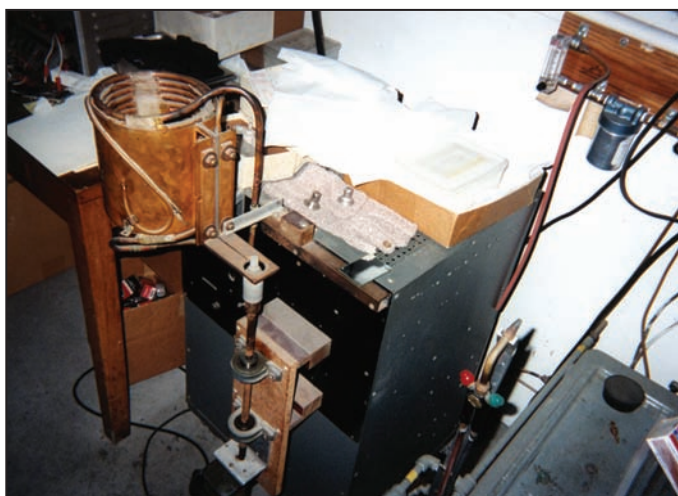


PHOTO 3: RF sealing. Used to seal 7056 glass to Kovar cup for types 6303, 7402. Also used for bulb on EA52 and EA53 tubes.



PHOTO 5: 12 station exhaust system. Used for 3D21WB and 7403 types.

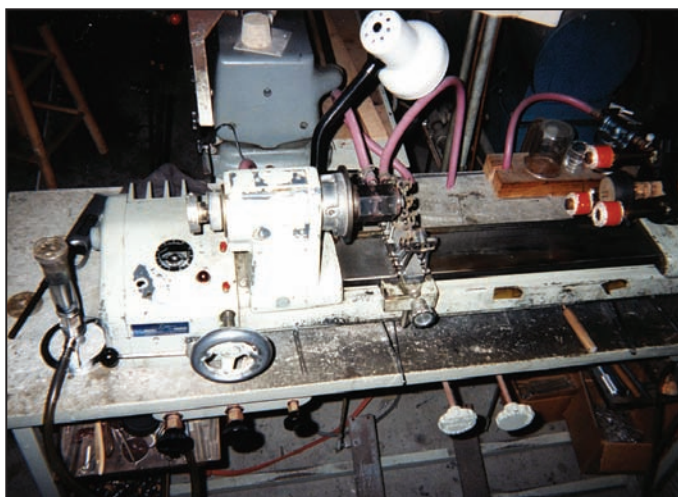


PHOTO 4: Litton Mod F-U glass lathe. Used to attach glassed Kovar assembly to bulb for 6303 and 7402 tubes.



PHOTO 6: Left: used to burn in brands. Right: used for baking bases on tubes. Set up for either 217-C or 2C53 bases.

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sion of the large glass RCA triode type 851, for use in unknown equipment at the Panama Canal.

TUBE DEMANDS

In the 1960s MU manufactured some of the more popular "Bendix Red Bank" tubes, including the 6900 dual triode and 6094 power tetrode. Tooling to make 6900s is still available. According to Charles, if someone "really wanted a tube" to be made at MU, such as an 845 triode, a minimum

production level would be 250 pieces per month. Wholesale price would "be about \$250 each," and the tubes would be "100% handmade." Unlike other defunct tube factories elsewhere in North America, MU still has a skilled labor force available. Manufacturing a 6L6 type would require a minimum of \$100,000 in tooling and development costs, plus several hours of labor apiece. Annual production of 10,000 pieces would lead to a retail price of about \$100. (Please note that these are

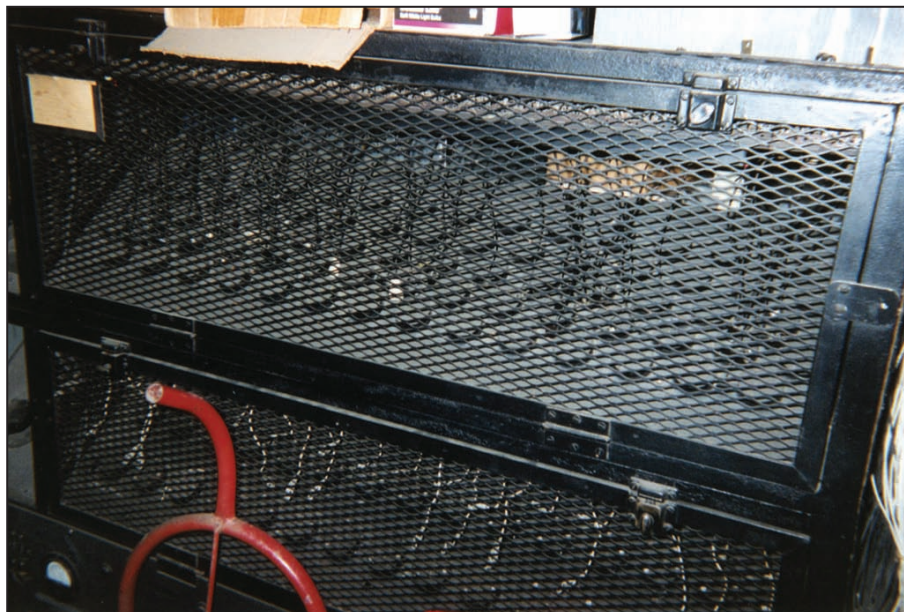


PHOTO 7: Tung-Sol built age rack. Top ages tube type 122. Bottom ages 3D21WB or 7403.

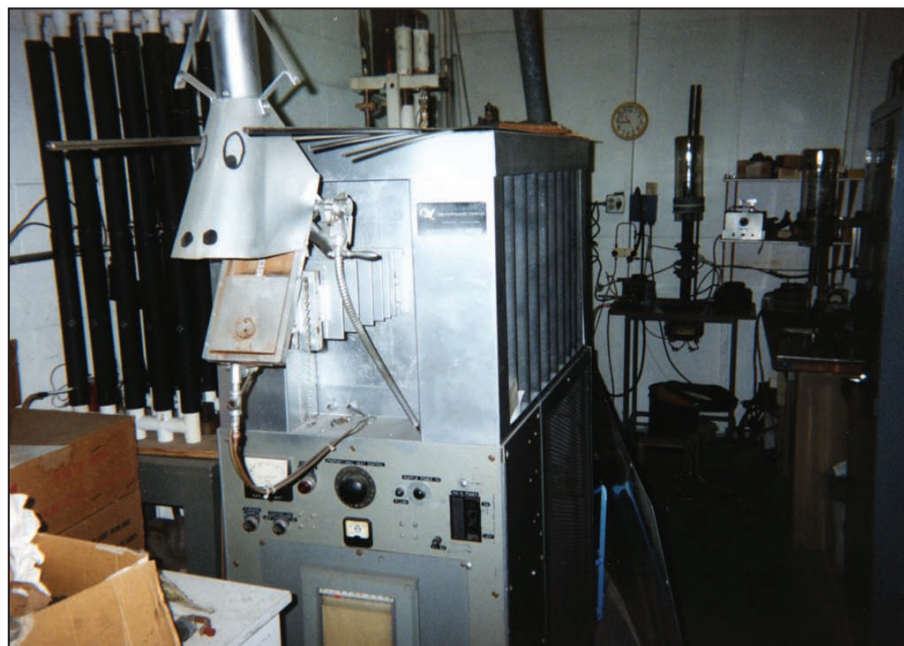


PHOTO 8: CM furnace (in-house known as dragon furnace). Used for copper brazing X-ray and laser parts. Other brazing bell jars in back for 1 and 2 tip torch brazing.

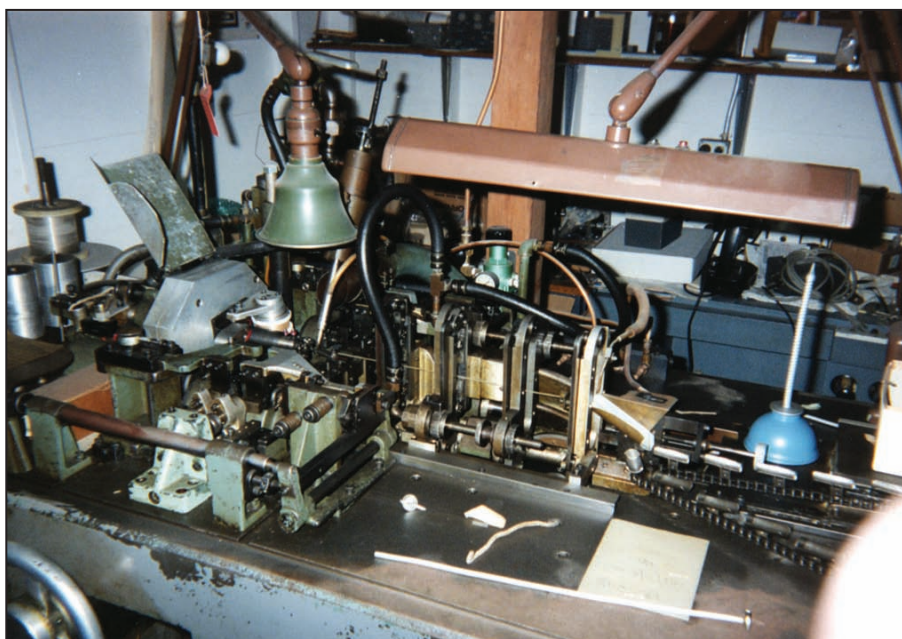


PHOTO 9: Sylvania automatic grid machine. This one is set up to make grid one of types 7234, 7683, 6842.

very rough estimates.)

As Roni told me, "We can make everything in-house except glass bulbs. We can make stems but it is difficult." This is an unusual level of vertical integration for a small tube factory. However, Roni hasn't pursued the manufacture of audio tubes, because of the fickle tastes of the audiophile and guitar-amp market, and their fondness for tubes that might not be perfectly reproducible. Unlike most American businesses, the war in Iraq has been a positive development for MU. They have recently received new orders for their popular types from the US military.

Roni still awaits a serious investor to pursue audio tube manufacture, having received a few recent offers—none of which led to any substantial



PHOTO 10: Mid-half of assembly room.

business. The lower costs of Chinese and Russian tubes continue to attract all the major customers. However, as the supply of good NOS audio types dwindles and the demand for better tubes increases, MU could enter this

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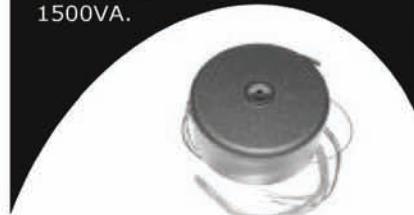
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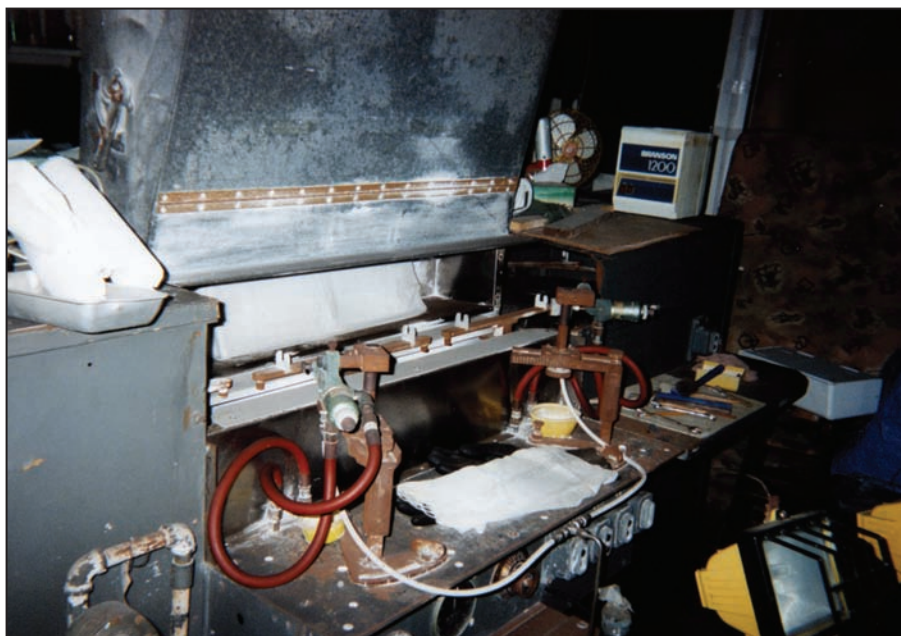


PHOTO 11: Automatic cathode spray machine.

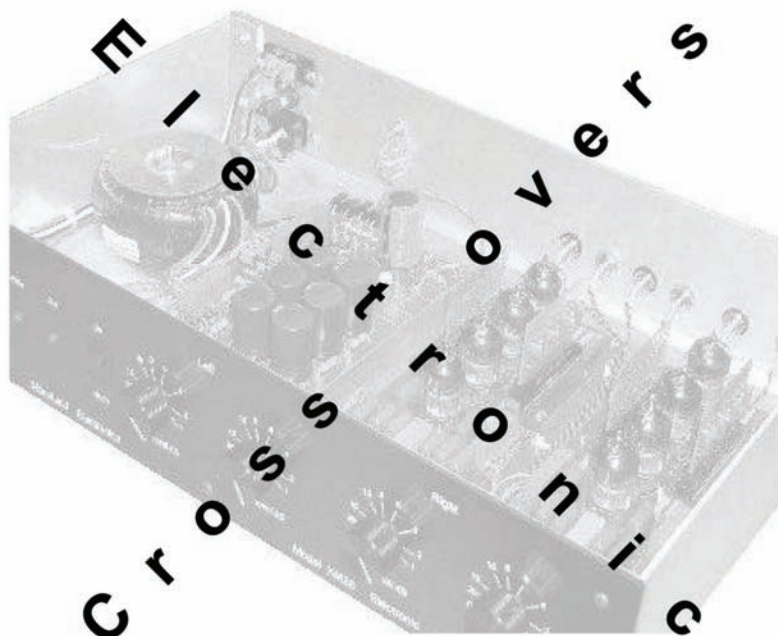
production market in the near future. A partner would be required to provide development money and perform marketing to end-consumers. ■

Eric Barbour is a consulting engineer and is currently owner/designer of

Metasonix. He is also senior editor of Vacuum Tube Valley magazine and has been one of our regular contributors since 1991. He was the winner of the Antique Wireless Association's 1999 Gerald F.J. Tyne Award and 2004 TCA Stokes Award for his efforts in documenting the early history of electronics. Barbour holds a BSEE degree from Northern Arizona University and is a member of IEEE, the Audio Engineering Society, the Antique Wireless Association, and the Tube Collectors' Association.

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PHOTO 12: One of the first Charac-trons made. Given to MU Inc. after seeing the display tubes.