

CONTEMPORARY TUBE MANUFACTURE: KR AUDIO ELECTRONICS

Abel Santoro

Located in Prague, in the Czech Republic, heart of Europe, KR Audio Electronics is a world leader in the production of low-frequency power triodes and high-fidelity audio equipment. Figure 1 shows the logo of the company.



Fig. 1. Logotype used on KR tubes.

The vacuum tubes made by KR are hand-crafted, which process employs artisans, working with metal, hand-blown glass, chemicals, and electronic design. There is an absolute refusal to use automatic machines for making tubes, said to be the unique reason for KR high quality.

KR Audio Electronics was founded by Dr. Riccardo Kron, who had an interesting personal background in the manufacture of vacuum tubes. The story started when Riccardo's grandfather Bela Kron left Budapest and opened a Hungarian restaurant in Milan in the 1920s, living there with his extended family. No one family member had a particular influence on Riccardo. After the end of WW II in the spring of 1945, he spent hours looking through surplus stores, performing experiments with radio transmitters and building radios and a black-and-green TV set. All of this was fabricated with military cathode-ray tubes and other surplus items. A major adventure for him was to find tubes at wholesalers and flea markets and build exciting electronics projects to be sold later, creating in this way his own small electronic enterprise. Post-war reconstruction was moving rapidly, especially in the field of electronics, where students were exposed to the best of American technology and German engineering.

Riccardo remembered a professor who

took him to the home of symphony conductor Arturo Toscanini to install a Leak (British) mono audio amplifier in 1952.

Dr. Kron started his professional career in 1960 at "Magnadyne," an Italian electronics company in Piedmont near Turin. Magnadyne had been founded in 1923, dedicated to making radios and later television sets of high quality. This company was equipped with its own electron-tube division, with an internal tube factory. Privately owned, this company was prominent for fine quality and reliability.

In his childhood, Riccardo Kron had spent hours listening to his father practice on his violin. After his professional formation, he felt that mass-produced tubes did not create the warmth and richness of the real music he had heard as a child. He became interested in developing a tube that would create a true and exact sound reproduction. But he could not find either the right men or a place for the research.

After the Berlin Wall fell, he saw in a flea market in central Italy, a young Czech gentleman selling tubes. He was an engineer who sold tubes to make money; also he ran a small factory in Prague with four workers. This plant, that had produced famous tubes in the past, was a Philips establishment from 1928, then Tesla from 1948 to 1990.

Riccardo spoke with him and concluded that this individual, with a few skilled craftsmen, could make replicas of Marconi tubes, blowing the glass individually and assembling the internal parts by hand, but this artisan had no market for these collector's tubes.

Then Dr. Kron made a proposal: if he would provide the money for research and development, they could make a new type of vacuum tube for audio only, which would revolutionize sound reproduction in high-quality amplifiers.

Early in 1992, after a substantial investment, Dr. Kron obtained his first new triode audio tube in 42 years: no such

tube had been designed and produced since 1950. With this new tube the sound of a high-end audio amplifier used at changed dramatically. It became live, real music. Dr. Kron had done it, but what now? The tube was expensive, the name of the company unknown, and the country of manufacture virtually new.

This was born KR Enterprise, renamed later as KR Audio Electronics. This victory was shared with his team consisting in engineers, chemists, vacuum technicians, glass blowers and mechanical specialists.

KR glass envelopes are made by artisans forming molten glass into bulbs by blowing a bubble in the middle of the glass while rotating and heating it.

The production employees do everything, the tube is not created on a big assembly line with automatic machines. Fabrication is done entirely by. In each KR tube every piece is a unique art object, even though the firm prides itself on being a technological manufacturer. The result is tubes claimed to give higher vacuum, less grid emission, and longer life.

THE FACTORY

The factory operates in a building originally used by the Dutch Philips company for tube manufacturing. This plant was nationalized under the Communist regime in 1948, making tubes for the Russian occupier under the name Tesla. Because electron tubes are not readily damaged by nuclear radiation, Tesla made numerous tube types for Moscow's military purposes in those days of the Cold War.

With the fall of communism, the factory returned to the private hands of Aleša Vaic, another tube manufacturer. The latter offered, during the 1990s, a line of replicas of European tubes of the 1920s and 1930s under the Vaic Valve brand.

The KR factory is divided into three sections: fire and gases, assembly, and electrical.

The glass section, which converts long tubes of SIMAX borosilicate glass into tube envelopes, is operated by the glass-

master. SIMAX is a very hard glass like Pyrex, said to dissipate heat faster than regular glass and thus enhance tube life and performance.

Figure 2 shows the glassmaster measuring and cutting a piece of glass pipe to make bulbs for two KR 842 tubes. At the desired length the tubing is cut with a red-glowing wire, then he marks the middle of the pipe and heats this point (Fig. 3) until the glass is just soft enough to be extruded into a cone which is separated into two equal parts.

Now, in one of the tubes corresponding to our KR 842, is inserted a felt piston with a hollow tube (Fig. 4). Then the glassmaster, blowing into the little lead tube, forms the conical top of the tube in the dome that we recognize in power tubes (Fig. 5).

With the envelope prepared, the next step is to make the stem, which forms the junction between the internal parts of the triode and the external world. This is made by another glassmaster. With a small piece of glass pipe and a large and narrow flame, he constructs the stem (Fig. 6) putting inside the four wires that will make the connections (Fig. 7). The wires are spaced correctly and sealed airtight into the hot soft glass (Fig. 8).

In the next step requires considerable precision and delicacy to assemble the internal tube parts. The cathode of the KR 842 is composed of 32 pieces of a proprietary nickel-base alloy. The grid and plate are crafted here as well, and are connected to the respective wires in the stem. This work is done with fine tools and microscopes (Fig. 9).

Now the completed stem is sealed to the glass envelope while an opening with a small glass tube remains in the stem to connect the glass envelope to the vacuum pump in the vacuum room (Fig. 10), where we find a lot of Tesla-branded equipment, with test benches and all types of vacuum tools. The next step in the fabrication of the KR 842 is the activation of the cathode and the firing of the getter. This last step extracts all gases remaining inside the tube, and will be the only time that one will ever



Fig. 2. Cutting tubing for bulbs.

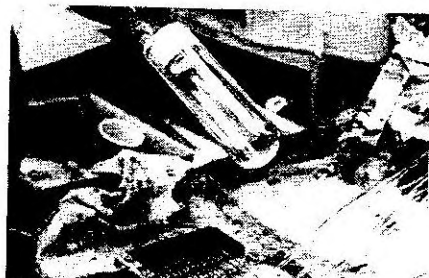


Fig. 5. Bulb top after forming.



Fig. 3. Dividing a section of tubing with a gas flame.

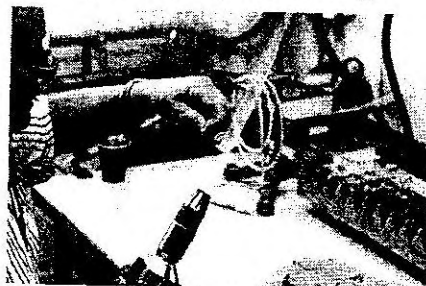


Fig. 6. Fabricating the stem.

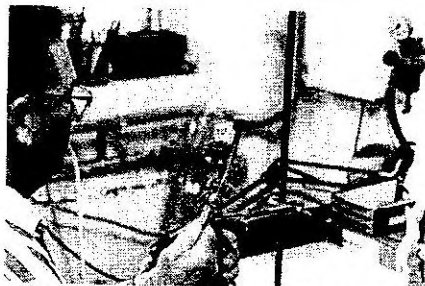


Fig. 7. Pressing the stem.

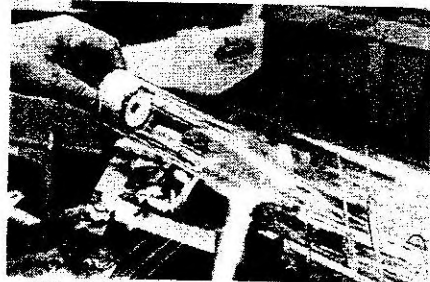


Fig. 4. Flame-forming a bulb top.



Fig. 8. Completing the stem.

see a KR Audio tube glowing!

On a big vacuum pump we can see a series of KR 842s (Fig. 11) ready to be activated, later, the tubes are detached from the vacuum manifold with a torch without breaking the vacuum. This is done with great care (Figs. 12 and 13).

The final stage is to apply the ceramic base with the contact pins, finishing the 128 hours of hand work on one single tube, which gives us an idea of its cost. The completed tubes are tested rigorously before shipment (Fig. 14).

Like everything here, this job can be performed correctly only after years of experience. Other tube factories use machines to do the job and to make up for the lack of handcrafters' expertise, but here all works are done by hand accompanied by the music of a restored old-time Tesla radio.

Each KR tube receives a serial number, placed at the top of the bulb (Fig. 15). An ordinary 300B tube designed in the early 1930s had 28 internal components and a KR 300B tube has 128 internal components. KR Audio can produce 500 tubes per month of this type. During the development of the tube KR 52BX (today its substitute KR 842), KR Audio was the first to use titanium plates. The latest novelty is the T-100. All these tubes are high-power triodes for audio use only.

The dates of first production of KR Audio tubes and their power output in class-A operation are the following:

<u>Tube</u>	<u>Date</u>	<u>Watts</u>
KR 300B	Dec.1997	6-12
KR PX-25	Jan. 1998	5-10
KR 300B XLS	April 1998	15-24
KR 2A3	Jan. 1999	2-5
KR TM*	March 1999	-
KR T-100	April 1999	20-26
KR T-1610	May. 1999	22-50
KR 842VHD**	Sep. 1999	12-22
KR 300B Balloon	Feb. 2001	6-12
KR-845	July 2002	20-26
KR PX-4	June 2003	3-6
KR 211	March 2004	20-26

* "Repro Marconi radio tube," AKA "R"

** Unrelated to U. S. 842 - Ed.

Dr. Riccardo Kron passed away in

2002, and the work has been continued by his wife Dr. Eunice Joy Kron and her team, known as world-wide tube specialists. Figure 16 shows Dr. Eunice Kron at the Munich High-End Show standing with a KR Audio "Kronzilla" amplifier.



Fig. 16. Dr. Eunice Kron

Today in Prague, KR Audio Electronics continues building 15 different tube amplifiers, including two all-solid-state preamplifiers. KR continues manufacturing the 12 models of audio tubes and is the developer of the KR T-1610 tube, the largest and most powerful audio tube of modern times (Figs. 17 and 18).

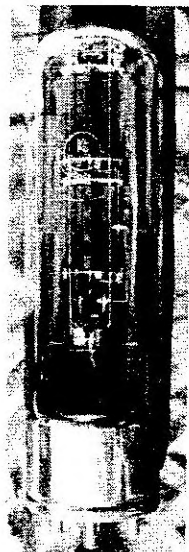


Fig. 17. T-1610 triode (150 watts' dissipation). (At the top of the bulb is a vertical bit of glass tubing that restrains sidewise motion of the cage, like the construction of United Electronics' ruggedized 50-watters of the late '40s. - Ed.)

The KR tubes are elements of high precision made with enormous care, and

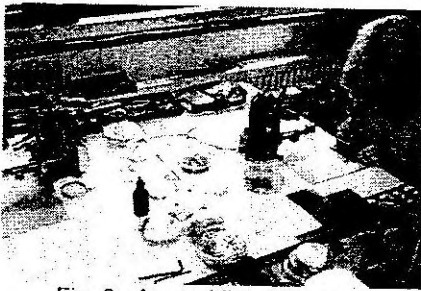


Fig. 9. Assembling the cage.

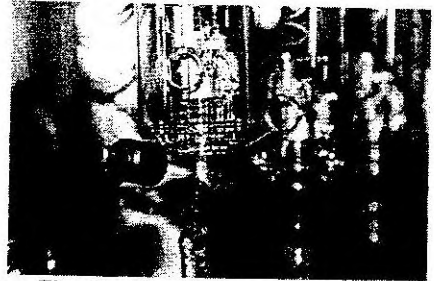


Fig. 13. Completion of tipping-off.

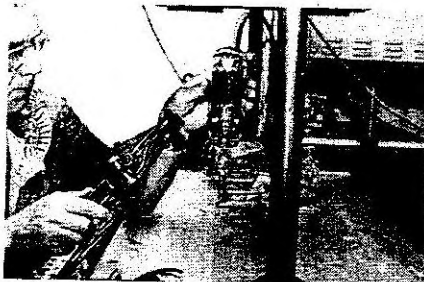


Fig. 10. Attaching tube to the vacuum manifold with hand torch.

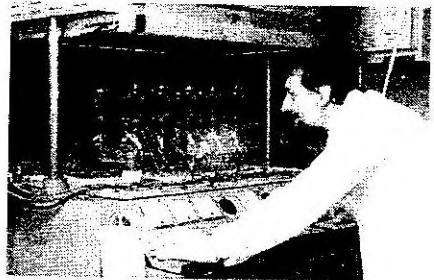


Fig. 14. Inspecting tubes.

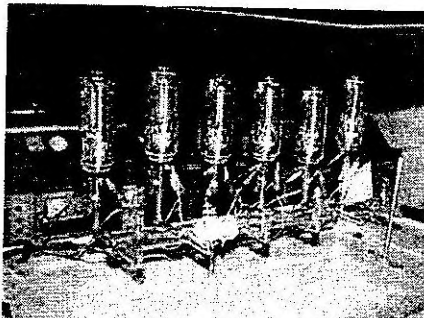


Fig. 11. KR 842 VHDs after exhaust.



Fig. 12. Start of tipping-off.

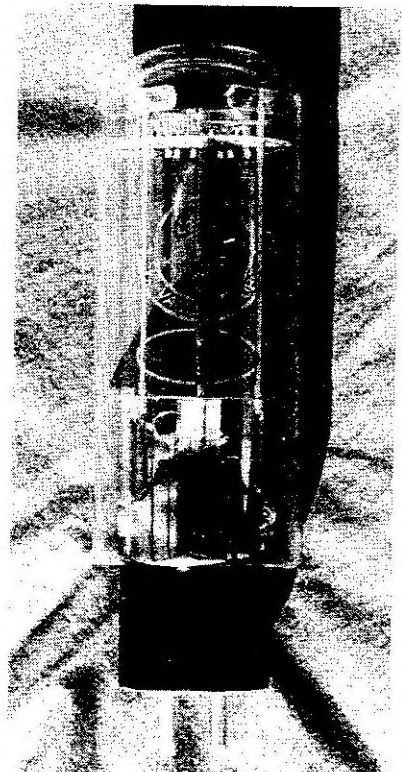


Fig. 15. Finished 842 VHD.

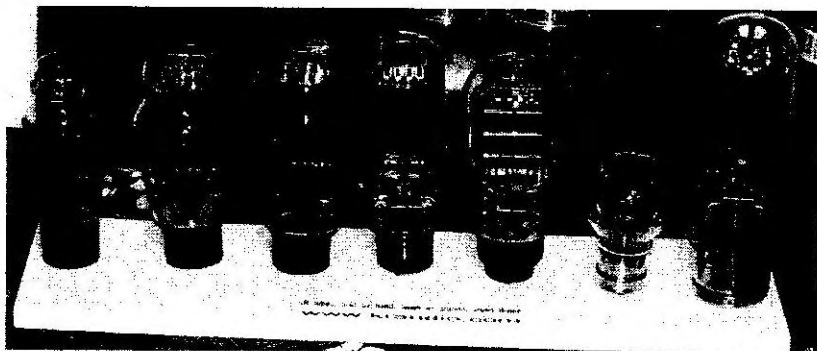


Fig. 17. Left-to-right: the 2A3, 300B, 300B with "balloon" ("S") bulb, 842 VHD, PX25, "TM.", and 845. The tubes are displayed on a stone slab with the slogan "KR tubes, built by hand, tough as granite, sound divine."

high standards of quality, resulting in an exceptionally long life. In Figures 19 and 20 one can see some of the tubes made by KR Audio Electronics and the famous Kronzilla SX amplifier with the two big KR T-1610s, respectively.

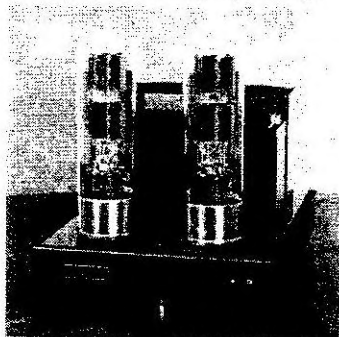


Fig. 20. Kronzilla SX amplifier.

KR Audio Electronics has several representatives around the world, among them one in Argentina, "Star Audio" of Mr. Martin Lezama in Buenos Aires and another in the United States, "Renaissance Audio Electronics Inc." of Mr. Bradley W. Smith in Ann Arbor, MI.

KR Audio Electronics is a leader in this field and has been in business since 1992, exhibiting at the Consumer Electronics Show (CES) in Las Vegas since 1995 as well as other national and international high-fidelity audio shows around the world. The company has won awards for its tubes and amplifiers and has earned excellent reviews in the various trade publications, both foreign and American.

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