TUBE COLLECTOR

TUBE COLLECTORS ASSOCIATION

"HISTORY • PRESERVATION • APPLICATION"

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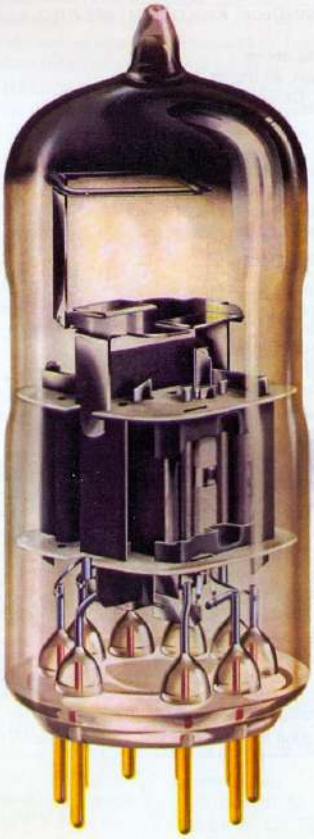

TUBE COLLECTOR

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.

Web Site: *www.tubecollectors.org*

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Group moderator: Ron Lawrence, W4RON, *w4ron@carolina.rr.com*

To join TCA: annual dues is $20.00 (in North America; $25.00 elsewhere. Payment by PayPal is welcomed, to *tca@jkasystems.com*.. If using a check or MO, please make it payable to "Tube Collectors Association" and mail to the address above. The membership year runs January-through-December. Those joining after February receive the year's back issues of TCA publications. Multi-year membership is invited, at: in North America, $37 for two years or $54 for three; elsewhere, $49 for two years or $73 for three.

Articles on tube topics are welcomed. Editorial correspondence should go to the editor at *tubelore@jeffnet.org* or **102 McDonough Rd., Gold Hill, OR 97525**.

Renewals. Inquiries, changes of address, and other membership business should go to Bob Deuel at *k2glo@jkasystems.com* or **PO Box 636, Ashland, OR 97520**.

FRONT COVER: "Cut-away view of a special-quality double triode with frame-grid construction (E88CC)," from a Philips promotion for premium "10,000-hour" tubes. The U. S. version is the 6922, a cousin of the 6DJ8 TV-tuner tube now highly respected as an audio type.

REAR COVER: A promotion for Lissen-brand valves in the U. K. *Ad: Philip Taylor*

MICROPHONICS FROM THE EDITOR

2012 TCA MEMBER MEETING

The 2012 Member Meeting will occur at the Old Sams Valley School outside Gold Hill, OR. This is the site that was used for the 2010, 2008, etc. meetings. The enclosed flyer has details and navigation information. See you there (*bring tubes*)!

MORE ON HALEDY

The "weird tube of the month" for June was the "Haledy TT-1." The writeup expressed frustration that vendor was unknown and unavailable via industry directories or the Web. Well, Jim Cross exhibited either higher search skills or better luck, and reports that the seller was the Haledy Electronics Co. of 57 William St. in New York City. This was a distributor of industrial equipment like stroboscopes and temperature controllers for heaters. The location, with nothing listed at it today, is at the tip of lower Manhattan, either within the old Radio Row district or a quick walk from it. A Google search on the full company name will return some information on the tube and its uses.

MORE ON L&K AND TAYLOR

The convoluted stories of Lewis & Kaufman and of Taylor Tubes Inc. appear in the Feb. 2009 and Oct. 2011 issues of *TC* respectively. Not detected at the time, there was a brief relationship between the two. Here's how *Radio-Television Service Dealer* for Jan. 1951 put it:

LEWIS & KAUFMAN ACQUIRES TAYLOR TUBES INC.

Jack Kaufman, president of Lewis & Kaufman, Inc., west coast electron tube manufacturing company, has announced that a group headed by him has purchased the entire capital stock of Taylor Tubes, Inc., pioneer Chicago manufacturer of transmitting, industrial and television tubes.

It's not clear how long this arrangement lasted. The 1954 *Radio's Master* catalog has separate pages for the products of the two companies. Possibly L&K, undergoing corporate churn itself, was incented to sell Taylor to Continental Electric about 1956.

IN THIS ISSUE

DIRECTORY SUPPLEMENT

We have some additions and a correction for the member directory in the June issue:

David Bliss
9230 Miners Crossing
Loomis, CA 95690
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Terry Buddingh
1689 Juniper St.
Livermore, CA 94551

James Cole
P.O. Box 70788
Riverside, CA 92513

gold-plated electrolytically, fired again at 1280°C. Lateral wire is 7.5-μ diameter tungsten, gold plated by drawing vertically through a bead of molten gold, to a thickness of 0.3 μ, finished size 2 μ - approx. .0003". Strip of 10-11 grids is wound on a small lathe. Lateral wire is held under 8-gram tension, supplied by lifting a weight. "Lead screw" is made by wrapping an 8 mm - 5/16" mandrel tightly with moly wire. Lateral wire is fed directly over "lead screw." Ends of each grid are dipped into paste of G28 hard-glass powder in water. Strip is fired at 780°C to melt glass. Remaining lateral tension must be 1.5-2 grams. Cut into grids. Peeling loose wire on legs (2-3 turns) is very tedious, about one per minute.

Mica hole alignment is controlled to 10 μ = 0.0004".

Plate is Alclad PN, turns very black. Source Wickeder.

Cathode temperature is about 700°C.

Shrinkage is claimed 10-15% (probably including recovery work).

Testing: max. Δgm - 6% for $\Delta E_f = 10\%$.

Particles are major problem.

Type 6360 (Twin pentode with common cathode, grid #2 & beam plate for 200-mc operation).

Cathode operates quite hot, to give high-frequency performance. They use "0" nickel, evidently a little more active than 220. They also use double carbonates. They speculated that triple carbonates might work on this type.

Half-grids are wound as four-posters, then slitted.

They like grid #1 supports of copper-clad nickel-iron, due to lower expansion, but had to give up on it temporarily due to slippage of cladding on core. They claim 10-15% shrinkage.

Personnel Information

Wage rates for girl operators are about $10.00 in Holland, $15.00 in England. They employ at least twice the supervisory help (inspectors, foreman etc.) as we do. They expressed the feeling that our operators move considerably faster than theirs.

/s/

M. Bareiss & D. Mitchell

5-16-56

WANT ADS

Ads are offered for TCA members' (and nonmembers') convenience, in parallel via the bulletin and the club's Web site. We expect ads to be related to tube collecting / history / use and noncommercial in nature. We may reject any not meeting this standard and may edit ads for space. Ads may be emailed to n6jv@n6jv.com or mailed physically to Ludwell Sibley at 102 McDonough Rd., Gold Hill, OR 97525-9626.

These insertions are in addition to those in the June issue.

FOR SALE

Books: THE CATHODE-RAY TUBE (Keller), a 314-page, hard-cover, comprehensive history of the CRT from 1991 with approx. 300 photos and drawings and extensive references to 100 years of CRT literature. Covers television, oscilloscope, radar, avionics, photorecording, and computer CRTs. WINNING WITH PEOPLE: THE FIRST 40 YEARS OF TEKTRONIX (Lee), 326-page hardcover, 1986. Prepaid price for either $69.50 ($62.50 to TCA members) + $6 S/H in the US. Peter A. Keller, 7445 SW Bayberry Dr., Aloha, OR 97007, kellerp4@frontier.com. *(Email corrected 8-12)*

Tubes and literature: I plan to have a good volume of tubes for sale at the October member meeting – interesting weird ones and commodity types. Also a good volume of electronics- and tube-related books. Ludwell Sibley.

HOMEMADE TUBES: NICK'S TRIODE

Abel Santoro, LU8DXI

Nicholas A. Masluk lives in New Haven, Connecticut. He is a physics graduate student at Yale. Now in the process of writing his thesis, he will be graduated in a few months.

He has had an interest in electronics as far as he can remember and for him vacuum electronics is particularly interesting especially with devices made of glass such that one can look inside.

He always thought it would be neat to be able to experiment with making vacuum electronics devices oneself.

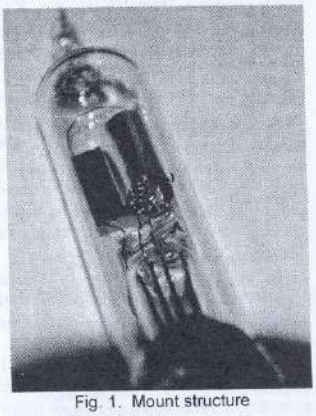

Fig. 1. Mount structure

At Yale he attended an introductory scientific glassblowing course, and since then has worked in glassblowing during breaks from school. He has all his glassblowing equipment in his home, not in his apartment at school, for only a few times at year he can play with this stuff.

Making triodes and other tube devices is a long-term goal for him and, he says, once graduated and moved to a permanent residence he will be able to spend more time practicing glassblowing and acquiring the necessary equipment and materials.

CONSTRUCTION OF THE TRIODE

For the triode envelope, lead glass, which has a high coefficient of thermal expansion, was used. The lead wires consist of a short section of 0.35 mm borated Dumet wire (roughly 5 mm long) butt-welded to 26 AWG (0.405 mm) nickel 205 wire on the vacuum end, and 22 AWG stranded copper wire toward the outside (the wire is tinned, so it looks silvery). To weld the wires a capacitor of 32,000 microfarads is charged to 20 volts, and shorted out with the ends of the two wires touching end to end to a glass capillary.

Once made, the ends of the four lead-in wires are twisted together, such that the Dumet sections are spaced evenly apart for sealing into the glass. The end of the lead-glass stem is heated at the end of a highly oxygenated flame until soft, then it is squashed between two graphite pads, sealing-in the Dumet wire sections, as well as a small portion of the non-Dumet wires for mechanical support. The glass-to-metal seals are then heated until the glass glows orange to ensure a good seal to the Dumet wires.

The cathode is a coiled tungsten filament, which is supported by the nickel portion of the feed-in wires. The grid is simply a spiral of nickel wire surrounding the filament. Both of these can be seen more clearly in Figure 1.

The plate is made from 0.001" aluminum foil, which is folded over one of the nickel lead-in wires for mechanical support and electrical contact.

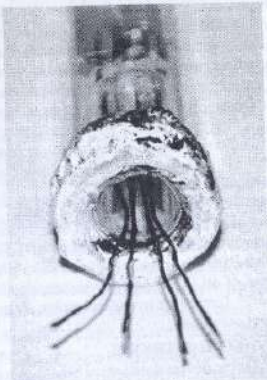

Fig. 2. Indium solder seal between stem and bulb

An indium alloy was used to seal the outer envelope to the stem (Figure 2). Before joining the two parts, the ends of each were coated thoroughly inside and out with the solder in order to improve the chance that a good seal is located somewhere all around the joint.

Once both parts have been pre-tinned they are joined, adding liberal amounts of solder, and ensuring there are no small openings.

Before evacuating the triode, a section of the 3-mm tubing is thickened such that the inner diameter is reduced (keeping the same outer diameter), which will later be heated by the vacuum seal. The reduced inner diameter and thicker buildup for glass allow for a stronger seal that does not get sucked-in by the vacuum.

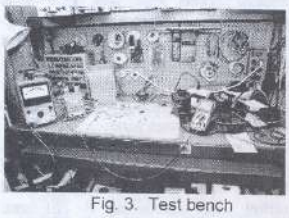

Fig. 3. Test bench

Ideally, to pump the triode down, a high-vacuum pump such as a turbo-molecular or diffusion pump would be used. To speed the pump-down, the device can be purged with argon, which is a heavy gas that is easy to pump, as it will push out contaminant as it is pumped away. To outgas components inside the tube, the outer envelope can be heated in an oven (not possible with this device due to the indium seal), the plate can be heated with an induction heater (not possible with the aluminum foil in this device, as it would melt), and the filament should be flashed to burn out contaminants. It is useful to have a getter in the tube to eat up any contaminant that remains after tip-off.

The vacuum in this triode is "soft," the pump used being a Welch Duo Seal 1400. It has an ultimate pressure rating of 10^{-4} Torr. Because the pump is brand new with a fresh charge of oil, it is hopefully getting down to the 10^{-4} Torr range in the tube after 30 minutes of pumping.

TESTING THE TRIODE

While the device does indeed behave as a triode, performance is far from impressive.

Fig. 4. Tube lighted-up for testing

Figure 3 shows the electrical-test bench in Nick's workshop. Figure 4 shows the tube under test. The filament was heated to 25 VAC at 390 mA. The plate current is very low and is detailed in the table below.

Anode Volts	Grid Volts	Anode current Nanoamperes
150	-20	3.2
150	0	4.2
200	-20	4.2
200	-10	5.4
200	0	6.5
200	+10	7.2
200	+20	7.9

Figure 5 shows the finished tube.

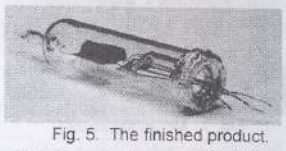

Fig. 5. The finished product.

EPILOG

Nick says: "In the end I would like to be able to build amplifiers, radios, etc., with homemade tubes as the ultimate sort of DIY electronic project. There are probably only a few people in the world who have made vacuum tubes themselves in an amateur environment, so it would be nice to be part of this group!"

ACKNOWLEDGEMENTS

To Mr. Nicholas A. Masluk for the photos that he sent me and for clearance to write this article. His web page is www.randombytes.net. *[The site has much more detail on the unique indium-solder sealing technique, on Masluk's construction of miniature light bulbs, on vacuum technique, etc. - Ed.*

WEIRD TUBE OF THE MONTH:

THE VA-217 REFLEX KLYSTRON AMPLIFIER

Danial Stocks

It is a well known bit of electronic theory that an oscillator is an amplifier with a frequency-determinant feedback loop and appropriate phase shift, but it is not so often considered that this definition also is applicable to many types of single-port microwave oscillator tubes, such as the reflex klystron. This is indeed the case, however, and it is possible to cause a reflex klystron to operate in an amplifying mode. True amplification is possible, as opposed to injection-locked oscillator function. The two cases are functionally similar when input drive is present, but the primary difference is that an injection-locked oscillator will continue to produce output power at its own natural resonant frequency in the absence of drive, as opposed to an amplifier, which will produce an output proportional to the input signal, and no output in the absence of a drive signal.

The Varian VA-217 reflex klystron is unique in that it is the only known reflex klystron to be specifically designed for use as an amplifier.

This device was introduced during the late 1950s or early 1960s. This was a time when the use of reflex klystrons for amplification was a topic of research and publication in the professional literature. Several references at the end of this article show some of the published research on the topic. An internal notice dated Oct. 25, 1962 registered the 'K' suffix type. All letter suffixes from B to K, other than I, had been assigned at this time. The differences between suffix types are minor, with the main noted difference in some cases being that the type was requested or commissioned by a different customer. The list of suffix types and some variation remarks are listed in Table 1. The overall design output power and operating voltages may vary between types, as it can be seen in separate catalog data that the VA210C was specified for a resonator voltage of 250 V and an output power of 30 mW, whereas the VA217H type was listed as running at 500 resonator volts and producing 500 mW output. The catalog data mentions that these types are intended for missile service and provides typical reflex-klystron operating data, hinting nothing of the amplifier mode. The internal registration document, however, lists these devices as 'reflex used as an amplifier' and specifies a minimum of 60 dB small-signal gain and 33 dB saturated gain in this service. The intended application is listed as Augmenter service, and so they may have primarily been used in a simple single-antenna transponder-type setup. No further information is given as to the intended mode of operation or setup.

TABLE 1. VA-217 SUFFIX DESIGNATIONS

Type	Freq., GHz	Notes
VA-217	8.5–9.6	Obsolete
VA-217A	-	Not assigned
VA-217B	8.5–9.6	Special leads
VA-217C	8.5–9.6	Product line
VA-217D	8.5–9.6	Lower beam voltage
VA-217E	8.5–9.6	Probe type tuner
VA-217F	8.5–9.6	Long tuner life
VA-217G	8.5–9.6	Autonetics
VA-217H	8.5–9.6	Frequency Engineering
VA-217J	8.47–9.57	Microwave Associates
VA-217K	8.5–9.6	Emerson

A look in the literature shows that the reflex-klystron amplifier would have offered a particular advantage for some applications. In a declassified military report on radar beacons, it was noted that a coherent transponder - one where the phase relation between the transponder signal and the incoming radar pulse is fixed - allows the velocity of the device fitted with the transponder to be directly determined from the Doppler shift of the transponder return signal.

The coherent transponder is essentially an RF amplifier, but problems occur if it must both transmit and receive through the same antenna. A typical approach that was used was to amplify the signal in successive stages, with only one of the stages