HERE'S WORLD'S LARGEST ONE TUBE SET

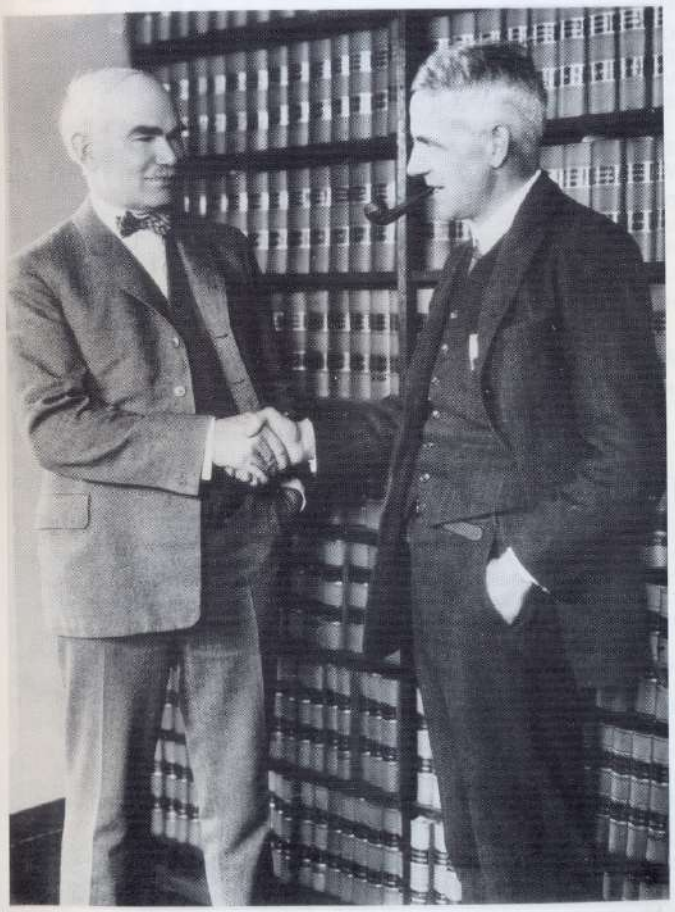
There have been many freak receivers constructed by amateurs and manufacturers, but this one tube set probably outdoes all others for size. Photo shows Miss Agnes Leonard at Radio Show, Grand Central Palace, New York City, operating the receiver. Note the size of the batteries and the tube. (Photo by International Newsreel.)

TUBE COLLECTOR

TUBE COLLECTORS ASSOCIATION

"HISTORY • PRESERVATION • APPLICATION"

Vol. 10 No. 5 October, 2008



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 *Tube Collector*. 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.

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**.

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: Lee De Forest jollies-up with Roy Weagant, namesake of a family of external-controlled tubes of ca. 1919. The picture was taken in the offices of Sheffield and Betts, patent attorneys in New York. The original caption was "When Grid and Gridless Meet." *Photo: Jerry Vanicek*
REAR COVER: A bit of promotional fluff from the New York Radio Show, ca. 1924.

MICROPHONICS FROM THE EDITOR

"CONSTRUCTION OF A VACUUM TUBE"

Back in February we reported availability on YouTube of a French-made video on home construction and testing of simple tubes. Well, apparently there's a Gallic tradition along this line. We're pleased to present a translation by Abel Santoro of a 1923 book chapter on this subject beginning on page 2.

TCA 2008 MEMBER MEETING

This year's event is scheduled for Saturday, Oct. 4, at the Old Sams Valley School outside Gold Hill, OR, the same site as the 2006 meeting and 2007 tube conference. See the yellow flyer distributed with August's magazine for more details, or contact the editor.

BOOK REVIEW

RADIO RESCUE

By Lynne Barasch, ISBN 0-374-36166-5.
Reviewed by **Jim Cross**

This is a children's book recounting the true story of the author's father, a young New York ham in the early to mid-1920s. It shows his fascination with the hobby and his two-year work to become licensed. He became an experienced operator, and was able to relay a message during a 1926 hurricane, which lead to the rescue of a family in Key Largo, Florida. The book has full-page cartoons illustrating the story, and the inside front and back covers include a timeline of the discoveries and inventions which led to radio, and even a chart giving the Morse Code alphabet.

While this book was apparently reviewed a few years ago in *QST*, I was completely unfamiliar with it until a relative (knowing my interest in radio) loaned me a copy. While not about tubes exactly, it mentions a UV-845 transmitting tube by name. I recommend this as a nice story for children and grandchildren to give them a flavor of what fascinates us about radio and tubes. When I read it to my kids, at least my five-year-old son got excited, as he made the connection between the tubes I have and the tubes and radio in the story.

The book is available for a reasonable price on Amazon.com. The ARRL used to carry it, but they are currently out of stock.

LAWRENCE GETS A "HOUCK"

We're pleased to report that Ron Lawrence, W4RON, has received this year's AWA Houck Award for Preservation, based on his comprehensive "Radio Heaven" collection. Congratulations all around!

ERRATA

In Joe Knight's compendium on very early RCA transistors in the August issue, the "TA-E-1579, first drift transistor" item should read "TA-E-1574." The second death announcement in the June issue should have read "Minoru Muraoka."

IN THIS ISSUE

CONSTRUCTION OF A VACUUM TUBE

Franck Duroquier; translated by **Abel Santoro,** LU8DXI

An excerpt from La T. S. F. Des Amateurs (Wireless Telegraphy for Amateurs), Masson et Cie., Editeurs, 120, Boulevard Saint-Germain, Paris (VI°), France, 1923

While three-element lamps (vacuum triodes or audions) are very useful, they soon suffer burn-out of the filament, while new tubes are very expensive. Renewing burn-out tubes at small expense is a very good recourse for the amateur. We will initiate the amateur into the secrets of construction of the "Lampe Merveilleuse" or "The Wonderful Vacuum Tube."

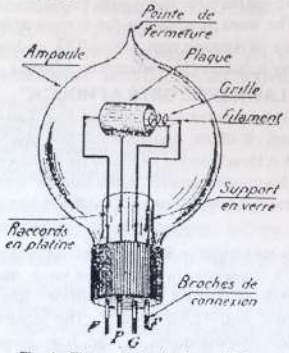

Fig. 1. Three-electrode French tube.

The construction of a vacuum tube is a very delicate process which demands a great deal of application. Unsuccessful attempts will not sadden the amateur because perseverance will lead to future victory.

When we spoke of vacuum tubes previously, we thought in terms of a spherical shape (Fig. 1), but in this case we will use a glass pipe for the construction of our vacuum tube, which is more convenient for securing the heating of the internal electrodes for degassing, in the vacuum process.

The small audions made with this recipe are of the same quality as audions sold in the radio shops. With the plate supported directly on the internal wall of the glass envelope, these tubes are able to work as transmitting tubes, because for best degassing produced by intense electronic bombardment facilitates this process by the plate being in direct contact with the internal glass envelope, which increase the heat dissipation.

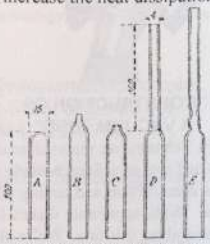

Fig. 2A-D. Construction of the glass envelope

CONSTRUCTION OF THE GLASS ENVELOPE

To make the glass envelope, it is necessary to use a glass tube of 15 mm in diameter, and 10 cm long, of the style of a laboratory test tube which will be the glass envelope of the new audion, (Fig. 2A). The bottom of the tube is heated by a Bunsen burner. When the bottom is soft, air is blown into the open side, to make in the bottom center, a conic protuberance with a small hole of 2 mm in diameter, made by the air flow (Fig. 2B). Following this, the small hole is heated in the burner to regularize its shape, forming a small roundlet (Fig. 2C).

Before the cooling of the bottom of the tube, and keeping it over the burner, a glass pipe of 4 mm in diameter and 10 cm long is welded just onto the small hole of the tube (Fig. 2D). Finally, the glass pipe is heated again in the zone near the weld with the tube (Fig. 2E), making a little constriction which will facilitate the process of sealing-off the audion, after evacuating it.

The amateur may, for the same price of a test tube and a piece of glass pipe, send the complete glass envelope of the audion for blowing by a glassblower.

MOUNTING THE ELECTRODES

In a piece of wood of 15 to 20 cm long, are placed two nails 4 cm long, 10 cm apart (Fig. 3).

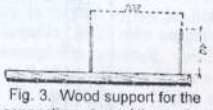

Fig. 3. Wood support for the connecting wires of the audion.

Between those two nails are taken four copper wires 50/10 mm in diameter, separated 2 mm mutually, which are put through a glass bead 7 mm in diameter, 10 mm long (Fig. 4). With the glass bead centered on the wires (Fig. 5), it is heated with the burner until the bead is at the softening point, then it is flattened on the wires (Fig. 6). Later the wires are bent and cut in the upper side according to Fig. 7. Wire No. 1 is the plate support, wires Nos. 2 and No. 3 are flattened on their upper side to support the filament, and wire No. 4 is the grid support.

Fig. 4. Glass bead.

The filament to use, is [a section of] the tungsten filament of a new lighting lamp of 110 volts, 25 candles. This filament is supported by bending the upper sides of the wires Nos. 2 and 3, onto the filament and flattening (Fig. 8).

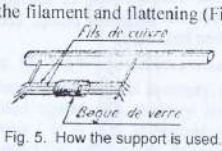

Fig. 5. How the support is used.

The grid is made by rolling on a pencil of 6 mm in diameter, 16 cm of copper wire of 3/10 mm in diameter, in a spiral 18 mm long, ending in a small loop (Fig. 9), which is intended to support the grid by wire No.4, which maintains the grid vertically (Fig. 10).

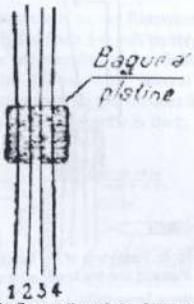

Fig. 6. Connecting wires of the audion

Now the tungsten filament is fixed at the upper side of support wire No.2 (Fig. 11), being careful to put the filament on the axis of the grid. For this purpose a small Brucelas nipper is used.

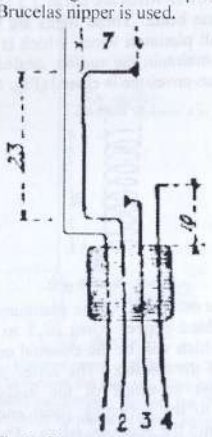

Fig. 7. Shape and arrangement of the connecting wires.

The plate is made with an aluminum sheet 18 mm x 40 mm which is bent on a mandrel of 13 mm diameter (Fig. 12). When the aluminum cylinder is formed, one vertical side of the sheet is bent to 4 mm bordering on wire support No. 1 (Fig. 13).

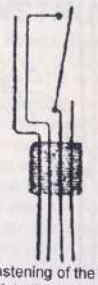

Fig. 8. Fastening of the tungsten filament into the lower support.

It is very important to check the concentricity of the electrodes before introducing the electrode array into the glass envelope, because the plate must touch the inside wall of the envelope.

The lower wires are cut at 2.5 cm from the glass bead. These wires are welded to small platinum wires, which is essential to maintain the audion sealed when the glass envelope is closed (Fig. 14).

Fig. 9. Audion grid.

At the other ends of the platinum wires are welded copper wires of 3 to 4 cm long, which will be the external connections of the audion. The lower side of the glass envelope of the audion, is heated to the softening point and flattened onto the platinum wires. The platinum adheres to the glass, making the audion air-tight. Now the audion is ready for the vacuum process.

When we have burnt-out commercial audions, it is possible to use the glass support of the electrodes and the connecting wires to make a new audion. The only work to do consists in straightening the grid and the plate and to replace the burn-out filament with a new tungsten filament of 0.05 mm in diameter. This glass array is welded to a new glass envelope of about 2 cm in diameter.

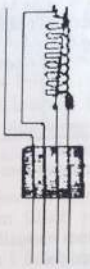

Fig. 10. Fastening of the grid into its support.

The vacuum inside the audion is made by a pump (Fig. 15). This model is a pump from H. Mignet, which in normal work gives a good vacuum. The amateur may make himself a pump inspired in the drawing and dimensions which appears in the book La T. S. F. Moderne. The Mignet pump is for sale in the house of the glassblower, M. Blachard, 49 Lhomound St., Paris. Here the amateur can to buy glass envelopes ready for him to make audions himself.

At the front of the pump is the suction tube which connects with the vacuum pipe of the audion, which is put inside a metallic cylinder 3 cm in diameter and 12 cm long. This cylinder has asbestos in its internal wall. In the side of the cylinder is the exit for the connecting wires of the audion, in the other side leaves the vacuum pipe of the audion, which connect with the pump, keeping the audion held well.

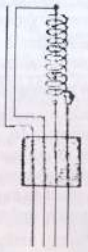

Fig. 11. Fastening of the filament to the upper support.

Now, 40 to 50 cubic centimeters of mercury is poured into the funnel of the pump, observing that the mercury level is above the admission orifice. Then the mercury is ejected by the jet hole (gicleur), impelled by its own weight and for the atmospheric pressure, striking the inner wall of the pump. With a strong sound the mercury goes falling into the glass reservoir at the end of the pump.

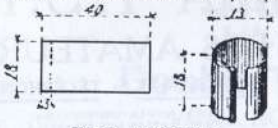

Fig. 11. Audion plate

The mercury drops act as metallic pistons which sweep small volumes of air into the pump, producing the vacuum. With time, as the vacuum grows, the drops of mercury fall most roughly, vibrating into the pump. The mercury projecting out of the pump accumulates in the glass reservoir placed below.

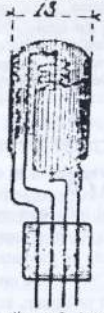

Fig. 12. The three electrodes mounted

Before that the funnel is empty, it must be filled again with mercury from the reservoir. It is very important to keep the funnel full of mercury, because if air enters the pump, the vacuum process must be repeated.

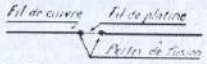

Fig. 13. Copper-platinum-copper welding.

A small Geissler tube mounted in the other inlet of the pump which is connected to the audion, gives an idea of the degree of vacuum inside the audion. The two electrodes of the Geissler tube are connected to a Ruhmkorff coil, which is fed from a 4-volt battery.

When air remains in the Geisler tube, the tube glows with several colors, which disappear as the vacuum increases When the Geissler tube is dark, the vacuum is perfect.

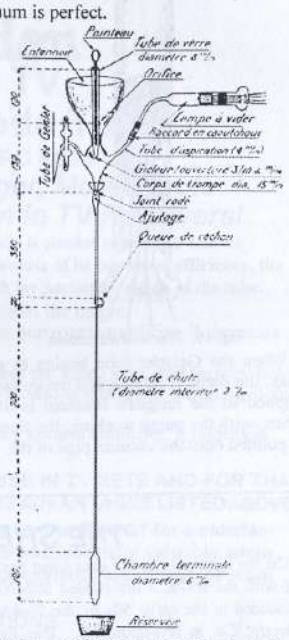

Fig. 14. Mercury pump of H. Mignet. At top, a funnel to receive the mercury. Top right, the tube being exhausted. Top left, the Geissler tube (vertical) for pressure measurement. At bottom, the reservoir for the exiting mercury. The pump is about five feet high.

The audion may be used as a vacuum indicator, connecting the plate and the grid of it, to a Ruhmkorff coil.

Now the pump is put to work, and when the grade of vacuum is high, the pump begins to make a strong sound. At this moment the metallic cylinder placed around the audion must be heated with a flame to degass the audion inside.

The heating process may be made, too, with a electric resistance instead of the flame. The audion must be heated to red-

white and the tungsten filament connected to a battery of 2 volts instead of 4 volts. This is intended for degassing the glass envelope of the audion and its internal parts.

Fig. 15. The finished audion.

When the Geissler tube begins to go dark, the flame is retired, and the voltage applied to the tungsten filament is off. Then, with the pump working, the flame is pointed onto the vacuum pipe of the audion, making its tip-off. The vacuum process has a duration of some 30 to 40 minutes. When the audion is cool, it is ready for to use (Fig. 16).

FRANCK DUROQUIER

LA T.S.F.
DES AMATEURS
TÉLÉGRAPHIE - TÉLÉPHONIE

MANUEL POUR LA CONSTRUCTION ET L'UTILISATION DES APPAREILS RÉCEPTEURS DE TÉLÉGRAPHIE SANS FIL PAR ONDES AMORTIES ET PAR ONDES ENTRETENUES ET DES APPAREILS DE TÉLÉPHONIE SANS FIL
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120, BOULEVARD SAINT-GERMAIN, PARIS (VI^e^)
1923

Frontispiece of the book. "Manual for construction and use of receiving apparatus for wireless telegraphy by damped waves and continuous waves and of wireless telephone apparatus."

THE SHELDON 6S78

On the next page is the data sheet packed with the 6S78, a hot-rodded 6SN7GT produced in the early '50s by the Sheldon Electric Co. in Irvington, NJ. This firm was better known as a maker of "Telegenic" B&W picture tubes of 10" to 24" size, and electrical parts like extension cords and cube taps. They also obtained registration, in 1952, of the 5R4G rectifier, apparently a bakelite-based version of the earlier micanol-based 5R4GY.

At the time, a typical TV set contained three hard-worked 6SN7GTs, so there was a huge replacement market. Sheldon's tube is beefed-up: plate dissipation went from 2.5 watts per side to 3.5, transconductance rose from 2600 micromhos to 3500, and typical plate current jumped from 9 mA to 12.

This uprated tube was probably a good idea in an engineering sense. However, the claims made on the data sheet are a bit enthusiastic. No. 3, the one about reducing "snow," is just plain, er, Bad Science. Eric Barbour mentioned this confection in his article on 6SN7s (*Vacuum Tube Valley*, Issue 11) and expressed some skepticism over the performance claims.

With the heater current raised from 600 mA to 800, there should've probably been a warning against using this tube in series-string sets. Most such receivers used 12SN7s, but there's always an exception.

The sheet says this is part of a *line* of "HI-PO" tubes. Its companions have not been seen, nor has advertising for this line turned up. - Ed.