TUBE COLLECTOR

TUBE COLLECTORS ASSOCIATION

"HISTORY • PRESERVATION • APPLICATION"

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TUBE COLLECTOR

TUBE COLLECTORS ASSOCIATION, INC.
PO Box 636, Ashland, OR 97520, USA

The Tube Collectors Association is a nonprofit, noncommercial group of individuals active in the history, preservation, and use of electron-tube technology. *Tube Collector*, its bulletin, appears six times per year.

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To join TCA: annual dues is $20.00 (in North America; $25.00 elsewhere), to the address above. Please make checks payable to "Tube Collectors Association." Payment by PayPal is welcomed, to *tca@jkasystems.com*. The membership year runs January-through-December. Those joining after February receive the year's back issues of TCA publications. Multi-year memberships are offered: in North America, $38 for two years or $56 for three; elsewhere, $49 for two years or $73 for three.

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Renewals, changes of address, and other membership business should go to Bob Deuel at *tca@jkasystems.com* or **PO Box 636, Ashland, OR 97520**.

FRONT COVER: Hisashi Ohtsuka (right), enjoying his 2009 Schrader Award plaque with Dr. Yukawa, museum director of the University of Electro-Communications in Tokyo.
Photos: Hisashi Ohtsuka

REAR COVER: Part of the Ohtsuka Collection, now being set up in the UEC Museum.

MICROPHONICS FROM THE EDITOR

WEST COAST TUBE CONFERENCE

Saturday, Oct. 10, Old Sams Valley Rd., Gold Hill, OR. For details, see the yellow flyer mailed with the August magazine. Auction catalog now in preparation. If attending, don't forget to let us know (tubelore@jeffnet.org, or (541) 855-5207) so we can get the food right.

TCA LAUREATES

	Stokes Award (writing)	*Schrader Award (collecting)*
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2008	Frank Philipse	Bro. Patrick Dowd
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2004	Eric Barbour	Al Jones
2003	Bill Condon	Jeremy Harmer
2002	George Jessop and Barry Vyse	Udo Radtke
2001	Robert Millard	Steve Shepard

"ACE AUTHORS": No. 807 SQUADRON

Eric Barbour — Abel Santoro
Jim Cross — Danial Stocks
Bro. Patrick Dowd — Philip Taylor
Peter Keller — Jerry Vanicek

BOOK REVIEW

RADIO VALVE DATA: 1926-1946 Supplement to British Radio Valves - The Classic Years

By Keith Thrower. Introduced 2009. 8-¼" x 9-¾" wire-ring-bound format, 196 pp. Orderable from Valve & Tube Supplies, Woodlands Vale House, Calthorpe Road, Ryde, Isle of Wight, PO33 1PR, U. K., www.valves.uk.com. ISBN 978-0-9537166-4-7.

We reviewed Keith Thrower's British Radio Valves - the Classic Years: 1926-1946 in the August *TC*. Well, it turns out that this book is not alone: the author has accompanied the book with this herculean tabulation of technical data on 4000+ tube types. Their time span is defined by the title. The products of 79 vendors active in the British market are included: Amplion, Aneloy, ARA . . . through Vatea, Vita, and Voltron. This includes such unusual sources as Ostar-Ganz (20 types, all with 250-volt heaters) and Loewe (22 types, including the famous multi-section ones, with internal diagrams). Military and Post Office types (303 and 216 respectively) are featured, with information on what civilian types are similar or identical. The information includes 393 or so U. S. types that appeared in Britain. Tubes covered are mainly receiving parts, but there are some transmitting types.

The data presented are organized by vendor. They comprise the usual paramet-

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WARTIME SPERRY KLYSTRONS: SALES DATA

Our microwave guru Danial Stocks has turned up a sales report covering Sperry klystrons for the period January 1940 through December 1944. Here's the tabulation, with side comments added in italic type.

Type	Number	Notes	Type	Number	Notes
410R	490	*AKA 2K30.* ⚷	2K42	61	*Reflex osc. (5)* ☺
411	153	*AKA 2K31*	2K43	9	*Reflex osc. (6)* ☺
412	19	*AKA 2K32*	2K44	2	*Reflex osc. (7)* ☺
414	4	*4K34*	xe7726	6	*AKA 2K46. (8)*
416	26	*AKA 2K36*	2K47	11	*Freq. mult. (9).* ☺⚷
417	10,144		3K21	42	*Amplifier (10).* ☺
418	14	*2K38*	3K22	79	*Amplifier (11).* ☺
421	6	*421C is AKA 2K21*	3K23	5	*Reflex osc. (12).* ☺
2K31	1		3K31	8	*(13).* ⚷
2K34	8	*(1)* ☺	5K40	8	*Amplifier.* ⚷
2K35	13	*(2)* ☺	XZA	6	
2K36	3	*(3)* ⚷	XZD	6	
3K39	1004	*Reflex osc. (4)* ☺	410R or 2K31	18	

⚷ *Not in EIA / Data Cache index, i. e., probably never registered.*

☺ *Sperry data sheet known to exist.*

1. *Amp., 2 cavities, tunes 2.73-3.30 GHz*
2. *Amp., 3 cavities, tunes 2.73-3.30 GHz*
3. *Freq. mult., 0.3 GHz in, 3 GHz out*
4. *Tunes 7.5-10.3 GHz*
5. *Tunes 3.3-4.2 GHz*
6. *Tunes 4.2-5.7 GHz*
7. *Tunes 5.7-7.5 GHz*
8. *Tripler, 2.7-3.3 GHz in, 8.1-10 GHz out*
9. *0.25-0.28 GHz in, 2.25-3.36 GHz out*
10. *Tunes 2.3-2.725 GHz*
11. *Tunes 3.32-4.0 GHz*
12. *Tunes 0.95-1.15 GHz*
13. *New discovery.*

Typical of a developing technology, the figures range from sample quantities of soon-abandoned parts, to major sales of the 417-type tube, the local oscillator in widely used radars like the Navy SG and Army SCR-584. They also do not hint at massive second-source production of 417As by others like Sylvania or Westinghouse. But, not worrying too much about the absolute numbers, the 10,000-to-one contrast is remarkable!

Stocks points out that we now have confirmation that the 3K31 existed. He is bemused that there is no mention of the 2K32 or 2K44 in this period.

TO REDUCE TUBE TYPES

From Radio Manufacturers Association *News Bulletin* 180, June 20, 1939. Emphasis added.

Reduction of new types of tubes is a new objective of RMA. The Tube Division of the Association, at its convention meeting on June 13, arranged to work with the RMA Engineering Department toward reducing the **evil of multiplicity** in new tubes. A special committee, including Director David T. Schultz of Newton, Mass., Carl Hollatz of Owensboro, Ky., Max Balcom of Emporium, Penna., and Bruce Coffin, was appointed to develop a plan to reduce multiplicity of new tube types which can be curtailed. In the general promotion of the interests of tube manufacturers, the Tube Division discussed the RMA Tube Data Bureau and tube numbering procedure; also the question of a standard guarantee for television tubes. It was decided to hold more frequent meetings of the RMA Tube Division and another meeting was called for July 18 at the Hotel Roosevelt in New York.

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.

Thus 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 thought 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.

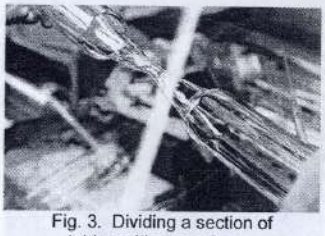

Fig. 3. Dividing a section of tubing with a gas flame.

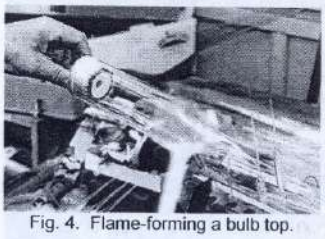

Fig. 4. Flame-forming a bulb top.

Fig. 5. Bulb top after forming.

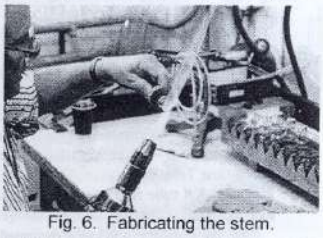

Fig. 6. Fabricating the stem.

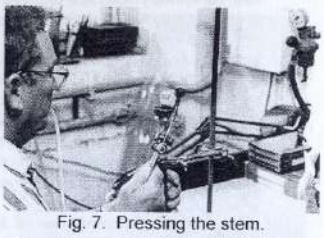

Fig. 7. Pressing the stem.

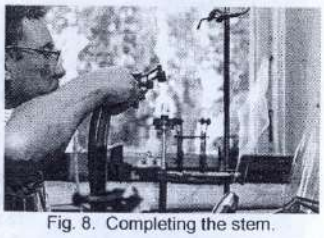

Fig. 8. Completing the stem.

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 handcrafter's 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:

Tube	Date	Watts
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).

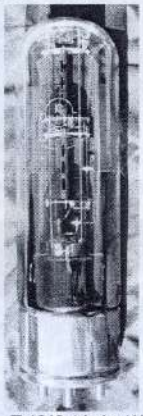

Fig. 17. T-1610 triode (150 watts' dissipation). (At the top of the bulb is a vertical bit of glass tubing that restrains sidewise motion of the cage, like the construction of United Electronics' ruggedized 50-watters of the late '40s. - Ed.)

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

Fig. 9. Assembling the cage.

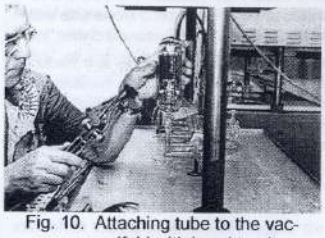

Fig. 10. Attaching tube to the vacuum manifold with hand torch.

Fig. 11. KR 842 VHDs after exhaust.

Fig. 12. Start of tipping-off.

Fig. 13. Completion of tipping-off.

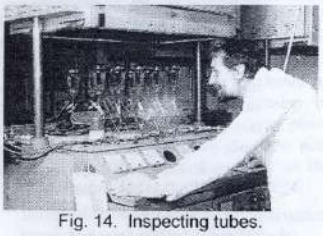

Fig. 14. Inspecting tubes.

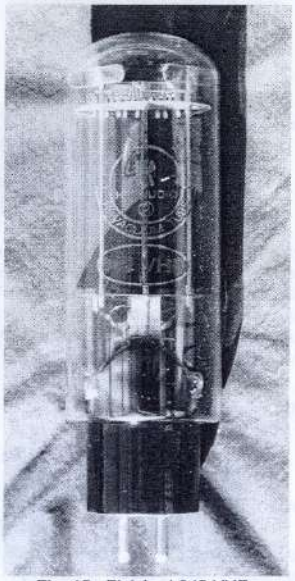

Fig. 15. Finished 842 VHD.

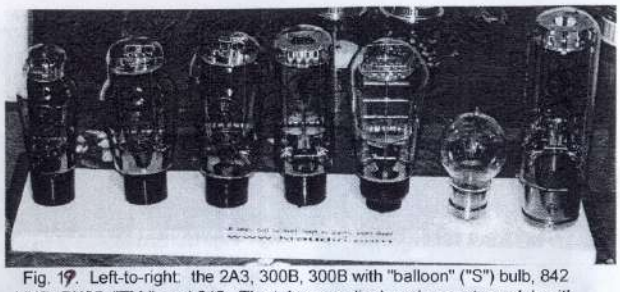

Fig. 19. Left-to-right: the 2A3, 300B, 300B with "balloon" ("S") bulb, 842 VHD, PX25, "TM,", and 845. The tubes are displayed on a stone slab with the slogan "KR tubes, built by hand, tough as granite, sound divine."

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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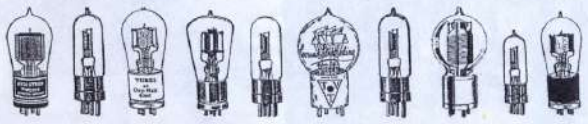
To Mr. Wojciech Pacula, editor of *High Fidelity* magazine, www.highfidelity.pl for permission to use printed matter of *High Fidelity*" in this article.



SYLVANIA "HOUSE-NUMBERED" CRTs - Part 1

Peter A. Keller

Material supplied to the author by Al Johnson, formerly of Sylvania's Seneca Falls, NY Industrial and Military Tube Department has been collated to show the wide variety of "house-numbered" custom CRT's developed during the 1950s and 1960s. See "Sylvania Special CRTs" by Al Johnson in the June 2007 *Tube Collector* for interesting insights of the Seneca Falls operation. Judging from Sylvania's letterheads and other published material, it would appear that the entire Seneca Falls plant was known as "Picture Tube Operations" of Sylvania Electric Products Inc., Electronic Tube Division. Within that was the Industrial and Military Tube Department, the developer of the tubes in this listing. The Seneca Falls plant began operation in October 1948. Sylvania became a part of General Telephone & Electronics Corporation on May 5, 1959. Printed data sheets for CRTs never acknowledged the ownership change, at least through 1972, although magazine advertising and brochures did.

Sylvania produced an extensive line of EIA-registered television picture tubes as well as industrial and military cathode-ray tubes. An infinite number of CRT variations of the registered types are possible and customers were always asking for something "just a little bit different" for their particular application. It is interesting to see the variations requested and the company requesting them when known. Examples are the SC-2770 for the Heath Company and the SC-2773 for Allied Radio's Knight kits. The CRTs ranged from minor changes in deflection sensitivity or basing of existing designs up to radically different CRTs such as for charge printing of mailing labels and sector-scan radar displays.

The listings are derived from both published data sheets and an in-house summary of basic descriptions. Some interpretation of Sylvania's sometimes cryptic abbreviations has been made in an attempt to clarify the information. Parentheses are used to show these inferences. Where dates are shown in parentheses, data sheet or drawing dates are shown. Technical data is available for those listings. The date shown is just for the documentation available. Development periods would have preceded these dates. The "Prototype" cited in brackets { } lists the CRT from which the custom design evolved. The Sylvania summaries are inconsistent in depicting them. In some cases, just the first two letters are used, such as "8F". This would imply the registered type "8FP4." In other instances, it may be shown as "8FP" or even the full designation of "8FP4." Generally, most registered phosphors could be supplied in any tube with the designation added as a suffix to the type number, for example, SC-3122P4.

Some abbreviations and the presumed translation used in the listings include:

alum. - aluminized
AR - anti-reflective?
EM - electromagnetic
ES - electrostatic
FF - flat face?
GPL - General Precision Labs (a former employer of the author in the '50s)
LHP - low heater power
Rug. - ruggedized
SF - self-focus?

This installment lists the known tubes up to SC-2999. Also listed are some ST- types. Presumably "SC" denoted "Sylvania Commercial" and "ST" denoted "Sylvania Television." There are many number gaps that are probably caused by project cancellations or no surviving data being available.

REFERENCES

Johnson, A., "Sylvania Special CRTs", *Tube Collector*, Vol. 9, No. 3, pp. 3-10.

Sylvania, CRT Data Sheets, various.

Sylvania, Technical Manual, 12th ed.

Sylvania, Custom CRT summary, unpublished.

Keller, P.A., The Cathode-Ray Tube: Technology, History, and Applications. Palisades Press, 1991.