The Radio Collector

June, 1994

Evolution of the Broadcast Receiver

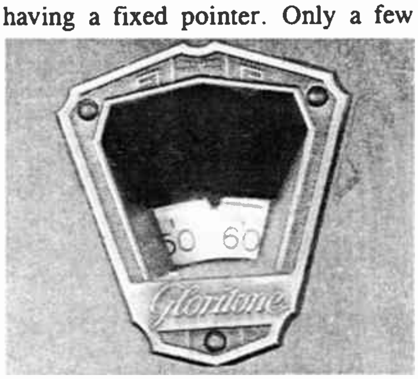
Part 6 - Innovations in Tuning

In previous installments of this story, we talked about most of the important electronic developments incorporated into radio receivers prior to the beginning of World War II. But it would be wrong to leave you with the impression that the end products of radio evolution were the little 3-way portables and a.c.-d.c. table models discussed last month. While these "midget" sets were being marketed, plenty of full-featured, wood-cabineted table models and consoles were also being sold.

Moreover, during the 1930's and early 1940's, radios began to sprout new features that we haven't yet touched on. These features didn't necessarily advance the state of the radio art; in fact, many were frank marketing gimmicks. But some of the ones that made radios more interesting and/or more convenient to use should be mentioned here. Most of these could be loosely categorized as tuning innovations.

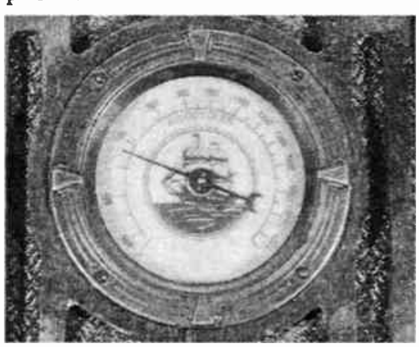
Dial Developments

One of the most obvious innovations was in the design of the radio dial itself. In the early 1930's, the typical dial rotated behind a small window having a fixed pointer. Only a few divisions on either side of the received frequency could be seen. A little later, on many sets, the window had broadened out to a semicircular arc showing much more of the scale.



Typical early 1930's dial rotated behind small "window" having a fixed pointer.

Still later, the "airline" or "clock" style dial came into use. This had a fixed scale (printed in a square, circular or oval pattern) and a movable pointer turning on a center axis. This made the set's complete tuning range visible all at once, and paved the way for the addition of the new short-wave bands that were beginning to intrigue the listening public.


"Airline" dials had fixed scale, movable pointer, showed entire tuning range.

Short-Wave

By the early 1930's, some manufacturers began to offer coverage of the early police band, which was located just above standard broadcast. Patient listeners tuning that band could eavesdrop on communications between police cars and dispatchers. Later in the decade, as war clouds deepened, sets were offered that covered still higher frequencies -- sometimes labeled "Short Wave" or "Foreign Broadcast."

Explorers in these rarefied regions could tune around among broadcasters and propaganda stations from all over the world, each reporting on current events with its own particular bias. Here, too, could be heard the friendly chatter of ham radio operators and the more businesslike conversations of maritime, aircraft and other commercial communicators.

Sets with a single short-wave band typically had a "split scale," with one end of the pointer indicating the broadcast frequencies and the other the short wave. Multiband sets usually had additional dial scales arranged concentrically with the broadcast band scale.

It wasn't uncommon for the call letters of major market radio stations to be printed near their operating frequencies on the broadcast scale. And the shortwave scale often sported the names of different countries near the frequencies typically used by them. Generic markings (such as "Police," "Aircraft," "Amateur" or "Ships") were also sometimes shown.

Towards the end of the decade, the "slide-rule" dial began to appear. The scales on this dial were straight rather than semicircular, and the pointer traveled in a straight line across them. Multiband sets had two or more straight lines arranged parallel to each other, each with its appropriate range of markings. This arrangement made

On this "split scale" dial, top of pointer indicates broadcast; bottom, short wave.

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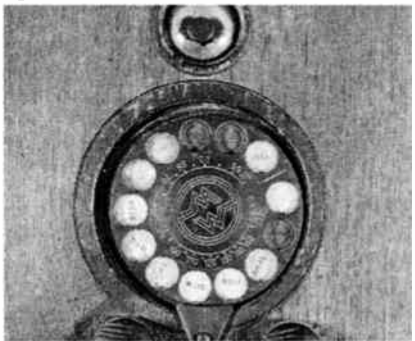
the numbers on the dial scale a great deal easier to read.

1940's table model has slide-rule dial, push buttons for station selection.

Push Buttons and Tuning Eyes

Push buttons that could be set to select favorite local stations also became common around this time. Both mechanical and electrical designs were popular. The mechanical version physically moved the set's main tuning capacitor into the preset position via a cam-and-lever arrangement. The much slicker electrical version typically worked by switching individual trimmer capacitors in and out of the tuning circuit. Push-button mania often spread to other set functions as well, with bandswitching, tone and even power under index finger control.

No discussion of tuning innovations would be complete without mentioning the tuning eye, which first appeared about the mid 1930's. The"eye" was actually the round screen of a small electron ray tube. When the set was on, the screen lit up with a lurid phosphorescent green glow. Two shadows appearing on the screen moved closer together as the station was tuned in--looking vaguely like the closing of an eye--and farther apart as it was tuned out. Thus the "eye" served as a tuning aid, helping the listener obtain the strongest possible signal.


This Ward's set has tuning eye, innovative "telephone dial" station selector.

The tuning eye was actually a spinoff of the automatic volume control circuitry that had come into use during this era. The AVC, as it was called, automatically reduced set sensitivity when strong stations were tuned in, preventing overloading, and increased sensitivity as weak stations were tuned in. The varying voltage that controlled the AVC action, applied to the grid of the tuning-eye tube, was responsible for the opening and closing effect.

Happy Collecting!

No overview can hope to be complete, but this series of articles should have given you a pretty good handle on the types of "golden age" (1920's through 1940's) radios that are out there to be collected. Conversely, if a radio from this period should fall into your hands, you should be able to estimate its age and its place in the evolutionary scheme of radio development. Good hunting and happy collecting!

MARC F. ELLIS

AES CHANGES OWNERSHIP

During its 12 years of operation, Antique Electronic Supply (6221 South Maple Ave., Tempe, AZ 85283) has established itself as one of the preeminent suppliers of parts and materials for the antique radio hobbyist. According to a press release just received at *The Radio Collector*, George H. and George A. Fathauer, AES' father-and-son management team, have recently sold the company to electronics industry veteran Joseph Campanella. For the last seven years prior to his retirement from a 30-year career with Sperry Corporation, Joe was president of the Sperry (Honeywell) Aerospace and Marine Group, headquartered in Phoenix, AZ.

AES will continue to operate as a family business, since Noreen and Greg Cravener (Joe's Daughter and Son-In-Law) will be joining the firm as Vice President of Operations and vice President of Technical Services, respectively. Greg is a graduate engineer with over ten years of experience in key engineering and computer processing positions; Noreen has over eight years of experience in operations management, four of which were in the electronics industry.

The company will remain at its present location and retain the same phone and fax numbers (602) 820-5411 and (602) 820-4643 respectively. The toll-free fax number is (800) 706-6789. The present employees will remain with the company and the new

(Continued on p. 6)

PLAY IT AGAIN!

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

BASIC VACUUM TUBE OPERATION

Last month, we concluded our coverage on vacuum tube history, having talked about the major developments in tube technology through to the years just before World War II. Now it's time to begin taking a look at the vacuum tube from a more technical point of view, providing you with some information about how tubes operate and how they work in circuits.

Voltage and Electron Flow in Tubes

As Edison discovered, current will flow between an incandescent filament and a metal plate (both enclosed in a vacuum) if the plate is connected to the positive terminal of a battery or other d.c. voltage source and the filament to the negative. We now know that the current is composed of negatively charged electrons emitted by the hot filament and attracted to the oppositely charged plate. This "Edison Effect" was the basis of the development of vacuum tube technology by later inventors and experimenters.

Electrons leaving the filament are replaced from the battery. But in the practical vacuum tube designs that followed Edison's work, not every electron emitted by the filament went straight to the plate. That would have left no reserve to handle a sudden, large signal. Instead, the filament was designed to emit far more electrons than required for the current flow. These excess electrons formed a cloud around the filament called the "space charge." The space charge is analogous to a water reservoir which can handle varying demands while being replenished at a constant rate.

Lee DeForest found that a wire mesh grid placed between the plate and filament could be used to control the flow of electrons through the tube. It does this by repelling or accelerating the electrons, depending on whether the voltage on the grid is positive or negative *with respect to the filament*. The phenomenon is the basis of a tube's ability to *amplify*, making the relatively large current flowing between the filament and plate mirror the changes in a relatively tiny signal applied between grid and filament.

Voltage Reference Points

Since many faults in radio circuitry alter key voltages on tube elements, voltage measurement is an essential part of any servicing routine. We normally make these measurements against the point of zero voltage, which is the common point to which all circuits in a set eventually return. In a transformer set, this point is usually the chassis. In AC/DC sets, it is one side of the power line, and it is the B- terminal in battery sets. We call this common point "ground" whether or not it actually connects to the earth. Remember this definition of ground; we will use it from now on.

Although most service tests are made against ground, It's important to note that the operation of a tube is governed by the voltages on its various elements with respect to the filament or cathode and not with respect to any external reference such as ground. A tube may have +20V on its cathode and +16V on its grid measured to ground. The tube doesn't care what happens outside it, however, and sees only that the grid is 4V less positive than the cathode. From the tube's viewpoint, the cathode is at 0V and the grid at -4V.

Grid Bias

We have said that the voltage on the grid controls the flow of electrons. Early radios operated tubes with no voltage on the grid except the varying one supplied by the received signal. It was soon learned, however, that a fixed negative voltage applied to the grid reduced distortion and battery consumption and extended tube life.

With few exceptions, the grid is always made negative with respect to the cathode. If it goes positive, electrons will be attracted to it and grid current will flow. Most grids are not designed to carry much current and will rapidly overheat. The fixed voltage on the grid (measured under quiescent, no-signal conditions) is called the "bias". The bias sets the operating point of the tube and the signal varies the grid voltage around this point.

The negative bias voltage for the grid can be supplied in two ways. The filament or cathode can be grounded and the grid returned to an actual source of negative voltage from the power supply or a battery. This is called "fixed" bias. Batteries were commonly used in the 1920's. They were called "C" batteries to differentiate them from the "A" (filament) and "B" (plate supply) batteries.

The second method is to let the tube develop its own bias. Remember that the grid needs to be negative only with respect to the cathode. If we put a resistor in series with the cathode and ground, the tube current causes a voltage drop in the resistor making the cathode more positive than ground. If the grid is at 0V by being returned to ground, it will be negative with respect to the cathode. This is called "self" or "cathode" bias.

Coupling Between Stages

As already mentioned, a varying signal voltage on the grid of a tube causes a varying plate current which exactly reproduces the signal. The current variations can operate current driven devices like speakers and headphones, but the other circuits in the radio are voltage - not current - driven.

Current variations are converted to voltage variations in two ways. If a resistor is put between the tube plate and the B+ supply, the varying current will cause a varying voltage drop in the resistor. This appears as a varying voltage at the plate and can be passed on through a capacitor to subsequent stages of the radio.

There is no voltage gain in a resistor; all the amplification comes from the tube. Note, also, that when the incoming signal drives the grid more negative, plate current (and voltage drop through the resistor) decrease, causing plate voltage to rise, and vice versa. This is called phase inversion; the signal voltage at the plate is 180° out of phase with the signal voltage at the grid.

The second way is to supply the plate voltage through the primary of a RF, IF or AF transformer. The varying current through the primary induces a varying voltage in the secondary for use in subsequent stages. The secondary usually has more turns than the primary so there is voltage gain in the transformer as well as in the tube. Audio transformers were called "amplifying" transformers in the early days. Depending on how the secondary is connected, there may or may not be phase inversion.

Next month we will go on to discuss tube characteristics and manuals.

Conducted by Ken Owens
478 Sycamore Dr.
Circleville, OH 45113

CORRESPONDENCE FROM OUR READERS

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

Branly Background

Here is an answer and a correction to the Mini Quiz of May's issue.

The invention of the coherer is ascribed to Edouard Branly of the Catholic University of Paris who published his researches in France in 1890. The results reached the English journals by mid-1891. Branly, however, did *not* receive a Nobel prize for this work. There is no evidence that he ever suggested the coherer as a detector of Hertzian waves, and he did not patent it.

Oliver lodge had been working along the same lines in 1889. It was Lodge who gave the device its name and developed it as a detector. Strictly speaking, the coherer is a latching relay, not a detector. It consists of a glass tube with metal filings lightly pressed together by metal plugs at each end. It is normally non-conducting. When a signal is received, minute arcs between the filings cause them to cohere and become conducting. Thus the device can be used to operate a bell or lamp upon receipt of a signal.

Once "cohered," the filings remain conducting until the device is shaken to separate the filings. It was therefore necessary to have a mechanical "tapper" to jar the coherer between each dot or dash to prepare it for the next one.

As regards Nobel prizes, the only radio-related ones were to Lenard in 1905 for cathode rays, Marconi and Braun in 1909 for wireless telegraphy, and to Shockley, Bardeen and Brattain in 1956 for the transistor. -- Ken Owens, Circleville, OH

In answer to the May, 1994 Mini Quiz - how does Edouard Branly sound? My source of information is Gernback's *1927 Radio Encyclopedia*, though it does not mention Branly's receiving a Nobel prize.

Branly was born in Amiens, France on Oct 23, 1844. Gernsback states that he must have completed work on the coherer prior to 1890 since he wrote a paper on his findings that year. -- George W. Carr, Olde Tyme Electronics, Lancaster, OH.

Here's an excerpt from a note to Ken Owens from our mini-quiz editor Julian Jablin. Julian didn't respond to the Nobel prize issue but, being personally acquainted with him, I know that nobody could be more pleased at having a published work stimulate constructive criticism and commentary. As to the Nobel prize lapse, Julian is hereby sentenced in absentia to 30 lashes with a wet noodle.

. . .Your comment regarding Branly and the coherer was most interesting. Branly is, of course, credited in a number of sources as the "inventor" of the coherer, although I would certainly agree that the term "inventor" might well be an oversimplification of the matter.

I have some problems myself in using the terms "invented" or "inventor" with relation to early advances in electronics. You know better than I that the development of the electrical art did not represent a neat continuum. There are so many instances where an inventor dropped a promising lead -- which another experimenter took just one step further to completion.

Then there's the matter of who first got into print and how. Was Marconi the "inventor" of wireless or was Popov? Or none of the above?. . .

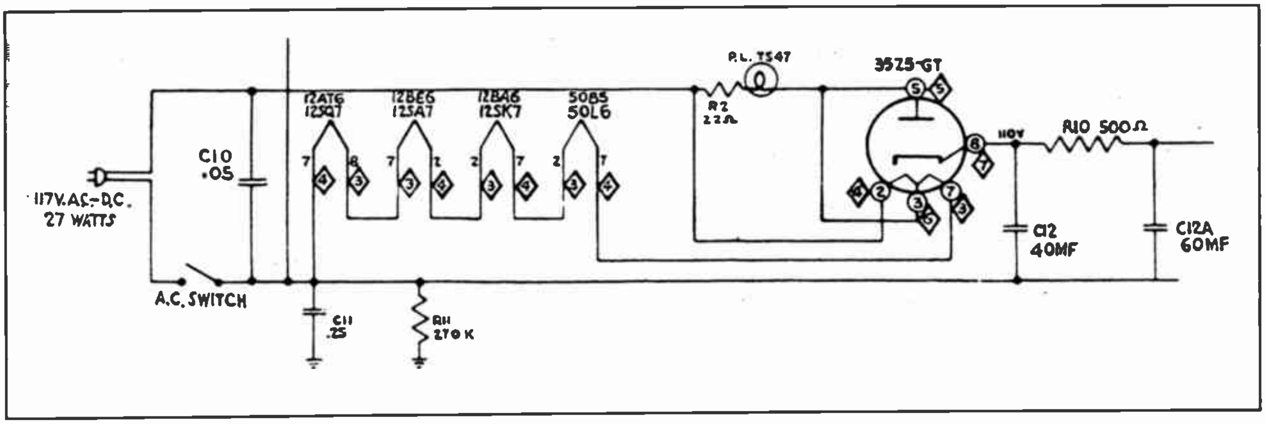
More on Series String heaters

The first thing we have to do is get the heater voltage of the type 43 tube straight. In April's cover story "Downsizing For the Depression," I had accidentally reported it as 6 instead of the proper value of 25. When making the correction last month, I created another typo that showed the voltage as 45! Guess I'll have to sentence myself to a few wet noodle lashes along with Julian. And, of course, I need to thank readers Ray Larson and Dick Mackiewicz for calling this boo-boo to my attention. Both Ray and Dick also offered some comments regarding the role of the 50L6 tube, which was not specifically mentioned in last month's cover story "The A.C. - D.C. Set Comes of Age." So, Ray and Dick, you have the floor!

. . . As line voltages in the US began to rise above 110, the 50L6 tube was developed to replace the 35L6 in series string circuits. Using the 50L6 with the usual 35Z5 and three 12-volt tubes allowed all of the tubes to run cooler and last longer. If anyone has a set using a 35L6 in such a lineup with no ballast or line-cord resistor, I'd recommend changing to a 50L6. . . -- Dick Mackiewicz, Coventry, CT.

. . .Regarding the 35L6, I think that the sets containing the 50L6 substitute were the real "All-American 5's." These tubes (*12SA7, 12SK7, 12SQ7, 35Z5, 50L6 -- Ed.*) add up to 121 volts, a bit closer to 117. I've seen a number of 5-tube sets written up in Rider's. They usually had a 2-watt resistor to drop an additional 12 volts or so when the 35L6 was used. -- Ray Larson, Los Angeles, CA.

(Continued on p.6)



Ray Larson sent this power-supply circuit for Gilfillan Model 56A-56E using a 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5 (or equivalent miniature series).

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.

ANSWERS TO QUESTIONS

In the March issue, reader S. Weller (Skokie, IL) inquired about why certain of his a.c.-operated antique sets tended to change volume abruptly when a lamp or appliance is turned on or off elsewhere in the house. Three readers offered good theories in the April issue, and Allan Brown (Woodlawn, Ontario) offered further comments along with the questions he posed (see next item) in last month's issue. Not long after that, I heard from Bob Zinck (Halifax, NS, Canada), who offers the following comments:

All the answers given so far are more or less correct. Marginally operating components *can* be shocked back into temporary operation by either a power-line transient or a pulse of natural static. Heavy power loads will cause line voltage drops which will particularly affect bias voltages in non-avc sets, although this would probably be a more gradual change due to bypass capacitors in these circuits.

Having experienced this effect in the past on battery operated sets as well, I am inclined to believe it is the result of changing RF fields as alluded to by Mr. Dubois. The house wiring could very well re-radiate and/or shield the RF, and this would depend on the reactance of any given wire loop, which would indeed change with various loads connected to it.

I'm afraid it would take a super-computer to figure out any given numbers, suffice it to say that it does occur. An external antenna and ground eliminates the problem, which sort of gives an empirical proof of this.

Good collecting!

In a very interesting long letter printed last month, Allan Brown posed several very good questions focusing on the issue of what a vintage radio should sound like. Among the questionable sounds he noted coming from some of his sets were: a faint rumbling noise, definitely not a.c. hum, that becomes much more noticeable after the set has been in operation for a few hours and eventually causes audio distortion (observed in an old Philco identified as a 1926 model); whistles changing in pitch as stations are tuned in (observed in certain 40's and 50's radios); microphonics that, depending on the musical content of the signal, become quite loud before fading away (observed in a 1949 Motorola battery portable using tube types 1R5, 1U4, 3S4, 1U5). Allan wondered if it was likely that the sets sounded like this when new or if the noises were the result of component aging. Here are a some good comments that were received in response:

. . .Re the question by Allen Brown about noise: first, his set couldn't be a 1926 Philco because Philco did not make radios until 1928. Not knowing the actual model year makes it difficult to diagnose the problem, but I would suspect capacitor deterioration. Capacitors built before about 1931 were constructed in a manner almost guaranteed to break down with time. Capacitors in later sets also can break down. If an audio coupling capacitor gradually breaks down as the set is played, the sound can be very noisy and ultimately become distorted as the grid biases are upset.

Whistles are usually the result of deteriorated bypass capacitors, especially in the RF screen and cathode circuits. Microphonics in older "S" bulb tubes are normal. Later battery types like the 1R5, etc. are slightly microphonic because the filament structure is very light and easily moved by vibration. Any change in element spacing within a tube will modulate the electron stream and make noise. AC operated tubes such as the 12SK7 have very heavy cathode structures which do not respond to vibration.

Other than hum, noise *is not normal* in a radio. An antique set should be peerfectly quiet. Hum levels in the early AC sets were high by today's standards, but the speakers used then did not reproduce much below 200 Hz, so it was not objectionable. I would say to Mr. Brown: if you find the noise annoying, so would have the original owner. He wouldn't have tolerated it nor should you. -- Ken Owens, Circleville, OH.

I have a few comments referring to the sound of older radios and tube microphonics. Like Allen Brown, I had some radios where the sound would distort after being on for quite a while. So far, this problem has always been traceable to a leaky coupling capacitor feeding the audio output stage. After a while, it would let a positive voltage appear on the grid of the tube. Once that capacitor was replaced, the radios would play all night long with no distortion.

Also like Allen, I had problems with tube microphonics in a battery portable (in my case, an RCA-54B1). I ended up swapping tubes to minimize this problem. It also helped to put a small rubber band around each tube (I believe this was often done at the factory). I never tried new tubes, so I don't know if they would have helped.

I encountered a 1B5/255 tube, in the amp of a Wurlitzer 412 jukebox, that was so microphonic it would "pick up" sound from the speaker and create a feedback howl. Replacing the tube with another used one didn't help much, but I finally cured the problem by substituting a N.O.S. tube with a heavy rubber band around it. I often wonder if age makes a tube more prone to becoming microphonic.

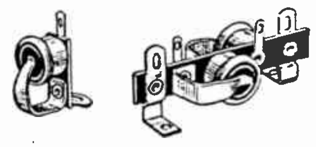
Two of my (1940's) radios tend to whistle after stations are tuned in. All capacitors have been replaced, so that's not the problem. The difficulty may be due to the design of the radio, or perhaps a complete alignment would help. I also notice volume changes in some sets, but I don't have an outside antenna. Right now I use a six-foot wire clip to the curtain rod and no ground at all. Maybe some reader who has a good outdoor antenna and ground can let us know if using them minimizes volume changes. *(Editor's Note: Regarding the antenna issue, see Bob Zinck's letter at the beginning of this section.)* -- Bob Baketz, Elgin, IL.

GENERAL INFORMATION

Back to Bias Cells!

Jack Iverson (Palatine, IL), whose original letter started a discussion on Mallory bias cells that continued over several issues of this column, sends us a post script on that topic. It's a little writeup from a Mallory data sheet that included good drawings, reprinted here, showing the cell in a couple of versions of the factory holder. In discussing the advantages of using the cell instead of a conventional self-biased arrangement employing a paralleled resistor/capacitor in the cathode circuit, the following statement is made (bold-face is Mallory's):

"The tone quality and power output of small AC-DC sets for example can be remarkably improved by using bias cells to bias the first audio tube in place of the cathode resistor condenser combination." *So if your "All-American Five" is producing bad audio, don't rule out the possibility that the first audio stage might have been retrofitted (or even originally equipped) with a now dried out and defunct Mallory bias cell!*



Thanks to Jack Iverson for these clear drawings of Mallory bias cells in single (left) and double holders.

Binding Posts and Wire
Here are some sources of useful repair or construction materials:

Bob Zinck (Halifax, NS) writes that knurled brass "binding post nuts" are still readily available at large hardware supply stores. An exploratory visit to such a store in his area turned up three sizes (#6, #8 and #10). Their current use is for fastening light fixture escutcheons.

Tony du Bourg (Summit, NJ) has come up with a source for that all-but-impossible-to-obtain double cotton covered coil wire. It is Organ Supply Industries, PO Box 8325, Erie, PA 16505-0325. Phone 814-835-2244. The 1992 catalogue Tony sent along listed the wire ("natural" color) in 22 and 24 gauge sizes. 28 gauge wire was available in blue, green, red or yellow. That's the good news; the bad news is that you'll probably have to put together a syndicate to purchase this wire. It's sold, by weight, in full spools only. The spools weigh from 2 1/2 to 6 pounds each. The prices quoted were in the $10.00/pound range for "natural" wire and about $14.00/pound for the 28 gauge colored wire. Call or write for current availability and prices.

Thanks, also, to Tony for a hint about how to fake cloth-covered power or speaker cords. It seems that cotton laces for hockey skates (at least if you find the right kind) are woven in the form of hollow tubes. The samples Tony sent me are labeled "72 Inch Athletic Laces." Slip a length of zip cord inside one 72" lace and you've got a pretty good fake vintage power (or speaker) cord. Headphone cords might be a bit harder to fake because of the multiple leads and "y" connections, but a determined forger equipped with needle, black thread, and lots of patience might be able to craft a creditable replacement.

Isolation Transformer
In last month's issue, Julian Jablin pointed out the dangers of working on AC-DC sets without an isolation transformer and suggested that one could be constructed from a pair of heavy-duty filament transformers with similar secondary voltages. Julian recommended tieing the secondaries together and using the two primaries for the "line in" and "power out" connections. Here's another idea on the subject from Dick Mackiewicz (Coventry. CT.).

An isolation transformer is a must for working on AC-DC sets. Fertik's Electronics (5400 Ella St., Philadelphia, PA) has a 40-volt, 3-amp transformer that would make an ideal and inexpensive foundation for such a unit. Just connect the secondaries of three of these transformers in series aiding (*see editorial comment below*).

Much modern test equipment is equipped with a three-wire AC cord which places the chassis at AC ground. Connecting a ground lead from such test equipment to an AC-DC set with a hot chassis is hazardous to say the least. More reason to use that isolation transformer!

To put Dick's idea into practice, connect the primaries of the three transformers in parallel and wire them to a line cord. Temporarily wire two of the secondaries in series and connect the free ends to an AC voltmeter. If you get a negligible reading, the voltages are opposing, and cancelling each other out. Reverse the leads from one of the secondaries and try again; the two voltages will now be "aiding" and you should read about 80 volts across the secondaries. Make the connection permanent and wire the third secondary temporarily in series with either free end. Read a voltage of 120 across the three secondaries and you can make the connection permanent. Read only about 40 and you need to reverse the leads to the third secondary and try again. Dick didn't mention the cost of the transformers but he says that Fertik's will send a listing of their selections for a SASE.

CORRESPONDENCE
(continued from p.4)

Anonymous Benefactor
I'd like to thank the person who sent me the information to determine the capacity of an unmarked variable capacitor. The envelope was post marked "Albany, NY," containing a very nice line graph and a spec sheet for a capacitor tester called a "Daetron." No name of sender or source of availability. What a way to leave a guy hanging out! If you see this note, could you provide any more information? -- Alan A. DuBois, Jr., 67 Peggy Ann Rd., Queensbury, NY 12804.

Tube Engineer
I want to congratulate you on your issues of *The Radio Collector*.

In the May issue, Ken Owens ("Play it Again" column) stated that the Ken-Rad Company had closed its plant in Owensboro, KY.

As an electronic engineer working for the military (Armed Services Electro-Standards Agency) at Fort Monmouth, NJ, I once had occasion to visit the *General Electric* tube plant which, if I recall correctly, was also in Owensboro, KY. I'd be curious to know if the plant Ken mentioned is the same one, perhaps purchased by Ken-Rad at a later date. I also remember inspecting the CBS tube plant in New England and Chatham electronics (part of Tung-Sol) in New Jersey.

Prior to that job, I was a tube development engineer for Tung-Sol, working on tubes like the 5670, 6CG8, 6BK7A etc. After leaving that company, I heard rumors that they were developing tubes that would operate on a 12-volt plate supply, possibly to be used in automobile radios. They were also beginning to get into transistor development. Does anyone know when Tung-Sol closed down?

Old-timers will remember the variometer and vario-coupler used extensively in 1920's radio circuits. On an assignment for Mackay Radio, I actually designed and built a large variometer (for a marine transmitter) in the 1950's! I didn't save my calculations and would like to obtain the basic design equations again. Can anyone help? -- Steve Kalista, WB26KN, 9 Maple Dr., Jim Thorpe, PA 18229.

AES OWNERSHIP CHANGE
(continued from p. 2)

management will continue to honor the sales policies noted in the catalogue which, as always, AES will send you free.

The Fathauers will remain with the company as consultants, with George H. continuing to be active in the purchase of tubes and George A. facilitating the orderly turnover of the operations to Mr. Campanella. Both Fathauers want to express their heartfelt appreciation for the support of their customers over the years, and Mr. Campanella comments: "We look forward to continuing the tradition of supplying parts and supplies for vacuum tube equipment with an emphasis on quality and service. We welcome your suggestions as we look for ways to better serve our customers."

VINTAGE BOOK REVIEWS

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

AN HOUR A DAY WITH RIDER ON D-C VOLTAGE DISTRIBUTION IN RADIO RECEIVERS, by John F. Rider Publisher, Inc. New York City, New York. 1936. 96 pages. Hardbound.

This review is a continuation of our reviews of books in the "An Hour A Day With Rider" series. The series was published by John F. Rider in the mid 1930's to assist radio servicemen in upgrading their expertise.

The first chapter of *An Hour a Day With Rider on D-C Voltage Distribution in Radio Receivers* consists of an elementary explanation of electrons and electricity. It covers the various units of measurement (volts, amperes, etc.), temperature coefficients, Ohm's law, etc. The following two chapters deal with series circuits and their practical application, while the fourth and fifth chapters cover parallel and series-parallel circuits in a similar manner.

This book was apparently written for servicemen who received their training in the battery-set era, since most of the material covered deals with a.c. power supplies. The odd thing is that, by the time this book was published in 1936, the radio repair industry would have had six or seven years' exposure to AC sets with DC distribution supplies.

While the book employs a fair amount of math, it is easy to understand and clearly explains how to calculate current, voltage and resistance in any DC circuit. Little of the information covered in the volume will be new to the advanced restorer/serviceman. The beginner, however, may find its help useful in calculating values not present on a schematic diagram.

Conducted by Paul Joseph Bourbin

COMPANY CHRONICLES

Brief Biographies of Classic Radio Manufacturers

KOLSTER

This unsuccessful company had its genesis in 1924 when Rudolph Spreckels, of the wealthy sugar refining and banking family, became chairman of the board of the Federal Telegraph Company of California. Spreckels decided to finance Federal's entry into the broadcast receiver market. But, because there was already a Federal radio brand (produced by the unrelated Federal Telephone and Telegraph Co. of Buffalo, NY), a different name had to be selected for the new products.

The brand name chosen was the surname of Frederick A. Kolster, a well-known, Swiss-born radio engineer and inventor who had been with Federal since 1921. Kolster was former chief of the radio section of the National Bureau of Standards, inventor of a the Kolster decremeter wavemeter and radio compasses and a former associate of Lee de Forest's.

The new product line was inaugurated with two elaborate models produced under contract by Brandes and introduced via double-page ads in the *Saturday Evening Post*. But because Brandes wasn't making any money on the contract, they employed slipshod construction methods--resulting in 60 percent of the sets being returned by the distributors. These problems were resolved a few months later when Brandes was absorbed into Federal to form Federal-Brandes Incorporated--but not before the company had lost upwards of $800,000.

Because of the failure of the pricey seven- and eight-tube models, a more competitive six-tube model was produced for the following (1926-27) season. But even this did not enjoy brisk sales and Spreckels had to sink another $750,000 of his family's money into the effort. The company also moved its offices from the Woolworth building in New york City to more Spartan quarters in Newark, New Jersey.

Kolster received an RCA license in 1927, making it possible for an a.c. model to be introduced in October of that year. Those sets didn't sell well either, however, and 1100 employees were let go the following February. That May, 10,000 obsolete models were sold to Emerson Radio and Phonograph Corp (then a dealer in surplus stocks), and by the following October it was estimated that 128,000 surplus radios remained on the factory floors.

Spreckels and other stock-holding executives began to bail out. In April, 1928, the company changed its name from Federal-Brandes to Kolster, unloading a large

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. 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 Viscous damping fluid for Gray viscous damped transcription arm, circa 1950's, or suggest substitute. Bob Zinck, 118 Doull Ave., Halifax NS Canada B3N 1Y9. Voice (902) 477-5713 - Fax (902) 477-7164.

Wanted Circuit diagram for Knight KG-220, a 30-50 mc FM monitor made by Allied Radio, Chicago. Alton A. DuBois, Jr., 67 Peggy Ann Rd., Queensbury, NY 12804.

Wanted Car radios, AC-DC sets, etc. using 5 pin 6 volt tubes 36-37-38-39. Ray Larson, 12241 1/2 Gorham, W. Los Angeles, CA 90049-5214.

Wanted Graybar 310 receiver (like RCA Radiola 60) in decent working condition. Ed Doughty, 3865 N. Thomas Rd., Freeland, MI 848263.

Wanted Buying WWII military surplus radio sets and accessories. Highest prices paid. Over $6,000 cash paid in 1993. America's WWII radio surplus leader. Sam Hevener, W8KBF, "The Signal Corps," 3853 Everett Rd., Richfield, OH 44286-97623. (216) 659-3244 before 8 p.m.

Wanted An original AM (+FM?) radio for 1965 Chevy P/U. Pay cash or trade tubes, other parts. David, 4016 Texana Way, Beale AFB, CA 95903. (916) 788-0624.

Wanted Antique radio headphones. Also want any junk Tuska radios or parts. Highest prices paid. Dick Mackiewicz, 1549 N. River Rd., Coventry, CT 06238. (203) 742-8552.

Wanted Any Rider manuals or any Radio College of Canada manuals. Shayne Trowsse, R.R. 3, Box A3, Casselman, Ontario, Canada, KOA 1MO

For Sale RME DB-23 preselector $25.00. 864 tubes $9.00 ea. 175 watt modulation transformer. All plus UPS. J. Iverson, N9KYT, 1110 Old Mill Dr., Palatine, IL 60067. (708) 359-0941.

For Sale Send SASE for new flyer with crystal detectors, headphones, experimenter and restoration supplies, test equipment and much more. Dick Mackiewicz, 1549 N. River Rd., Coventry, CT 06238. (203) 742-8552.

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COMPANY CHRONICLES

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amount of stock in a questionable manner -- for which they were sued in 1931 by a group of disgruntled stockholders. Court receivers were appointed in 1929, and Kolster's assets were auctioned in 1931. Shortly afterwards a new company, Kolster International, was formed by Mackay, but ceased production before the end of 1932. Federal-Brandes in England, also controlled by Mackay, survived and eventually became part of ITT.

The information for this Company biography was obtained from Alan Douglas' three-volume encyclopedia "Radio Manufacturers of the 1920's," published by The Vestal Press, Ltd., Vestal, NY and copyrighted 1988, 1989 and 1991 by Alan Douglas.

CALENDAR OF EVENTS

Planning an auction, swap meet, convention or show? Send us a brief rundown for a free announcement. Be sure to include date, location and contact information. Plan on getting the information to us two months in advance for timely insertion of your item.

July 8-9-10. Extravaganza '94 sponsored by the Michigan Antique Radio Club and the Antique Wireless Association. Holiday Inn South/Convention center, 6820 South Cedar St., Lansing, MI. (517) 694-8123. A major event offering swapmeet, seminars, contests and an auction. Look for **The Radio Collector** booth. Extravaganza '94, P.O. Box 585, Okemos, MI 48805-0585.

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.

This Danish Engineer was a major figure in the develpment of the electric arc wireless transmitter.

Answer to last month's quiz: French Physicist Edouard Branly, who published his research in 1890. Correct answers sent in by Ken Owens, George Carr.