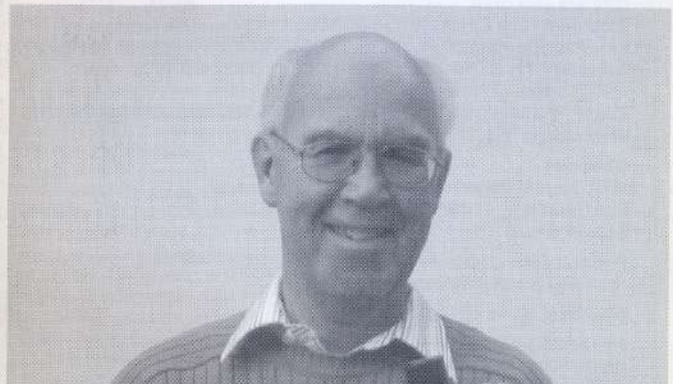
TUBE COLLECTOR

TUBE COLLECTORS ASSOCIATION
"HISTORY • PRESERVATION • APPLICATION"

Vol. 9 No. 1 February, 2007



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*

email Reflector: *tubecollectorsassociation@yahoogroups.com*
To subscribe: send a blank, untitled email to *tubecollectorsassociation-subscribe@yahoogroups.com*
To unsubscribe: send a blank, untitled email to *tubecollectorsassociation-unsubscribe@yahoogroups.com*
Group moderator: Ron Lawrence, KC4YOY, *kc4yoy@carolina.rr.com*

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 also offered, to *tca@jkasystems.com*. The membership year runs January-through-December. Those joining after February receive the year's back issues of *Tube Collector*. Multi-year memberships are offered: in North America, $39 for two years or $58 for three; elsewhere, $49 for two years or $73 for three.

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

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

FRONT COVER: Eduard Willi, Swiss tube-history author (see p. 2), depicted with a Signum G 2 H 34 rectifier.

REAR COVER: Want to sell tubes? How can your customer fail to buy a replacement when the red "bad" light comes on? This ad is from *Service* magazine, November 1937.

MICROPHONICS FROM THE EDITOR

TCA 2007 MEMBER MEETING

As announced at the 2006 annual meet, next year's event will be held to coordinate with the Michigan Antique Radio Club's *Extravaganza*, on the afternoon of Thursday, July 12. The venue will be the Holiday Inn South Convention Center in Lansing. This will afford TCA members an opportunity to enjoy the MARC flea market, which opens on Friday morning, and to register for the other activities. We expect to offer some "tube exposure" to MARC members as well. More details will follow.

Extravaganza is a well organized event that consistently gets "good press" in antique-radio publications.

We'll have ample time for participants to give talks on tubish topics. If interested in making a presentation, please contact your friendly editor.

IN THIS ISSUE

"This shiny white truck, lettered in green, keeps Sylvania Radio tubes in the public eye wherever it goes. It is used to carry special supplies, and will appear in various cities throughout the country . . ." (*Sylvania News*, Vol. 4 No. 10 (1934))

TYPE	P1	P2	P7	P11	P16	P19	P20	P31	P32
T321	154-293	154-226	154-294	154-295				154-347	154-385
T503	154-264	154-265	154-266	154-267	154-318	154-311		154-341	154-387
T519 (Early)				154-356					
T519 (Late)				154-308					
T581	154-228	154-224	154-229	154-230	154-335		154-297	154-354	154-395

Table 1. CRT Part Numbers

version of the 545A for the military. It appeared only in the 1961 and 1962 instrument catalogs. The T945P2 CRT was listed in the catalogs as standard but no other information using that designation has been unearthed so far. It was basically just a militarized T543P2. By 1968, the T945 was designated T5431. The CRT data sheet for the T5431 dated April 19, 1968 describes it as follows:

> "The Tektronix Type T5431 is an aluminized 5-inch flat-faced cathode-ray tube with electrostatic focus and deflection and a helical post-accelerator. The tube features faceplate shielding to prevent radio interference; provisions for use at high altitude, over wide temperature ranges, and in high-humidity and fungus environments; and a ruggedized structure to withstand vibration and shock. The T5431 is designed to meet the applicable portions of Mil-T945A environmental specifications. The T5431 was designed for use in the Tektronix Type 945 Oscilloscope."

No Tektronix part number has been found for the T945 per se. A 1972 parts reference table lists the T5431P2 as p/n 154-0501-00 and the T5431P11 as p/n 154-0501-01. Both were listed as stocked for Customer Service only since the 945 was a discontinued instrument by then.

COMING NEXT

The next article in this series will discuss more of the innovative CRTs introduced by Tektronix during the early 1960s. Also to be discussed will be other CRTs used to expand the product line to cover diverse customer requirements.

REFERENCES

Keller, Peter A., The Cathode-Ray Tube, Palisades Press, 1991.

Griffiths, Stan, Oscilloscopes, Selecting and Restoring a Classic, 1992.

Lee, Marshal M., Winning with People: The First 40 Years of Tektronix, Tektronix, 1986.

Tektronix instrument catalogs.

Tektronix internal publications of instrument / CRT/part number cross reference lists, 1962-1989.

Chuck DeVere, Cathode-Ray Tubes, Tektronix Circuit Concept series, 1967.

Tektronix, Cathode-Ray Tubes: Getting Down to Basics, 1985.

A NEW TECHNIQUE IN RECEIVING-VALVE DESIGN

Abel Santoro, LU8DXI

This article gives a brief description of early methods of valve fabrication with their problems, and describes a novel technique which greatly improved tube design.

The first mass-produced electronic valves used technology from the fabrication of electric lamps. All connections to the valve elements were pressed at the top of a small glass bell called the "pinch.' Figure 1 shows the similarity of design between an electric lamp and an early tube.

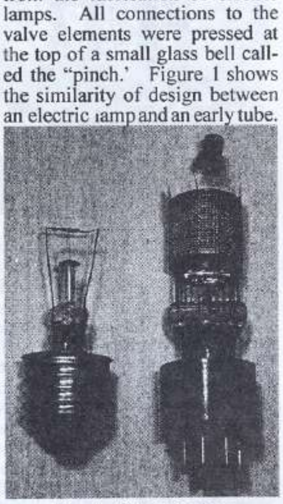


Fig. 1 - Stem pinches

The problems with this type of manufacture were the high electrical capacitance between the electrode leads, and the possibility of breakdown of the glass via electrolysis. This method of valve construction was successful at the beginning of the radio era, when the valves were triodes working at lower frequencies. But later on, with the birth of the pentode, with its large plate resistance and high transconductance, it became necessary to emphasize a low capacitance between the first grid and the plate, for good operation of the tube as an amplifier. For this reason most early RF pentodes were made with a cap at top of the glass bulb, for the first grid connection.

This made possible the design of good pentodes with low capacitance between control grid and plate, but still with high capacitance in the other leads that were pressed together in the stem, aggravated by the long lead wires between the internal electrodes and the contact pins in the bakelite base, restraining the performance of the valve at high frequencies. The solution to this problem would be a new and different design of the valve.

THE NEW TECHNIQUE

In 1938 a new construction of valves was developed by Philips to supersede valves with pinch construction. This new design replaced the bakelite base with a flat pressed-glass base through which contact pins passed, disposed in a circle and separated enough to maintain a low pin-to-pin capacitance. In this arrangement the internal electrodes of the valve are attached directly to the pins. The "pinchless" method allowed design of valves much smaller than those of pinch construction.

First were designed two valve types in different sizes, one with nine pins and the other with eight, respectively termed "C-Technique" and "B-Technique" valves. In the late '40s was made a third valve type in the same general style but much smaller, with eight pins. Valves of this type were termed "A-

Technique." The three designs were made as following:

C-Technique valves are the largest; the size is 62 mm x 38 mm excluding the nine pins.

Low-power B-Technique types have a size of 65 mm x 32 mm, while the rectifier and output valves are 80 mm x 32 mm, all with eight pins.

A-Technique valves are the smallest, all with eight contact pins. These valves have three sizes as follows: the amplifying valves, 52 mm x 23 mm; the output valves, 70 mm x 23 mm; and the rectifiers, 61 mm x 23 mm. Figure 2 shows three valves of different styles: from left to right A-, B- and C-Technique. The A- and B-Technique were applied in television and VHF receiving. The A-Technique was applied also to special valves.

Fig. 2 - A-, B-, and C-Technique

In the new valves, the base is a circular glass ʻablet pressed all together with the contact pins of chromium-ʻteel, which has the same coefficient of expansion as the glass, disposed in circumference, passing through the glass. Figure 3A shows a valve base of the C- and B- Technique type, distinguished only by the number and size of pins. Figure 3B illustrates the base of an A-Technique valve. Note the absence of the exhaust tube in the base. A valve (without internal electrodes), with pressed glass base and without pinch, made according to B-Technique is illustrated in Figure 4. In the B- and C-Technique, the exhaust tube is located in the center of the base, and when the electrode assembly has been mounted on the base and connected to the respective contacts pins, the bulb is sealed onto the upturned rim of the base forming the fused joint shown as (10) in Figure 4. The valve is finished in the normal way, and after pumping, and the sealing of the exhaust tube by fusion, a guard plate with central guide pin, (8) in Figure 4, is fixed to the glass base by applying a metal ring (4) around the base and spinning it over the rim of the guard plate. The detail of Figure 4 is as following: (1) supports for the electrode assembly; (2) glass bulb; (3) pressed-glass base; (4) metal retaining ring; (5) guard plate fitted beneath the glass base; (6) contact pin; (7) circular bosses in the pressed-glass base which increase the leakage path between the contact pins and the guard plate; (8) guide pin with cam; (9) sealed-off pumping tube; and (10) fused joint between bulb and the pressed-glass base.

Fig. 3A - C-Technique base

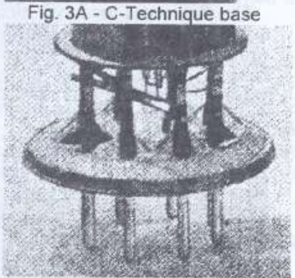


Fig. 3B - A-Technique base

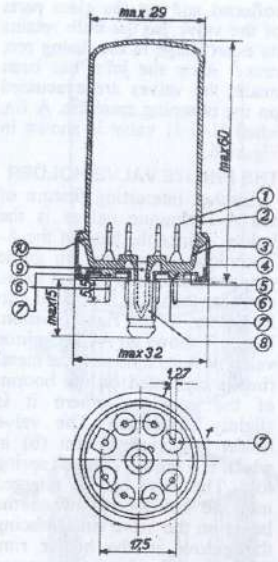


Fig. 4 - B-Technique style

The A-Technique possessed a considerable advantage over the others, not only by small dimensions, but for a great technical advance which lies in the airtight joint between bulb and base. The difficulty of fusing the glass base to the glass bulb was solved making the base with shape of a basin and keeping the contact pins separate from the wall of glass, to prevent excessive heating of the pins. In this construction technique the length between the internal electrodes and the external pins was shortened, but not as much as would be desirable. Moreover, with this design, it was not possible to reduce the external valve diameter below 32 mm, but in any event this design was a success. In the B- and C-Techniques, the high temperature of the joint (800 to 900°C) to fuse the glass properly, is tolerated for the pins and internal electrodes because of the dimensions of the valves, but in the A-Technique with its small dimensions, this high temperature would yield a great risk of oxidizing the internal parts and poisoning the cathode. The research laboratories of Philips in the Netherlands developed a new method for joining glass, using a special glass compound, which permitted very good glass-to-glass joints, at the low temperature of 450°C instead 900°C. In this technique the bulb and the base are joined together by glazing with sintered glass, of a softening point much lower than that of the glass of the bulb and the base, as shown in Figure 5.

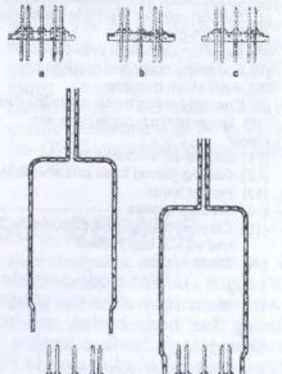
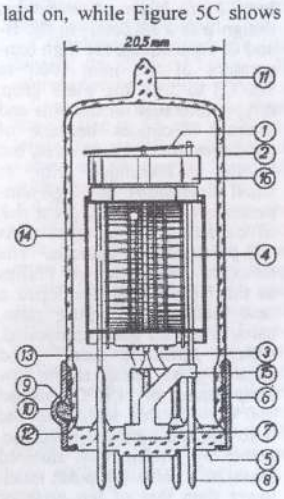


Fig. 5 - A-Technique bulb seal

Figure 5A shows the base plate without the glazing ring, in Figure 5B the glazing ring is just laid on, while Figure 5C shows laid on, while Figure 5C shows



(1) Getter plate
(2) Wall of bulb
(3) Connections from electrodes to pins
(4) Support rods for electrode assembly
(5) Pressed-glass base
(6) Metal rim cemented onto the bulb
(7) Screening cup in the glass base
(8) Pins, 1 mm diameter
(9) Cement holding metal rim to the bulb
(10) Bulge on rim to guide base into holder
(11) Sealed-off exhaust tube
(12) Glazing joining base and envelope
(13) Heater leads
(14) Screening cage
(15) Connection between cathode pin and screen cap in base
(16) Diode system

Fig. 6 - UAF41 diode-pentode

the same base after the glazing ring has been heated and set. Owing to its surface tension, it assumes a conical shape. In Figure 5D the glass bulb is approaching at the base and in Figure 5E the base and the bulb are joined together. Note that in the A-Technique the pumping tube is located at top end of the bulb, not in the base.

In this method of fusing only the glazing compound has to be softened and not the glass parts of the valve, so the bulb retains its exact shape in the fusing process. After the joint has been made, the valves are evacuated on the pumping machine. A finished UAF41 valve is shown in Figure 6.

THE PHILITE VALVE-HOLDER

Another interesting feature of the A-Technique valves is the holder. Since the base of the A-Technique valves has no guide pin, another means is used to ensure that the valve is pressed into its holder in the right position. Figure 7 shows an A- Technique valve with its holder. The metal ring is cemented on the bottom of the envelope where it is slightly recessed. The valve holder has a metal rim (b) in which is a groove (c) with spring (d). The valve can be plugged into the holder only when the bulge on the valve rim is facing the groove in the holder rim. When the valve has been pressed down into the holder, it is held in place by the spring (d). In view of this locking arrangement the A-Technique valves are termed "Rimlock" valves. Figure 8 shows a cross- section of the valve holder with the valve in it. The description of the figure is the following: (a) screen cup in the glass base; (b) strip connecting the screen cup with the cathode pin; (c) metal screening tube in the Philite holder; (d) contact springs. Philite is a synthetic resin which is mixed in powder form with sawdust or other filler material after which it is pressed to the desired shape in steel moulds under high temperature. The diameter of 23 mm chosen for A-Technique valves allowallowed a peak voltage of 8000 to be applied between diametrically opposite pins without disruption or electrolysis of the glass.

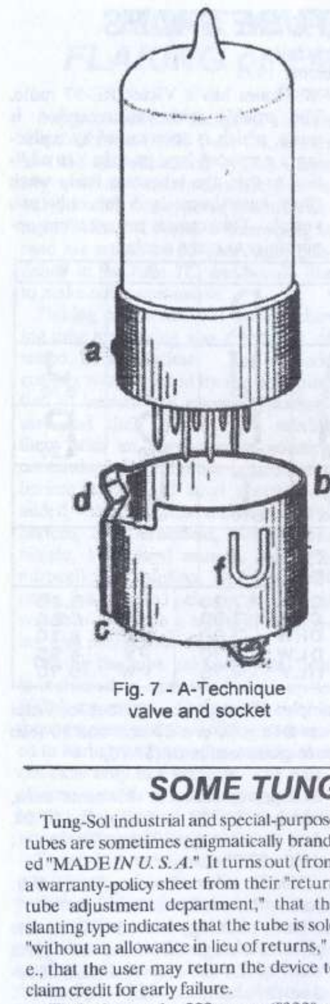


Fig. 7 - A-Technique valve and socket

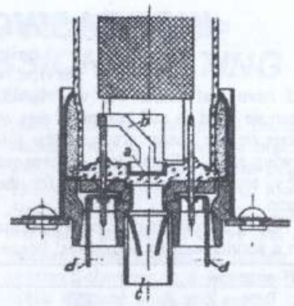


Fig. 8 - Valve in socket

This new technique of construction of glass valves without pinch, developed by the Philips research laboratories in 1938, has several advantages over the standard fabrication methods of the time.

ACKNOWLEDGEMENT

To Mrs. Marianka Louwers of Philips Company Archives, and Mr. Peter Coolen, of CIS Library Philips Research Europe, Eindhoven, The Netherlands, for permission to use the book Fundamentals of Radio Valve Technique (copyright 1949), published by the Technical and Scientific Department of N.V. Philips Gloeilampenfabrieken, Eindhoven.

SOME TUNG-SOL DETAILS

Tung-Sol industrial and special-purpose tubes are sometimes enigmatically branded "MADE *IN U. S. A.*" It turns out (from a warranty-policy sheet from their "return tube adjustment department," that the slanting type indicates that the tube is sold "without an allowance in lieu of returns," i. e., that the user may return the device to claim credit for early failure.

Their date code, 322yywwn ("322" to indicate Tung-Sol, "yy" and "ww" to give year and week, "n" to indicate the manufacturing location), was a *date-of-shipment* designator. If the tube was found to be initially defective (a "line reject"), it could be sent back up to six months later. Otherwise it became a "field return" and could be send back up to a year later.

Tubes with a straight-up "IN" in "MADE IN U. S. A." qualified for return only if initially defective. Private-branded tubes could receive an adjustment only if they were line rejects.

Unfortunately, the sheet doesn't report what digits indicated what factory locations. - Ed.