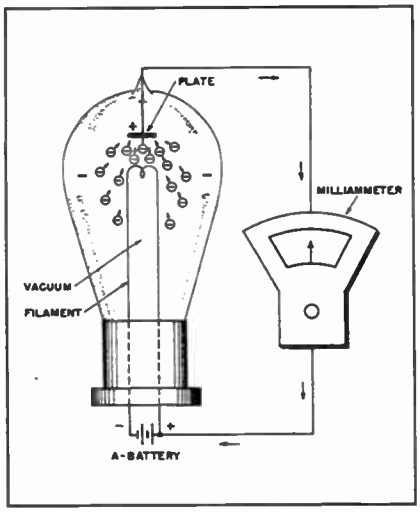
The Radio Collector®

November-December, 1995

The Receiving Tube Story
Part 7 - The Earliest Vacuum Tubes



"Edison Effect" test circuit. Milliammeter indicates current flow through bulb when connected to positive filament lead.

With the conclusion of Part 6 last month, I announced that this series on receiving tubes had come to an end. Yet I had pointedly ignored the early origins of the vacuum tube at the beginning of the series and now feel that was probably a mistake. Maybe I've been influenced by the excellent Rybak and Kryzhanovsky series on early wireless communication now running in RC. Or maybe it just doesn't feel right to start a brand-new topic in this last issue of Volume 2. Anyway, before we finally say goodbye to the series, here's a bit of a fill-in on the beginnings of vacuum tube development.

The Edison Effect

Historians generally agree that the vacuum tube era dawned when Thomas Edison went to work on some annoying phenomena he had encountered during his early development of the electric lamp in the 1880's. The primitive carbon filaments of his lamps were burning out too soon. At the same time, the interiors of the glass bulbs darkened rapidly with use--becoming coated with a deposit of carbon from the filament.

Seeing that the filaments were being weakened by the carbon "evaporating" from them onto the glass, Edison sealed a metal plate into a bulb, between the filament and the glass, to see if he could intercept and study the flow of carbon.

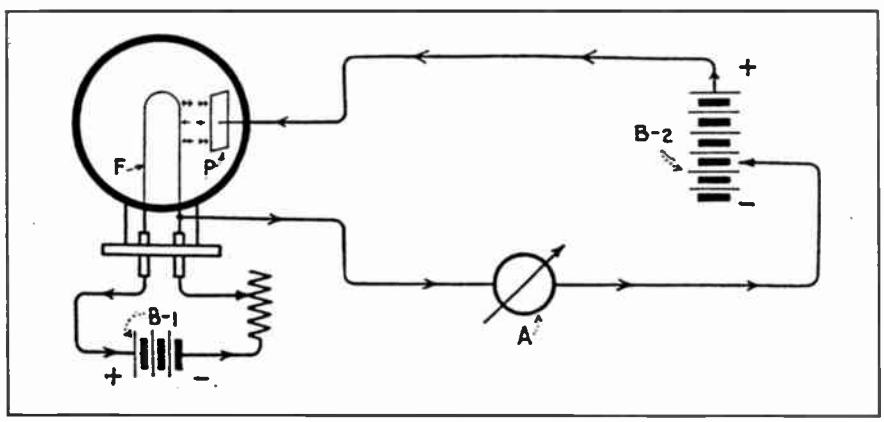
During his experiments with such experimental bulbs, Edison tried connecting a milliammeter between the positive side of the power source feeding the filament and the metal plate inside. He got a reading on the meter, which meant that an electric current was somehow flowing between the filament and the plate through the vacuum separating them. When the meter was switched to the negative filament connection, no current flowed.

Edison never got around to investigating the meaning of the odd phenomenon he had discovered, but in 1899 the eminent British Scientist J.J. Thompson theorized that the current was, in fact, the flow of infinitesimal negative "particles of electricity" which he termed *electrons*.

Emitted by the heated filament of the bulb, the negative particles were attracted to the plate when it was connected to the positive side of the filament through the meter. Hence an electron current flowed from the filament to the plate, through the meter and into the positive filament connection. When connected to the negative side of the filament, the plate became negatively charged, which meant that it repulsed the electrons emitted by the filament and no current could flow.

The Fleming Valve

But it remained for John Ambrose Fleming, working for British Marconi, to put the Edison effect to practical use. After duplicating Edison's original experiment he connected a source of alternating current between the filament and plate of the test lamp. Current then flowed through the bulb only during the portion of the a.c. cycle when the plate was positive with respect to the filament. When the cycle reversed, and the plate was negative with respect to the filament, no current flowed. This, of course, is the principle of rectification; the alternating current was changed to a pulsating direct current.



Fleming Valve demonstration circuit. When a.c. source is connected in place of battery b-2, rectification will take place--converting a.c. to pulsating d.c.

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It was already well understood that the crude mineral radio detectors of the era operated by rectifying the received signal. Fleming found (1904) that his device would work in place of a mineral detector, receiving signals more reliably at some sacrifice in sensitivity. He had, in effect developed the first radio *diode* (two-element tube). It was known as the *Fleming valve* because of its ability to control the direction of the current flowing through it.

The Audion

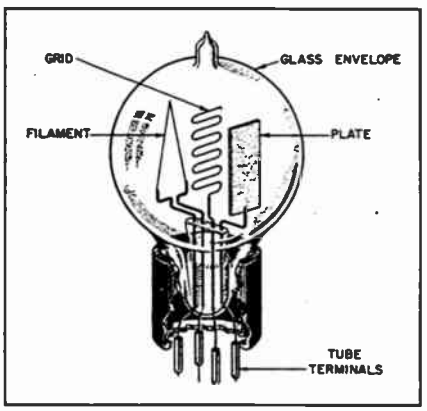
The epoch-making innovation in vacuum-tube technology was patented by Lee DeForest in 1906-7. Physically, it was nothing more than a few turns of fine wire surrounding the filament and positioned between the filament and the plate. This new element was dubbed the *grid*, and Deforest had created the first three-element tube, or *triode*.

With nothing connected to the grid, the new tube behaved like a Fleming valve: making the plate positive caused a current of electrons to flow from filament to plate. However, connecting a small positive voltage to the grid would attract and accelerate the electron stream flowing to the plate. As a result the plate current would increase. Conversely, making the grid negative would have the opposite result. But the significant thing was this: very tiny variations in the voltages on the grid would cause similar, but much larger, variations in plate current.

The implication of this is that, properly connected, Deforest's triode (or *Audion* as he called it) would act not only as a detector of radio signals but as a very sensitive amplifier. It could accept the minute radio frequency voltages present at the antenna and strengthen them to the point where they would provide comfortable volume in the headphones.

The fact that the tube could amplify, as it was very soon discovered, also made it very adaptable for use as an *oscillator*, or generator of a radio signal. Though we've been concentrating on the receiving tube applications, it's important to say that this was a major breakthrough.

Radio signals could now be generated in a more controlled manner and tuned more easily; the equipment to generate them could be relatively lightweight and easily constructed; no longer would radio signals have to be generated by ferocious arcs or heavy rotating machinery. Further, the way was paved for the development of effective and reliable methods for the transmission of voice and music.



Simplified drawing of De Forest's three-element "audion." Original had no base.

Though the Audion was a watershed development in the evolution of radio and--from the beginning--DeForest gave many flashy demonstrations of his invention in that application, the first practical, large-scale use of the device was in telephony. DeForest had sold telephonic rights to AT&T, whose engineers quickly improved the Audion, notably by evacuating the bulb to a higher vacuum. DeForest's brainchild was then quickly put to work as a voice amplifier on long-distance phone lines, including the first US transcontinental line (1915).

Large-scale commercial development of the vacuum tube for other applications was hindered for some time because of divided ownership of the patents. Marconi held the patents on the basic two-element tube (Fleming having been a Marconi employee), but DeForest held the patent on the grid. The stalemate was broken during World War I, when vacuum tube development was considered critical and the U.S. Navy offered to indemnify tube manufacturers against patent infringement.

This brings us back full circle to the point made in Part 1 of this series. RCA's tube types '200 and '201 (released in 1920), which were the first radio receiving tubes produced for the mass market, were products of the technological advances made in tube design during World War I. They were produced under a key cross-licensing agreement that enabled the major patent holders to pool expertise.--**MFE**

FROM THE EDITOR

Well gentle readers, I find myself in the position of having to apologize once again for a late issue. And I'm well aware of the fact that this issue is not only late, it's *outrageously* late. The reason: between the last issue of RC and this one, I became the editor of the *Old-Timer's Bulletin* (familiarly known at the "OTB") of the Antique Wireless Association.

For those who may not be familiar with it, this is a quarterly publication with a large-percentage of hard-core and highly experienced hobbyists--many of whom have also made significant professional contributions to the electronics art. I was very pleased to be approached for this job, and am looking forward to learning from many of the very knowledgeable contributors to the OTB.

Ken Owens, who writes RC's *Play it Again* column, has joined me on the OTB--where he is taking over a restoration column I had been conducting. But The Radio Collector goes on as usual. Though

(continued on p. 12)

PLAY IT AGAIN!

A No-Nonsense Course in Radio History, Evolution and Repair

AC SETS: THE SPEAKER AND AUDIO STAGE

Troubleshooting the Speaker Field

Like the battery sets that preceded them, the earliest AC sets used a separate high-impedance magnetic speaker or horn. Majestic pioneered the later practice of employing low-impedance electrodynamic (sometimes called simply "dynamic") speakers for better sound quality. Such speakers have a field coil which replaces one of the power supply chokes. The B+ current through the coil generates the speaker's magnetic field. Much later, PM (permanent magnet) speakers--which do not have a field coil--replaced the dynamics.

If your set uses such a speaker, its field coil must be connected to the power supply before you can make the tests described last month. Check the coil with your ohmmeter; it may be open or shorted to the frame. If so, you have several options: replace the speaker with a modern PM and add a separate choke; rewind the coil yourself; have it done. Coil winding is beyond the scope of this series, however, I will correspond with anyone who wants to attempt it.

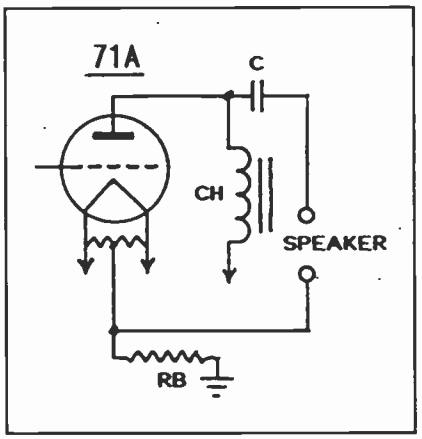
Because the electrodynamic speaker is normally mounted away from the chassis, a short between the field coil and the speaker frame will place the full B+ voltage on the frame--creating a serious hazard. Be sure to check for this condition. If there is no apparent short, test further by connecting a wire from the speaker frame to the chassis. (After you apply power to the set as described below.) If the field winding breaks down at this point, it will blow the fuse I will tell you about later instead of endangering you.

The Audio Output Stage

In battery sets, plate voltage for the output tube was usually fed through the horn or magnetic speaker. Makers didn't feel that 90 volts or so on the cord and speaker would be hazardous. But the higher plate voltages of AC sets were a different matter. RCA used an output transformer to isolate the plate voltage from the speaker. (Voltage was fed to the plate of the tube through the primary of the transformer; the audio signal flowed to the speaker through the secondary.)

Atwater Kent used the arrangement shown in the diagram. Note that the 71A plate voltage is fed through choke CH, which blocks the audio signal--preventing it from being shunted away through the power supply. Instead, the audio goes to the speaker through paper capacitor C, which blocks the plate voltage from the speaker and its cord.

Note that the speaker returns to the midpoint of the 71A filament. It could have returned to ground, but this arrangement protects the set. If capacitor C shorts, B+ will flow through the choke and speaker, but RB limits the current to avoid damage to either.



Atwater Kent output stage uses capacitor, choke to isolate speaker from plate supply.

If C shorts, the resulting presence of B+ (plate voltage) on the 71A filament will prevent the set from playing. Check this capacitor. If it shows any leakage at all, replace it with a 0.47μF "Mylar" unit. The AK capacitor is potted into a flat metal box and can be melted out. You will have to use a 400V capacitor to replace it; because a 600V one won't fit in the box.

Powering Up

With the rectifier tube plugged in and using the lamp test rig described in the July-August issue, connect the power supply to the set (if it was disconnected) and turn the set on. From here on, use the same procedure you learned for battery radios. Measure the voltage at each tube socket to make sure that B+ and filament voltages are present. B+ will be higher than with the tubes inserted. Turn off the set and insert the tubes. Be careful! If you mistakenly put a type 26 into the 71A socket, its filament will receive 5 volts instead of 1.5--and burn out--when you turn on the set.

Connect the test speaker you built earlier and turn the set back on. When it has warmed up, the lamp will glow at about 1/3 brightness. Measure voltages. The 71A should have 140-180 volts on the plate and the RF amplifiers 125-150V. The 27 detector should have 20-40V on its plate. You can remove the lamp test rig now and plug the set directly into the power line.

Missing voltages indicate faulty AF transformers or RF coils. Locate and repair such faults before proceeding. If the set is still dead, measure the bias voltage from the center tap of the filament resistors to ground. The voltage for the 26 tubes should be about +13V and the 71A about +30V. The 27 will be 0 since this center tap is grounded.

If there is B+ on the plates, but no bias voltage at the center taps, both halves of one or more of the center-tapped filament resistors are open. This condition can also result from open bias resistors although you should have checked them earlier. If you have a defective filament resistor you can replace it with a pair of 33Ω 1W carbon resistors wired in series.

Remove and discard the bad resistor. If only half the resistor is open, the set will play, the voltages will be correct, but there will be a loud hum. Replace the entire unit. Any remaining problems can be located with the troubleshooting procedures described earlier.

Once the set is operating properly, record all voltage readings. In case of future trouble, the record of the proper voltages for that particular set will simplify troubleshooting.

Finally, find a place under the chassis where you can mount a fuse holder. Cut one lead to the transformer primary and route it through the fuse holder. Install a 1.5A fuse. Sets with more than 8 tubes may need a 2A fuse. You will be adding a non-original component to the set, but one that will protects irreplaceable transformers. If the fuse blows, repeat the check out procedures described in this installment to find out why.

Next time, we'll start to examine superheterodyne receivers.

Conducted by Ken Owens
478 Sycamore Dr.
Circleville, OH 43113

Ken will be happy to correspond directly with readers who have questions about radio theory or repair. Please include a long SASE with your query.

THE EARLY DEVELOPMENT OF WIRELESS COMMUNICATION

Part II: The Work of Alexander Popov and Guglielmo Marconi

By James P. Rybak and Leonid N. Kryzhanovsky

The work of Heinrich Hertz and Oliver Lodge discussed in Part 1 of this article laid the foundation for the wireless telegraphy accomplishments of many who followed. Two of the most noteworthy of those wireless telegraphy pioneers are Alexander Popov and Guglielmo Marconi. It is Marconi who generally is given credit for being the "inventor" of the first practical wireless telegraphy system. For years, however, historians in the former Soviet Union maintained that Popov did work prior to that of Marconi which justifies calling him (Popov) the true "inventor" of wireless communications.

Alexander Popov's Coherer

Highly respected as an outstanding lecturer and experimentalist in virtually all aspects of electricity, Alexander Popov (1859-1906) taught at the Russian Navy's Torpedo School at Kronstadt. After having repeated Hertz's and Lodge's experiments, Popov demonstrated on May 7, 1895 his "instrument for the detection and recording of electrical oscillations."

The sensitivity of the filings coherer Popov used in this instrument had been improved substantially by him in early 1895 after considerable experimentation. Popov's detection instrument featured an automatic coherer tapping-back mechanism. The detection of a pulse caused both an electric signal bell to ring and the coherer tube to be tapped, making the coherer ready for the detection of the next pulse of electromagnetic waves. This automatic tapping back mechanism responded to both long and short electric wave pulses (corresponding to both Morse Code "dots" and "dashes.")

Since Popov used neither ground connections nor a transmitting antenna nor resonance, he could not successfully employ his equipment for long distance signalling, although his signals did span distances of 60 to 70 meters. Nevertheless, Popov's receiving instrument, when connected to a vertical wire or to a lightning rod which functioned as an aerial, was successfully used as a recorder of lightning discharges receiving what one now could call "Marconigrams" (telegrams) from the sky from distances as great as 30 kilometers.

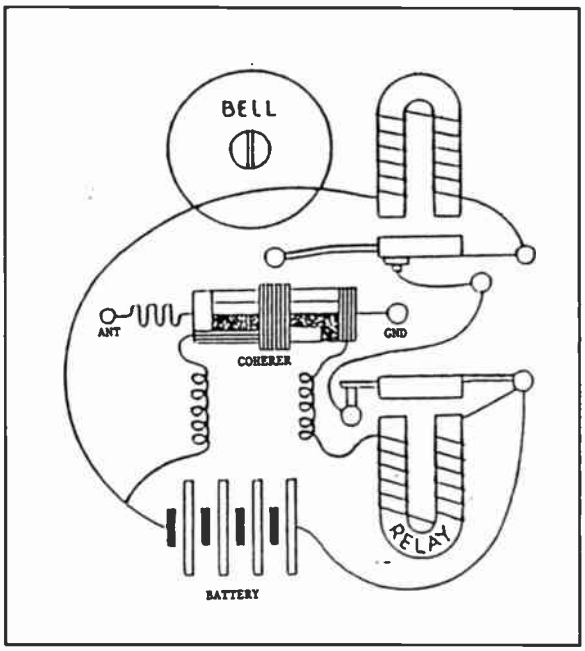
Communicating Without Wires

It should be emphasized that communicating without wires was Popov's goal from the start. The May 12, 1895 issue of the newspaper *Kronstadsky Vestnik* (*The Kronstadt Herald*), in reporting on Popov's work, stated that "All these (Popov's) experiments are motivated by the theoretical feasibility of signaling over distances without wires."

The concept that a filings coherer could be used to detect thunderstorms did not originate with Popov, however. The fact that a substantial decrease in the resistance of a filings tube occurs during a thunderstorm had been recognized since the 1850s and the use of a coherer for investigating the waves arising from a thunderstorm had been suggested in 1894.

In the January-March 1896 issue of the *Journal of the Russian Physico-Chemical Society*, a highly respected Russian scientific quarterly, a detailed description of Popov's receiving instrument appeared. Popov concluded his paper by writing: "With further improvements in my apparatus, it can be applied to signalling at a distance using fast electrical oscillations as soon as a source of such vibrations is found possessing sufficient power." Clearly, Popov believed that increased transmitter power, rather than improved receiver sensitivity or more efficient antennas, was the key to long distance wireless communications.

Like Lodge, Popov believed that electromagnetic waves propagate only in straight lines as does light. Scientists did not abandon this belief until Marconi had repeatedly demonstrated that transmission far beyond the horizon was possible.



Popov's coherer had an automatic tapping-back mechanism that also rang a signal bell.

Similarly, like Lodge and in contrast to Marconi, Popov could not focus his efforts exclusively on wireless. His teaching duties, regular summer work at the power station supplying electricity to the Nizhni Novgorod Annual Fair, and broad scientific interests (e.g., in 1896 Popov was one of the first to repeat William Roentgen's x-ray experiments) did not allow Popov to focus his efforts on the development of a wireless telegraphy system.

Regrettably, in his efforts to increase the communication range of his equipment, Popov increased the power of his transmitter but did not attempt to increase the effectiveness of his transmitting and receiving aerials. He grounded his receiver but did not take the important companion step of grounding his transmitter. Had he done so, Popov would have greatly increased the range over which he could signal. Popov similarly never tried to increase the sensitivity of his receiver through the use any form of resonance.

Marconi's Work

It is reported that Guglielmo Marconi (1874-1937) first read about electromagnetic waves in an 1894 eulogy to Hertz written by the Italian physicist Augusto Righi (1850-1920). Marconi immediately began working in two large rooms on the top floor of his family's house on their estate in Italy to determine if these waves could be used to communicate at a distance.

In the spring of 1895, Marconi took his wireless experiments outdoors and soon discovered that an intervening hill was no barrier to the reception of electromagnetic waves. Being intent on developing wireless telegraphy, Marconi used a Morse telegraph key to produce the signals generated by his transmitter. By using grounded vertical aerials of proper dimensions for both transmitting and receiving (these provided a very simple form of tuning or resonance), he increased the distance at which his signals could be received reliably to about 2 kilometers by the autumn of 1895.

In February of 1896, Marconi brought his wireless equipment to England. Guglielmo hoped that his mother's English relatives could provide introductions to people in important positions to help him get support for the further development of his equipment.

On June 2 of that year, Marconi filed a preliminary patent application for his wireless telegraphy system.

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INFORMATION EXCHANGE

This is an open forum for interaction among our readers. Here you can ask questions about some aspect of our hobby, answer a question that's been posed or pass along other information of general interest. Send your questions, answers and information to **The Radio Collector**, P.O. Box 1306, Evanston, IL 60204-1306. Submissions may be edited or paraphrased.

QUESTIONS TO BE ANSWERED

Decal Dilemma

I'm restoring a 1947 Emerson 535 "All-American 5" that was the first radio that I ever tinkered with when the electronics bug bit me in the seventh grade. This model was my Grandma's set that I grew up with. I need to restore the case and the Emerson decal and was wondering if there is a source for the correct sized "treble-clef" decal.

The decal sheet sold by AES, Vintage TV & Radio Supply and a couple of other supply houses seem to be from the same manufacturer, I discovered. The largest size on the sheet, 15/16"H x 3/4"W, is still smaller than the size on the set which is 1-1/4"H x 15/16"W.

Also, the original decal has both the treble-clef and the text outlined in black and the reproduction decals only have the treble-clef outlined and not the text. (Bad oversight on the decal company's part, I think). Does some other company or supply house carry the correctly sized and outlined Treble-clef decal? Will I have to have a custom sheet made?--Chuck Schwark, Chicago, IL

Atwater Kent 55
A Comment and a Question

Just received my first issue of The Radio collector and I like it. I wanted to share an experience and ask a question.

Ken Owens talked about replacing filter capacitors in the October/November issue. The standard advice is to replace them, period. Well, I bought an Atwater Kent 55 (late version) in an antique store. It had a thick layer of dust, but otherwise looked pretty good. I plunked down big bucks for it.

After cleaning it and replacing the line cord, I carefully poked around looking for potential trouble spots but found nothing wrong. The chassis looked 100% original, never serviced. It has those filter capacitors in a can filled with tar (as Ken described).

I really didn't want to melt that stuff if I didn't have to. So I decided to take a chance, plug it in on reduced voltage, and observe it for a while. It still looked good. I applied full voltage and the thing sprang to life. That radio plays like new, with 65-year-old parts. I was happy I took a slow and conservative approach to this radio.

Here's my question. This radio has push-pull 45's in the audio output. This tube does not have a cathode, but it's being powered by a.c. I thought the reason cathodes were developed was to permit operation on a.c. I don't understand how this works (though it obviously does).--Victor Commisso, Potomac, MD.

Though your set may work fine right now, Victor, those ancient filter capacitors are not to be trusted. One of them could go at any time, taking your rectifier tube and very-difficult-to-replace power transformer right along with it. If you are planning to use the set a lot, I'd recommend that you at least wire in a a fuse for protection. Ken Owens gives full details on how to do this in the current "Play it Again" (p.3).

As to your question about the type 45's, the power amplifier stage does not readily pick up hum from a filament operating on a.c. Normally, the "heat inertia" (resistance to heating and cooling) of the filament, alone, is enough to smooth out the alternating current so that it does not cause appreciable hum in the speaker.

The type 71-A, which was used as the final audio amplifier in most of the first mass-produced a.c. sets, has no cathode either. In fact, it was designed as a battery tube (companion to the 01-A).--Ed.

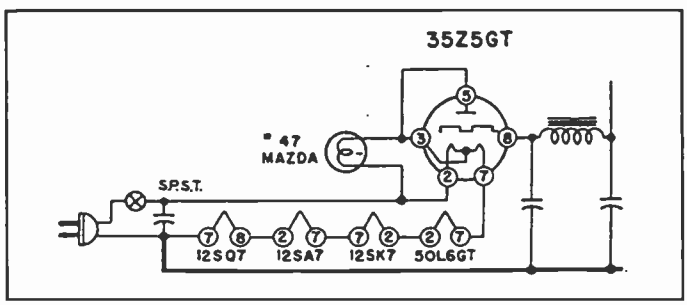
GENERAL

Bubble Pack Dial Window

Searching for a way to replace the clear plastic over the dial of one of my old radios, I hit upon the idea of using the plastic from one of the bubble packs that everything seems to be packaged in these days. Checking various store displays, I finally found a low-priced item in a bubble of the correct dimensions. It's not quite as sturdy as the original, but it does do the job! -- James C. McColl, Florence, SC

More 35Z5 Lore

After seeing the comments in the last issue on the 35Z5 rectifier tube, I can see that some additional discussion would be in order. The design of the dial bulb circuitry associated with the 35Z5's tapped filament is often misunderstood. It is a little more complex than might appear at first glance.



Typical 35Z5 pilot/filament circuit (See "More 35Z5 Lore").

The 35Z5 rectifier was designed with a tapped filament so that a 0.15 ampere lamp (#40 or #47) could be connected across one of the sections. (See the accompanying schematic). With *only* the rated filament string current flowing (150 ma), the drop across the tapped section would be 7.5 volts--dropping to about 2.5 volts with the dial lamp connected.

This does not light the bulb very bright. So to increase the brilliance, most manufacturers connected the plate of the 35Z5 (pin 5) to the filament tap (pin 3) so that all of the HV current would also pass through the dial bulb section.

So, when the set is first turned on, the dial lamp will show a flash of light, then dim down. This is due to the cold filaments having a low resistance, and therefore a high current surge. That first flash, after many turn-ons, is what weakens the bulb and eventually burns it out.

As the tubes warm up, the current decreases to its rated value and the bulb dims. While this is taking place, plate current begins to flow, which then helps to brighten the bulb. With strong signals being received, the plate current will fluctuate and the dial bulb will flicker slightly.

Under normal conditions, the total current flowing through the paralleled filament section and dial lamp will be about 200 ma. (150 ma. of filament current and 50 ma. of plate current). This current divides between the lamp and the filament section, but if the bulb burns out, the entire 200 ma will flow through that tapped filament section, greatly overloading it.

If, during this burned-out-bulb period, the set is turned of and turned on again before it has cooled down, the charging current of the rectifier capacitors will also flow through that tapped filament section, adding to the overload. All of which accounts for the warnings to replace the dial bulb in these sets as soon as possible after burn-out, and before installing a new 35Z5.

These problems can be minimized by connecting a 300-ohm, 1-watt resistor across pins 2 and 3. This will hold down the initial turn-on surge and, if the bulb burns out, will protect the filament section during overloads.

In the days during World War II when 35Z5's were impossible to find, those with just the pilot light section burned out could still be put to good use by shorting out pins 2 and 3 (the easy way, but with no dial light)--or by

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INFORMATION EXCHANGE

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adding a 25 to 30-ohm, 1-watt resistor across pins 2 and 3 to provide a voltage drop for a replacement dial light.--Anthony Jacobi, Ralston, NE.

Restoring a Tough One

I was given a console radio that a friend had been storing in his basement for 12 years. It's an Aircastle Model 961-1061 made by Speigel, Inc. Unfortunately, the Rider's writeup does not show dates, but I'm assuming pre World War II because of the separate audio input provided for TV sound. The set was unusually filthy and covered with dust. There was congealed oil on the push button mechanism and all controls. The speaker was missing, too.

The cabinet was in good, repairable condition--just a few scratches and some loose veneer. But the speaker would be a problem. It had been a dynamic type with
a push-pull output transformer attached to it.

To prepare the chassis for cleaning, I removed the push button assembly, variable capacitor and i.f. cans, wrapping the exposed i.f. coils in paper to protect them. All tube sockets were then covered with discs of duct tape. The chassis still didn't look too good after all possible corrosion and junk was removed. So I chrome-sprayed it, after carefully masking all holes (especially the ones for the alignment caps).

Luckily, I have an ultrasonic cleaner that was large enough to take the entire mechanical push button lever system together with the variable capacitor. They came out nice and clean. The only repair this assembly required was the refurbishing of a spring-loaded rubber drive wheel--part of the manual tuning mechanism.

After reassembling the chassis, I was ready to do some testing. I couldn't fire it up because of the missing speaker, but I did make ohmmeter checks for bad caps and resistors. Determined to carry on further, I contacted F. Krantz about a speaker. *(Frank is an R.C. subscriber who deals in vintage components and other antique radio items. His address: 100 Osage Ave., Somerdale, NJ 08083-1136--Ed).* The good news was that Frank was able to supply a 12" electrodynamic speaker complete with push-pull output transformer and 5-lead connecting cable. The bad news was that the cone was shot. But the output transformer, field coil and voice coil were good, so I ordered it. When the speaker arrived, I was delighted to see that the voice coil spider was removable, being held in place by two screws.Bless the designer! Now to get a new cone made.

I knew that some cones were made of thin, stiff paper and some were made of thick fiber. For my new cone, I decided to use a sheet of blotter paper of the type made for desk pads. I'd never tried this before, but here's the method that finally worked for me.

First I carefully centered the voice coil in its gap using strips of photographic film. Then, I cut 10 wedge-shaped pieces of template paper and laid them, one at a time, between the voice coil and the rim of the speaker frame. Each new wedge overlapped the previous one slightly, and the wedges were laid in a circular pattern to form a cone positioned similarly to the original voice coil in the speaker frame.

Now, with a pencil, I carefully drew lines along each of the overlapping edges. Cutting off these edges, I took the 10 "pi's" and placed them, side by side with their edges in contact, over a sheet of my blotting paper cone material. They formed a semicircular shape of roughly the correct dimensions to make my cone. All I had to do was bring the two straight edges of the semicircular piece into contact and tape them together.

I tried the resulting cone in the speaker frame but it was too big. Then I tried trimming it down, but it became out of shape. After making several cones, I finally got one the right size. I laid this into the frame and carefully glued its center opening to the voice coil. The glue was a product called "Pic," which is found in hobby model shops. It's an all-purpose glue that dries flexible, yet firm.

The outer rim of the cone was trimmed to make room for the rim flex material, which was a ring of ordinary felt cloth. The original cardboard mounting ring was preserved and reused. The completed speaker was not quite the same as the original, but does operate acceptably.--Alton A. Dubois, Jr., Queensbury, NY.

Converter Conservation

When a set falls into my hands that's too far gone to consider restoration, I will often wreck it down for parts. In such cases, I try to keep all of the parts of the converter stage together (oscillator coil, gang capacitor, tube socket with rivets drilled out, and possibly the loop antenna) with as much of the wiring intact as possible. I also mark, on one of the parts, the number of the tube that had been used. It helps to have a set of parts designed to work together when repairing a set that has a problem in its front end.--Ray Larson, W. Los Angeles, CA.

DVM--The Universal Meter

Some people contemplating the purchase of a DVM (digital voltmeter) feel that they should probably also keep an analogue meter around for use in alignment procedures. The reason is that the rapidly changing numbers of a DVM readout are hard to interpret while tweaking circuits to obtain peak output. But the problem goes away, allowing you to simplify your test bench inventory, if you purchase a DVM with an auxiliary bar graph. The one on my fluke works fine, though it's not so sensitive to small variations.

Remember, when using a DVM or VTVM to check set voltages against values listed in service literature, that your readings will be consistently higher. The "normal" readings found in most manuals were established with a 1000 ohms per volt meter--which loaded the circuit down much more heavily than the very high impedance modern instrument. -- Stan Lopes, Concord, CA

Loctal Lore

In an Editor's note last issue (*Correspondence From Our Readers*) Marc Ellis wondered if anyone else had encountered the difficulties he has experienced in removing Loctal tubes from their sockets.

Loctals do have a tendency to pin corrosion, making them difficult to remove. If a Loctal is tight in its socket, insert a wide bladed screwdriver between the chassis and the tube base and twist while rocking the tube back and forth. Be patient and gentle; I have broken a couple of sockets while trying to dislodge these tubes and it's no fun replacing them!

After testing the removed tube it's a good idea to spray the pins with contact cleaner or WD40 just prior to inserting them. Then remove and reseat the tube a couple of times to ensure good contact cleaning. Sometimes treating the tubes in this way is all that's needed to bring a dead set back to life.--Stan Lopes, Concord, CA

Poor Substitutes

I was concerned about a couple of tube substitutions suggested in last issue's *Information Exchange*. There are very few instances where a tube may be directly substituted for another in sets made before 1935. The fact that a tube has the same filament voltage and will fit the socket of the correct tube does not mean you can plug it in.

Substituting a 2A3 for a 45 is a case in point. In push-pull, fixed bias (the common circuit for both), a pair of 45s draws 3A filament current and 28mA plate current with no signal. Under the same conditions, 2A3s draw 5A filament current and 70-80mA plate current. This reckless exchange will put a severe overload on the power supply and all its components. The radio will play with 2A3s, but for how long?

Using an adapter to replace a 47 with a 3A4 may be a recipe for disaster. The commonly used circuit puts 250-275V on the plate and screen of the 47. The 3A4 is rated for 150V plate and 90V screen. Exceeding the tube ratings by this much invites catastrophic breakdown of the tube with possible damage to the output transformer.

There are some direct substitutions that can be made through the use of socket adapters. You can substitute a 6F6 for a 42, a 6K6 for a 41, a 5Y3 or 5Y4 for an 80 and a 5U4 for a 5Z3. These tubes are identical except for the bases.--Ken Owens, Circleville, OH.

I guess I'm responsible for bringing up the 2A3/45 substitution. I took it right from the pages of H.A. Middleton's "Master Receiving-Picture Tube Substitution Guide Book" (Rider Publications) without giving it much thought. There, it is listed as a substitution that will give good results. As I said then, I think this is a silly substitution for reasons other than the good ones Ken gives.: 2A3's are a lot less common than 45's.--Ed.

Transformer Transplant

I acquired a Philco console model 41-315X that had been stored in an open shed for an unknown number of years. On checking it over, I found it was definitely going to need a lot of attention. The chassis needed cleaning; the electrolytics were all bad; the output transformer was open on the primary;, and there had been some crude repair attempts that would have to be reversed.

Worst of all, the output transformer was a special one that had a tap on the secondary to provide negative feedback. Searching for a replacement to no avail, I decided to take the transformer apart to see if it could be repaired. I found that the primary was heavily damaged and was not repairable. But I was able to take advantage of the fact that the secondary winding was the outside one.

I bought a similar transformer (but without the tap) that was made for a pair of 6V6's (close enough, in my book to the 42's in my set). Carefully removing the secondary of the bad transformer, I wound it on the replacement transformer in place of that transformer's secondary. Space is limited, so tight winding is necessary when one attempts something like this. Hint: to separate the iron core leaves in order to get the transformer core out, soften the varnish with acetone in a ventilated area. Be careful, though, acetone is toxic and very flammable.--Alton A. Dubois, Jr., Queensbury, NY.

CORRESPONDENCE FROM OUR READERS

letters may be paraphrased, shortened, or otherwise edited so that everyone gets a chance at the floor!

Lodge Was No Airhead

The last issue of *RC* was a good one. I like the new series of articles on early history. However, it gives the impression that Lodge had his head in the clouds all the time. Although slow to move, Lodge was not totally oblivious to the business aspects of radio. He formed a wireless company (admittedly after Marconi led the way) and sued Marconi for violating his tuning patents. He won his suit both in England and the U.S.--Ken Owens, Circleville, OH

Museum Roundup

Historical Electronics Museum at BWI Airport

Should you be passing through the Baltimore/Washington area, a visit to the Historical Electronics Museum at BWI airport would be well worth your time. This little-known but extremely fascinating establishment is dedicated to the preservation of electronic equipment and literature of historical value. The 50-odd exhibits are on a par with those fund in major museums such as the Smithsonian.

The hardware on display includes radio, television and telegraph equipment of historical value. Among the notable displays of military hardware is the SCR-270 Radar System that detected the Japanese planes approaching Pearl Harbor on the morning of December 7, 1941.

But besides hardware, the museum has an extensive videotape, book and film library. The tapes chronicle such events as the fatal Apollo 13 space flight and the film collection includes a substantial number of military technical training and electronic warfare titles. The print library contains three to four thousand technical publications that go back to the beginning of electrical engineering theory. These library materials are available for loan.

Further information on the museum can be obtained by writing to the Historical Electronics Museum, PO Box 746, Mail Stop 4015, Baltimore, MD 21203. Phone (410) 765-3803.--From an article by Assistant Professor David A. Baldyga in the Ward College of Technology (University of Hartford) *Happenings*, Fall 1995. Courtesy Dick Mackiewicz

U.S. Army Signal Corps Museum

The U.S. Army Signal Corps dates its origin from just prior to the Civil War, when Dr. (later Major) Albert J. Meyer perfected a system of "wig-wag" flags for communicating at a distance.

Fort Gordon, Georgia, is now the "home base" of the Signal Corps and houses the most comprehensive historical collection of its kind in the U.S. In addition to exhibits telling the full story of U.S. Military communications, there is a significant representation of foreign items. There are radios a-plenty, vintage and modern!

The museum has available a number of monographs and other publications. For specific information contact The U.S. Army Signal Corps Museum, Fort gordon, GA 30905-5293.

A trip to the museum is highly recommended for the special perspective on radio history it can provide. It is located on post at Fort Gordon, just west of Augusta, GA. Visitors are welcome (no admission charge) Tuesday to Friday, 8:00 a.m. to 4:00 p.m. and on Saturdays to 5:00 p.m. The museum is closed on all legal holidays. -- Julian N. Jablin, Skokie, IL

The Motorola Museum of Electronics

Should any reader of *The Radio Collector* be visiting the Chicago area, I'd highly recommend a side trip to The Motorola Museum of Electronics. Housed in a spacious building on the Motorola campus in Schaumburg, IL, the facility is set up to give the visitor an in-depth view of the progress of electronics as seen from the perspective of an important contributor to the art.

Motorola began making radios in 1928 and produced the first practical automobile radio two years later. These early radio developments will be of the most interest to collectors, of course, and there is much to see in the exhibits. The transition to more sophisticated electronics moves along easily as one goes through the museum and the exhibits are equally interesting.

The museum is open Monday through Friday , 9:00 a.m. to 4:30 p.m. and is closed on holidays plus two weeks in January. From April to November, the Museum is open one Sunday each month. Phone for schedule. There is no admission fee. The Motorola Center is located in Schaumburg at 1297 East Algonquin Rd., Schaumburg, IL 60196. Phone 7708-576-6559. -- Julian N. Jablin, Skokie, IL

We'd like to tell readers of The Radio Collector about other regional radio museums. If you know of one, send us a brief write-up -- or just send in the name, address and phone number -- and we'll do the rest.

Radio Memories

I have been wanting to tell you for some time how much I enjoy *The Radio Collector*. It is the first item I read when the mail arrives. I am not involved in restoring radios, but the magazine always brings back memories of the days I started listening to radio.

It began in the late twenties when I was in the eighth grade. My first radio was the then common catwhisker and galena crystal. We lived in the country and I had a long antenna high outside between the house and the barn. From that time until I went to college, I went to bed nearly every night with the earphones on my head and the radio tuned to WBBM. What a pleasure it was!

The September-October issue brought back another highlight with the Crosley story. My first "real" radio was the Crosley Trirdyn. It served me faithfully for several years. For some reason I still remember the logo on the ID plate: "Crosley Super Trirdyn Regular." Needless to say, it brought in WBBM much better than the crystal, but I could not take it to bed with me.

Keep "The Radio Collector" coming!--Don F. Lehman, Columbus, OH.

Mini Quiz Answer

The American Nobel-Prize winning physical chemist you are looking for (see last issue's *Mini Quiz*) was Irving Langmuir. Once I identified Dr. Langmuir as the answer to your question, I realized I had heard the name before.

After checking the company I went to work for in 1955 (Ramo-Wooldridge Corp.--the "R" and "W" of today's TRW, Inc.), I found the name of David B. Langmuir. He was associated with what is now Space Technology Labs, part of TRW, Inc. He could be certainly be related to Irving in some way; I'll try to check it out.

I retired from TRW in 1992, but have been consulting for them for the past few weeks in Redondo Beach, CA. While out there, I got to go to some antique and radio sales. Just picked up the crystal set that you showed in your first issue of The Radio Collector (page 1, Jan, 1994) like new, for $20.00 with a set of phones. It was manufactured by The Mengel Co. of Jersey City, Louisville and Saint Louis.

Thanks for the interesting (and, as usual, correct) answer to last month's "Mini Quiz," Charles. That Mengel crystal set, in its little Jewel box case, is quite a find! I uncovered mine in a New Hampshire antique shop back in the early 60's, and I thought I was being quite a spendthrift when I gave $20.00 for it. I never saw another one like it until, at one of the major auctions not too long ago, I saw a Mengel change hands for several hundred dollars. And now there's yours!

Tube Manual Tip

I saw your writeup on the RCA tube manual in the last issue (*Vintage Book Reviews*) and would like to put in a word for GE's version. The RCA's are nice, especially if you need detailed data or curves, but RCA was infected with the NIH (Not Invented here) virus. They would only list the tubes they happened to make. GE, on the other hand, included data on *all* tubes--even those of other

(continued on p. 9)

(continued from p. 4)

Because of the need to protect his patent interests, the specific details of Marconi's equipment were not disclosed publicly until June 4, 1897 when William Preece (1834-1913), Engineer-in-Chief for the Post Office gave a public lecture at The Royal Institution in London. (The relatives of Marconi's mother had provided him with an introduction to Preece.) The lecture was published in the next issue of *The Electrician*.

Popov Vs. Marconi Receivers

Marconi was granted a patent on July 2, 1897 (the complete patent specification had been filed on March 2, 1897). This was the world's first patent related to wireless telegraphy. Marconi's receiver turned out to be quite similar to Popov's receiving instrument. However, unlike Popov's design, Marconi's employed two separate batteries.

The smaller of the two batteries in Marconi's receiver was used power the coherer circuit; i.e., it was used to establish the optimum quiescent point of the coherer and to provide the current which flowed when a pulse of electromagnetic waves made the coherer tube conduct. The second battery was used to power the tapping-back and recording instruments.

The tapping-back mechanisms developed by Popov and by Marconi warrant further discussion. A relatively simple method for automatic tapping-back had been suggested much earlier by Lodge. This was done in conjunction with his own initial efforts to develop an improved coherer based on, not a tube of metal filings, but on two metal spheres which barely touched each other.

Lodge had positioned an electric bell he used to announce the detection of a pulse of electromagnetic waves so that the bell's mechanical vibrations were conducted to the coherer. These vibrations broke the cohesion which occurred between the metal spheres. It is generally assumed that both Popov and Marconi were aware of this tapping-back mechanism used by Lodge.

Popov and Marconi, independently of each other, developed and utilized an improved tapping-back device also using an electric bell mechanism. In each of these tapping-back mechanisms, the coherer, upon the arrival of a pulse of electromagnetic waves, activated a relay which in turn activated the tapping-back devices. The actual tapping-back device employed by both Popov and Marconi to tap the coherer tube directly was the "hammer" or "trembler" from an electric bell.

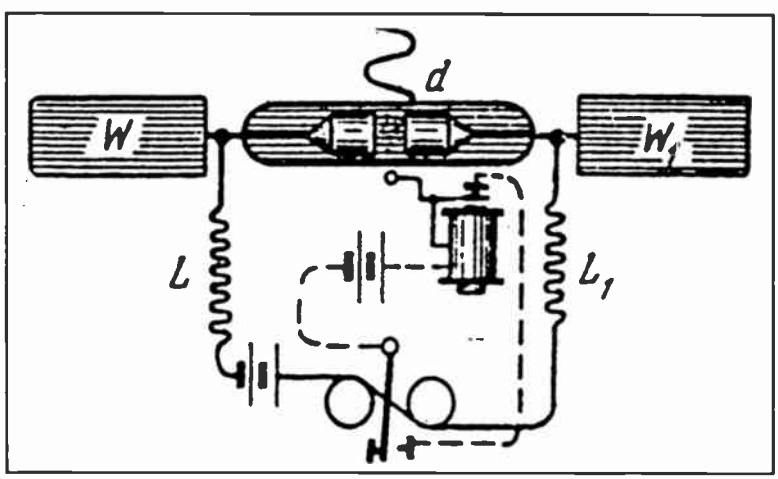
Other similarities between Popov's and Marconi's receivers are evident. Inductance was placed in the coherer leads by Popov to eliminate false operation of the coherer due to sparks produced at the relay contacts. Marconi similarly used inductance in the coherer leads. In addition to keeping unwanted high frequency currents from reaching the coherer, these inductances kept the desired high frequency currents supplied by the aerial from being shunted around the coherer through the battery. Marconi also used capacitance, high resistance, and inductance at various other locations in his receiving circuit to eliminate false operation of the coherer due to sparks produced at the relay contacts and elsewhere in the circuit.

In addition to advantages over Popov's design such as the use of transmitting aerial and earth connections on both the transmitter and receiver, Marconi's equipment featured a sophisticated, sensitive and stable coherer he had developed which used a mixture of fine nickel and silver particles between tapered silver plugs in an evacuated glass tube. The volume of particles could be varied by rotating the coherer around its longitudinal axis. This technique was used by Marconi to improve the sensitivity of the coherer.

Although Marconi's receiver was similar to Popov's, it seems unlikely that Marconi knew of Popov's work. Popov wrote at the turn of the century: "Whether my instrument had been known to Marconi or not, which seems more probable, it was, in any event, my combination of a relay, tube and electromagnetic tapper-back that served as the basis for his first patent for a new combination of already known devices. It is beyond all question that the first practical results in wireless telegraphy over considerable distances have been attained by Marconi before others."

At an earlier date, Popov had written: "The credit for the discovery of the phenomena which have been taken advantage of by Marconi is due to Hertz and Branly; then go a number of applications initiated by Minchin, Lodge and many others after them, including myself; and Marconi was the first to have the courage to take his stand on a practical ground and reached large distances in his experiments."

The conclusion of this three part article will include some additional reasons for Marconi's successes and a discussion of the "official" views of the former Soviet Union concerning the work of Popov.



Marconi's receiver had separate batteries for coherer, tapping-back mechanism.

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VINTAGE BOOK REVIEWS

Books from the era when vintage radios were new! Look for them at swap meets, flea markets and used book stores.

BASIC RADIO The Essentials of Electron Tubes and Their Circuits, by J.Barton Hoag, Ph.D. Published by D. Van Nostrand Co., First Edition, second reprint, 1942. 379 pages. Hardbound.

Hoag wrote this book to be a textbook for those in the Coast Guard being trained for radio service. He wanted to write a book that had more depth than the "popular" radio books of the time and yet not be as technical as the engineering books were. Some of the questions asked at the end of the book were written specifically to encourage the student to seek information from outside sources.

The book's thirty-eight chapters are designed so that each builds upon its predecessor. The first few chapters cover the basics and discuss the various facets of electronics, then the simple forms of tubes (diodes, triodes and rectifiers) are introduced. From these, come simple amplifier and oscillator circuits. Next comes the more complex tubes and detectors. A chapter is devoted to each special type of tube such as: gas filled tubes, photoelectric tubes, and cathode ray tubes.

The next series of chapters builds on these and goes into more complex forms of amplifiers, oscillators and special circuits. All of these concepts are brought together in two chapters devoted to transmitters and receivers. The book concludes with a series of chapters devoted to frequency modulation, direction finders, long waves, and short waves, U.H.F. and microwaves. The questions and problems follow and there is an excellent index.

As one can see, this not overly large book covers a lot of territory. Information is explained clearly, but only once. The author does not go over and over a subject. His building block approach, while excellent for teaching, makes it difficult to use when one wants to look something up. The index does make up for some of this shortcoming, however.

The math is not very difficult. There are many drawings which are quite helpful. This is not a practical radio repair text and there are no pictures of radio equipment. It merely explains the art of electronics and the circuits in use as it was during the beginning of World War II. This is a clear and concise book from which to learn electronics as it was during the "Golden Age" of radio.

RADIO OPERATING QUESTIONS AND ANSWERS By Arthur Nilson and J. L. Hornung. Published by McGraw-Hill Book Company, Inc. 1940, Seventh Edition, third impression. 415 pages. Hardbound.

Radio Operating Questions And Answers was a long running series having many editions spanning many years during the heyday of radio. The series started in 1921 and was revised and updated regularly. The book was not written as a textbook but as a review text to refresh the minds of those who were already trained in radio communication. It was designed to aid people passing radio engineering or operators license examinations. There are about 1300 questions and answers.

The body of the book is divided into six sections each pertaining to the six elements of the FCC examinations. The first element covers basic radio law while the second, and longest goes over basic theory and practice. The third and fourth elements cover Radiotelephones and Advance Radiotelephony. The fifth and six elements encompass Radiotelegraphy and Advanced Radiotelegraphy.

Appendix One lists the various abbreviations and codes used in radio such as: the "Q" code, miscellaneous abbreviations, and International Morse Code. The second appendix is a reprint of the FCC's Rules Governing Commercial Radio Operations, while the third appendix gives Extracts from Radio Laws. The book finishes with an index of subjects and one of illustrations and diagrams.

This book is not light reading, but is useful for someone who has some background in electronics and wants to refresh his memory. The title is easy to find. So the collector/historian can acquire many different editions and thus be able to follow the evolution of commercial radio over a fairly long period of time.

The math can get fairly complicated. There are no mentions of specific pieces of commercial equipment or diagrams of specific circuits. All explanations and illustrations are of a generic type. There are no photographs. The indices are adequate. While I would recommend this book only as a secondary reference source, it does offer one an insight into what was expected of a commercial radio operator. There are other books that are better for learning how commercial stations worked.

Please feel free to correspond with me any time about old radio books.

Conducted by Paul Joseph Bourbin
25 Greenview St.
San Francisco, CA 94131
e-mail address: paulbourbin@delphi.com.
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CORRESPONDENCE
(continued from p. 7)

manufacturers--as well as obsolete and industrial types.

Also, if you want to refer to the book while you're testing a radio, the GE manual has a comb binding and lies flat. If you are looking for a possible substitute tube, or if you know the base connections but not the tube number, the base diagrams each list all the tube types sharing that particular arrangement. In other words, don't ever pass up a GE *Essential Characteristics* manual if you see one.--Alan Douglas, Pocasset, MA.

I happen to have a GE Essential Characteristics in my library. But mostly, when I've reached for a manual, it's been the RCA. Intrigued by Alan's letter, I took the GE manual off the shelf and looked at it. I was quite impressed, and might add even a couple of more features to the ones he pointed out.

In my edition (1967), the tube characteristics (upper part of the pages) and tube basing diagrams (lower part of the pages) are on separate comb bindings. That means that you can place the appropriate basing diagram on the same page (or at least the same 2-page spread) as the tube characteristic listing you are interested in. I also liked the very clear layout and typography, making the tightly packed characteristics listings easy to read.

Testing Alan's statement that the book includes all obsolete types, I looked up some of our old favorites from the earliest days of radio, and they were all there. In an RCA manual of this vintage, those looking up such tubes would be referred to an "Obsolete and Seldom Used Types" chart giving minimal info.

And yes, the base diagrams really do list all the tube types sharing the configuration. I looked up some of the common pinouts (such as the classic 4-pin arrangement) and as far as I could see all appropriate tube types were listed. Thanks, Alan for calling this "sleeper" to our attention.--Ed.

Chronology Comments

The tube chronology in the last issue was good, but a few more words need to be said about the release of the type 38 (1931). The 38, an audio output pentode, came out with two other tubes meant to work with it. These were the type 36 (r.f. tetrode) and type 37 (triode detector). The following year, the companion type 39 (r.f. remote cutoff pentode) appeared, followed soon by the 84 isolated cathode rectifier--making up the complete standard tube complement for 6-volt auto radios.

I'm enclosing a schematic of an interesting and rare auto set that a friend found in his dad's garage and presented to me. It does use 36's, a 37 and a 38--though not exactly in the standard functions just described. You'll notice first that it is not a superheterodyne but a TRF set, using 36's as the first, second and third r.f. amplifiers. Another 36 is used as the detector, and a type 37 triode is pressed into service as the a.v.c. amplifier. Audio output is a type 38. There is no rectifier tube because the set has no internal "B" power supply. Instead, it runs off external "B" batteries!

COMPANY CHRONICLES

Brief Biographies of Classic Radio Manufacturers

MAGNAVOX

The Magnavox Company had its beginnings in 1910, when Peter L. Jensen (who had originally come to this country from Denmark to operate Poulson arc equipment) and engineer Edwin S. Pridham joined forces to form the Commercial Wireless and Development Company of Napa, CA. Their mission: to make a more sensitive telephone receiver (about the only way to increase the range of a radio receiver in those days before vacuum tube amplifiers). They succeeded by making use of very powerful electromagnets, but the resulting instrument was so heavy it couldn't be worn. It rested on the table, hooked to the listener's ears with rubber tubing.

The unit turned out to be too cumbersome to succeed as a telephone headset, but it was discovered that it made a rather good loudspeaker when coupled to a phonograph horn. This composite device was named the "Magna Vox" (Latin for "great voice") and promoted in a number of public demonstrations over the next few years.

Eventually, a phonograph pickup was developed for use with the "Magna Vox." This attracted the attention of Sonora, and in 1917 that company's western distributorship merged with Commercial wireless and Development to form The Magnavox Company.

Lt. Commander George C. Sweet, who was in charge of radio at the Mare Island Naval Shipyard (located near the Company's Napa, CA location), had become interested in the fledgling firm. He asked Pridham and Jensen to apply their audio expertise to the improvement of aircraft intercoms. This led to the development of the SE40005 noise-canceling microphone. Later, during The World War, the microphone and a moving-coil receiver designed at Magnavox were used in telephone systems on some 1200 Navy and merchant marine vessels.

In 1919, Magnavox (now located in Oakland, CA) began making vacuum tube power amplifiers, and the following year introduced a loudspeaker for radio work. By the end of 1923, the company was in a very healthy position, having accumulated a surplus of almost a million dollars.

Magnavox now branched out into tubes and sets. By mid 1926, over 200,00 tubes were said to have been made. But plagued by design problems, the tube line was eventually dropped. The first Magnavox radio, nicely designed and one of the pioneering single-dial models, was released around 1924.

But the company began losing money in 1925 and, after some design changes to reduce production costs on its 1924-1925 radio model, finally gave up radio manufacture altogether in 1926. From then on the firm concentrated on the manufacture of dynamic speakers, on which they held some key patents. This specialization was the key to the company's long-term survival. Magnavox became a part of North American Phillips in 1981.

The information for this company biography was obtained from Alan Douglas' three-volume encyclopedia "Radio Manufacturers of the 1920's," published by Sonoran Publishing, 116 N. Roosevelt, Suite 121, Chandler, AZ 85226, and copyrighted 1988, 1989 and 1991 by Alan Douglas.

DICK'S CORNER

Tips and Tidbits from the World of Antique Radio Collecting and Restoring

Save Those Vintage Batteries!

It's not unusual to come across early portable radios with the original dry batteries still inside the cabinet. Your first instinct would probably be to dispose of these batteries since they are long dead and seemingly useless. However, I urge collectors to save *all* batteries associated with the radios they purchase.

The early portable radios required just a few standard batteries. A couple of #6 dry cells and separate dry batteries delivering voltages such as 22 1/2, 45, 90 etc. would suffice for most sets. As radios became more complex, however, more and more special batteries were required. Manufacturers tried to make battery "packs," that is combinations of A, B, and C (filament, plate, bias) batteries designed so that all of the cells inside would fail at about the same time.

As portable radios continued to grow in popularity from the late 1930's through the early 1950's, sets requiring different battery pack configurations were created. The battery manufacturers (Burgess, Ray-O-Vac, Eveready, etc.) were quick to create and offer the different types of special packs.

Replacement battery packs are *not* available today!!! But I have found that many old battery packs have not leaked and still have a good physical appearance in spite of their age. Perhaps some readers out there will comment on why some decades-old dry batteries exhibit no signs of leakage, while others have swelled, split and deposited corrosive chemicals within the radios in which they were installed.

In any event, the collector should preserve the old batteries that come his way, especially the presentable ones. These definitely add authenticity to the radios in which they were found. And you can even "rebuild" them so that they work again.

To do this, carefully cut the seams of the battery pack's paper covering and discard the contents. If necessary, craft a new cardboard case to fit inside the covering. Design a "concealed" flap or door in the bottom of the case to expedite the installation of new cells.

Substitute series-connected groups of new flashlight (AA, C, D cells) and/or 9-volt transistor batteries to make up the various required voltages. Standard holders and clips for these batteries are readily available, so you can very easily replace dead cells with fresh ones. Appropriate connections from the new cells can be soldered to the original socket on the pack.

Even if you don't choose to rebuild your old battery pack, consider leaving it in the radio to preserve authenticity. Or, at the least, save the unit in a plastic bag along with a note identifying the set from which it was removed. Store in a dry, cool place to minimize the possibility of further deterioration. But, whatever you do, *don't* throw that old battery in the trash!

Conducted by Dick Mackiewicz

THE INTERNET CONNECTION

Information From and About Antique Radio in Cyberspace

In this column and over the next couple of installments, we will explore some basic "how-to's" and minimum requirements to get connected to the Internet. There are some recommendations on books and starter kits that can provide you with an easy "on-ramps" to the Information Superhighway as well as some basic hardware and software requirements at the nuts-and-bolts level. Following articles will discuss various Internet information sources, such as the Web, Gopher, FTP and Newsgroups.

Basic Hardware and Software Requirements
Before you can run all the nifty software out there for the Internet we need to check out some minimum hardware and software requirements for your computer setup. For PC systems, both DOS and Windows, you need a 486 or better processor (a 386 will work, but tends to be very slow with services, like America On line, that incorporate a lot of graphics and special "user-friendly" features). A minimum of 4 MEG's of RAM are needed, but I'd recommended at least 8 to 16 MEG's. If you are using Windows, version 3.1 or better is generally recommended. You will want to have as much extra RAM memory as feasible especially with Windows running. If you have a Macintosh, a Proforma platform or better should be used. No matter which computer you own, your hard drive should have about 8 to 10 MEG's of free space to allow ample room for the connection software as well as the extra space for support files (not to mention all the e-mail messages, files and the like you will download!). You will of course need a modem to connect your computer to your telephone line. A 9600bps modem is the barest minimum to access the Internet, and is adequate if you don't download a lot of graphic-intensive information. To take advantage of the graphical nature of some sites and minimize your on-line time a 14.4 or 28.8bps modem is really the recommended way to go.

Connection Options
There are basically two main ways to access the Internet. An Internet service provider, which is a company or organization that provides links to the Internet through their computer, and an on-line service like America Online, Compuserve or Prodigy. Internet service providers usually have bundled software packages that they sell or provide free with their sign-up options. The major on-line services already have the necessary interface software built into the standard software package that allows you access to their services. The level of service or options provided by these organizations varies with the level of complexity and cost. We will look into these more deeply in the next issue. For now here are a few books on the Internet and how to get connected:

The Internet for Windows for Dummies Starter Kit
by Margaret Levine Young & John R. Levine IDG Books (w/ software)
The Internet for the Mac for Dummies Starter Kit
by Charles Seiter IDG Books (w/ software)
Using the Internet
by QUE Corporation
Access the Internet
by David Peal (w/ software)
Navigating the Internet with Your Macintosh
by Tasmin Douglas & Ned Snell Hayden Books (w/ CD-ROM software)
Internet Starter Kit for Windows, 2ed.
by Engst, Low & Simon Hayden Books (w/ software)

In the first article I listed some words and phrases you'll encounter. Here
are a few more:

Browser: A software program used to access the WEB and display the graphics and text on a WEB PAGE.
Cyberspace: The whole INTERNET environment and its resources.
Hypertext: A text document with special imbedded codes to display the text mixed with graphics and other multimedia files such as sound and video files. Hypertext files are used on the WORLD WIDE WEB.
Link: An imbedded pointer to other WEB PAGEs or HYPERTEXT document.
Page: Another name for a LINKed HYPERTEXT document on the WEB.
Post: The action of sending E-MAIL or a message to a NEWSGROUP.
Server: A computer or computer system that provides a service or contains files or a database available to a network and its users.
Surfing: A slang term meaning to go ONLINE and search for information and/or POSTing or receiving messages or BROWSEing WEB files and pages.
URL: Acronym for Universal Resource Locator. This is the INTERNET or WEB electronic address of computer files, graphics or a particular computer. It specifies the actual address and the method of retrieving the information from that site.

And speaking of URL's, here are a few interesting antique radio sites on the
Web to visit or "browse":

Gerard Tel's Online Radio Collection:
http://www.cs.ruu.nl/~gerard/radios
Phil's Old Radios:
http://www.accessone.com/~philn/index.html
Antique Radio Classified on-line:
http://www.antiqueradio.com/index.html
The Bellingham Antique Radio Museum:
http://www.pacificrim.net:80/~radio/
File Archive for rec.antiques.radio+phono Newsgroup:
http://beach.cs.colorado.edu/Harvest/brokers/radio_phono
Query Interface to the rec.antiques.radio+phono newsgroup:
(lets you search topics discussed in the newsgroup)
http://harvest.cs.colorado.edu/Harvest/brokers/radio_phono/
A Web search "index" for finding other Web pages:
http://webcrawler.com
The Canadian Vintage Radio Society:
http://www.supernet.ab.ca/Mall/Recreation/cvrs.html

Here's a neat tidbit that I downloaded and condensed from the Internet newsgroup rec.antiques.radio+phono. It was originally a message thread (series of comments and follow-up comments related to an original posting) that appear on the group in October, 1995.

A collector had recently acquired a Hickok Model 533A tube tester at a swap meet. The chart included covered most of the tubes that he needed to test, but some older tubes were not on the chart. He needed settings for '00-A, '01-A, 26, 27, 71A, and other tubes of this vintage. There were two responses and the gist of the discussion was that the Hickok 500 and 600 series testers can test the tube types he needed. Individual Hickok models mentioned were: 532, 533, 533A, 533DM, 534, 534A, 534B, 535, 600, 600A and 605A. Here are the tube tester settings:

(tube tester settings appear on following page ---Ed.)

Conducted by Chuck Schwark
7454 N. Campbell Ave.
Chicago, IL 60645
e-mail address CASchwark@aol.com

CLASSIFIED ADVERTISING

Subscribers may place one free classified ad, up to 30 words long, in each issue. Count your name, ham call (if desired), complete address and one phone number as six words. Do not count the words in the boldface heading. Additional words are 15 cents each per issue. Non-subscribers pay 30 cents each per issue for all words. Free ads will be automatically run in two issues, but expire after their second insertion unless renewed by mail or phone. Those wishing to run the same ad for extended periods of time may want to use a "business card" space (see Display Advertising Dimensions and Prices table elsewhere in this issue). This is a boxed area in which we can print your business card or any advertising message that will reasonably fit (no charge for setting type). We reserve the right to make editorial adjustments in classified ads without advance notification and to refuse advertising at our discretion. We will reprint, without charge, any ad containing typographic errors, but assume no other financial responsibility.

Wanted Power transformer for Philco 45L (Ramirez p. 60). Philco #32-7226. Will consider junker chassis or trade Model 70 transformer (#5117). Will pay up to $25.00. Chuck Schwark, 7454 N. Campbell, Chicago, IL. (708) 673-0937 days. E-mail: caschwark@aol.com.

Wanted Early Crosley parts and sets, CR-1, Harko crystal, Harko Sr. (regenerative), Lowave, Audion Detector, No. VIII panel and cabinet, working chassis-speaker-knobs for Elf or Widget, Crosley table light (motion) No. 28-25, 2 audios for Tuska amp #226, 1 audio for Deforest Interpanel, speaker for Scott All Wave (2-dial) and duplex pickup. Gilferd L. Baker, Vintage Radio & Phono, Box 139, 1122 Pearl St., Emden, IL 62635.

Wanted Information and data sheets on FETRONS (junction-field-effect devices that replace vacuum tubes) manufactured by Teledyne in the 70's. Have a number of TR1010, TR1126A, TR1008, TR1006 and TS415A. Charles Brett, 5980 Old Ranch Rd., Colorado Springs, CO 80908. (719) 495-8660.

Wanted Tuning knob w/insert, or just insert, and volume knob, for Emerson 707 Series B. Also tuning knob for Y600 (or similar) Trans-Oceanic. Terry Schwartz, 340 Oakwood Dr., Shoreview, MN 55126-4821. (612) 483-4173.

Wanted Old headphones, headphone parts, plugs, adapters, junction boxes, paper. I will purchase any amount, or trade for phones not in my collection. Dick Mackiewicz 1549 N. River Rd., Coventry, CT 06238. (203) 742-8552.

Wanted #1804 bayonet base panel lamp - stereo indicator lamp for Heathkit AD-19 stereo. Don F. Lehman, 378 Fairway Dr., Columbus, OH 43214-1848. (614) 888-0219.

For Sale Reproduction crystal detectors, replacement Philmore domes, new loop antenna wire, grille cloth - more! SASE for details. Do you need some oddball part or information? Drop me a note. I'll try! Dick Mackiewicz, 1549 N. River Rd., Coventry, CT 06238. (203) 742-8552.

For Sale Crystal Radio Kits, complete with face panel, base board, variable capacitor, prewound coil and many parts for old style radio. Remit $22.50, Carl & Grace Ent., 5636 Romeyn, Detroit, MI 48209.

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FROM THE EDITOR
(continued from page 2)

particular issue was regrettably made late while I learned the ropes well enough to get my first OTB issue out, I'm expecting that things will be much smoother in the future. Those who might be interested in joining the AWA and receiving the quarterly Old-Timer's Bulletin should contact Joyce Peckham, Box E, Breesport, NY 14816. Dues are $12 (1 year); $22 (2 years); $15 (overseas airmail). These prices go up to $15; $27; $18 efffective May 1, 1996.

While it is unfortunate that this issue was late, the good news is that we had enough material for another 12-pager. Hope you enjoy it! Furthermore, it looks as if we have enough material on hand to ensure that the next two issues will also be 12-pagers. much appreciate the reader contributions that have made this possible. Keep them coming, folks!--**MFE**

THE INTERNET CONNECTION
(continued from previous page)

TYPE	FIL	SELECTORS	BIAS	ENGLISH	PUSH	METER READING
00A	5.0V	JR-3200-0	33	28	P4	666
01A	5.0V	JR-3200-0	48	32	P4	725
99	3.0V	JR-3200-0	55	26	P4	425
26	1.5V	JR-3200-0	39	55	P4	1150
27	2.5V	JR-3204-0	41	48	P4	1000
71A	5.0V	JR-3200-0	69	68	P4	1650

One response added the following alternate setting for the type 99. He has used these settings to test a WD-11 with a socket adapter (it has identical specs except for filament voltage) and they seem correct.

99	3.0V	JR-3200-0	55	73	P4	425**

**Micromhos only, over 350 on 3000 setting OK

MONTHLY MINI QUIZ

Match wits with our quiz editor! See next month's issue for the answer, as well as the names of all readers who responded correctly.

Owned by the American Telephone and Telegraph Company, which also controlled our country's long distance telephone lines, this radio station was in an ideal position to pioneer in the field of network broadcasting. It was sold to RCA in 1926.

Answer to last month's quiz--Irving Langmuir. Correct answer was sent in by Charles F. Brett.

Conducted by Julian N. Jablin

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