Colorado Radio Collectors Antique Radio Club

The FLASH!

Dedicated to the Preservation and Education of Wireless, Radio, Television and Associated Equipment

Volume 27, Issue 1 | The January 10th meeting is at the Miller Library in Castle Rock | Jan../Feb. 2016

Dual Conversion Superheterodyne Receiver

By

CRC Member—Gregory Malanowski

I was filled with excitement and a little bit of fear when I plugged my first superheterodyne receiver into the wall outlet. It was 1948 and Poland was in ruins three years after the end of WWII. I was 13 years old and had assembled the radio using parts cannibalized from broken, defunct pre-war radios found in junkyards or bartered from my school buddies. I watched as the filaments in the glass vacuum tubes slowly turned red and orange, the EM11 Telefunken "magic eye" began glowing bright green, and finally the speaker came alive with a crackling noise. Hurrah!

That was a short-wave receiver, for I had to wind the antenna and oscillator coils up myself, and for the short waves I needed only about 10 turns of thick wire. No problem.

The intermediate frequency (IF) filters removed from a badly damaged pre-war Polish "Elektrit" superhet were tuned to 128 kHz. My new radio worked great – I could receive twice as many short-wave broadcasting stations as my father could on his modern "AGA" radio. I was really proud.

My grandson operating a Hallicrafters SX-71 dual conversion radio

Disappointment came a few days later when I realized that the "superiority" of my design and construction was questionable – I was picking up the same short-wave station twice, on different marks of the dial, on two different frequencies. Damn. Why was this happening in my receiver, but not in my father's? I didn't know who to ask.

"Radio Engineering" by F.E. Terman, probably the best comprehensive radio engineering manual covering the entire spectrum of electronics, was translated into Polish in 1948 and became available at a few bookstores. I purchased the book and found a partial answer to my question. The rest I learned a few years later.

The superheterodyne receiver has a built-in local oscillator that generates a weak signal at a frequency Fo that differs by a constant value from the frequency Fs of the received broadcasting signal. Both signals are delivered to the so-called "heterodyne" or "converter" vacuum tube, or to an equivalent semiconductor device. As a result of non-linear mixing of these signals, there are a few new products at the output of the converter stage. One of them is a signal of a differential or "beat" frequency, called the intermediate frequency (IF).

$$Fs - Fo = IF$$

That means the frequency of the received radio signal

$$Fs = Fo + IF.$$

For example, if the local oscillator frequency in our short-wave radio Fo = 7MHz and the IF = 500kHz, then we will receive the radio station operating at Fs = 7.5MHz.

As mentioned before, the difference between the received frequencies (Fs) and the local oscillator frequencies (Fo) is constant throughout the entire AM or FM band. This was usually accomplished by using dual-ganged tuning condensers. Thus the intermediate, differential frequency (IF) also remains constant, no matter what broadcasting station or other transmitter is actually received. Therefore all high-frequency amplifying stages that follow the converter stage can be tuned to a single fre-

(Continued on page 3)

COLORADO RADIO COLLECTORS ANTIQUE RADIO CLUB
Founded October 1988

Message from the President

Since the last edition of the *Flash*, Christmas has come and gone, and another year has rolled over on the calendar. I hope you all had a great Holiday Season and had a chance to spend some quality time with family and friends, and perhaps a radio or two!

The club is going strong as we enter the New Year. Merril says we have some money in the treasury. And we have been picking up new members over the last few meetings; these are both great things. We have got a full schedule of events ahead of us this year and we will firm up the dates as we go along. We do know that the 10th Annual Vintage Voltage Expo will be Sunday March 20th 2016 at the same venue (Ramada Plaza). We discussed at the last meeting a bit about what our "special display" category might be, so bring your ideas to the upcoming meeting. Also Alexis suggested we place a bit more emphasis on promoting the club at this show… I think that makes terrific sense so let's work this at the next meeting too.

Thanks to all that came to the well-attended November meeting in Littleton; we discussed the recent club events, including the auction and Modernism Show. Several relevant items regarding the auction were brought up. One issue was the adhesive on the lot number labels doing some damage to some radio finishes, and also whether the label could contain some more info about the lot itself to help the buyer and the auctioneer understand more about it. This ties into the second topic that our longtime auctioneer, Tom Pouliot, brought up: He is looking for a volunteer to take over (or maybe share?) the auctioneering duties for this event. Many folks brought up how Tom's deep knowledge about so many aspects of these auction items really helps inform and "sell" the buyers. I agree. Well maybe we can increase the lot label contents and come up with some other ideas…. We have several months to think about this. So try your auctioneering skill at the next meeting when we have some items to sell…

And along the lines of transitioning a task from someone who has done it for a long time… at the last meeting we had a couple of "nibbles" on taking over the Flash editor's job from Rich. Hopefully we can hook a new editor soon.

At the last meeting we had a great set of "show and tells", a decent raffle and even auctioned off some nice Sony stereo equipment. We had a special guest, Anthony, who is Merril's grandson. He was very enthusiastic all throughout the meeting and did a special "show and tell" about his clock radio. It was very special indeed to have such a young radio enthusiast at our meeting. The older guys presented a Midland B6A farm radio (me), a digitally modified Hickok 539B tube tester (Bill Eccher), and a new (to him and us) wood grain filler product, Parks Pro Finish. (Tom P).

Going forward, I would like to suggest that we always have the video projector available at our meetings, so we can display photos to go along with the show and tell. Say you just restored a big console radio that you would like to share about and don't want to bring it to the meeting, or you want to show some hard to see component of a radio or a unique restoration technique. Just take some digital photos and bring them on a "thumb" flash drive. Next meeting I will bring the "before" photos of the Midland radio that I couldn't show at the last meeting.

We have had many members join the egroup since the last meeting, so it is becoming a way to communicate more effectively among us. See the panel at the right on this page for contacting Mike McCutcheon about joining, or if you want to post a message or question to the egroup.

I look forward to see you all at the January 10th, 2016 meeting in Castle Rock!

Tom Zaczek

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NOTE: at = @ in email addresses

Upcoming Events

12/31	1999 Panama Canal turned over
1/1	45 BC First celeb. of New Years
1/10	1946 First Meeting of U.N.

Meeting Locations

(Unless noted otherwise)

Littleton	Castle Rock
March	January
July	May
November	September

CRC MEETINGS

Meetings are held on the 2nd Sunday of every other month starting in January (except May is 3rd Sunday) at 1:00 pm. The meetings consist of business, "show & tell", raffles, auctions, swap meets, technical discussions and other subjects of interest

CRC MEMBERSHIP

Annual membership in the CRC runs from July to June. Dues entitle members to attend meetings, "The Flash!" our newsletter, discount book prices, participation in our spring show and Fall auction. Current annual dues are $20. New memberships will be prorated to the following June.

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quency IF. That's the beauty of the superheterodyne: several high-frequency amplifying stages are permanently tuned to only one frequency, and that simplifies the design of IF amplifiers. This also facilitates the design of IF filters to provide an optimal, almost rectangular shape of the resonant curve. This improves the selectivity of the IF filter while the sidebands of the AM signal are not distorted. The lower the chosen resonant frequency of these filters, the higher their Q, resulting in better gain and selectivity of the IF amplifiers.

The intermediate frequency is selected as a standard for a given geographic region to keep it away from frequencies assigned to communication or other services. For example, IF is 455kHz for the AM bands in the US, while it is 468kHz in Europe. Remember that when you are aligning the IF filters in your Grundig or other European radio! There are a few problems, however. In the process of mixing or heterodyning, another signal is also generated of the same intermediated frequency:

$$Fo - Fs = IF$$

Or, looking at this equation from the antenna input side, the frequency of the other received radio signal Fs = Fo – IF If the local oscillator frequency Fo is set to the same 7MHz as in the previous example, and the IF is 500kHz, then our radio will also receive another station operating at 6.5MHz. This unwanted signal of "mirror-image frequency" always differs from the wanted one by 2 x IF. The common methods of avoiding this inconvenience are to increase the IF so the image frequencies are far apart and the antenna tuning circuit can selectively dampen the image signal, and/or to add a tuned antenna amplifier to improve the selectivity before the converter stage.

The reason that my first radio received each station at two settings of the tuning dial was due to the low 128kHz IF. The short-wave resonant circuit was unable to sufficiently dampen the image signal shifted by only 256kHz, while in my father's modern radio with a 468kHz IF, the mirror-image frequency was 936kHz apart, so it was easily rejected by the antenna tuning circuit.

The ultimate but more expensive solution to the problem is to use dual conversion, which is employed in higher-class communication receivers. The dual conversion receiver has two heterodyne stages, producing two different intermediate frequencies, IF1 and IF2. The first heterodyne is a tuned converter stage, similar to these used in the common superheterodyne radios. What differs in the dual conversion radios is a much higher intermediate frequency IF1, usually about 3MHz. That moves the image signals by 6Mhz apart and the antenna tuning circuits preceding the converter can eliminate them easily. Using a second heterodyne stage, with its local oscillator permanently tuned to produce a differential IF2 signal of a much lower frequency, typically 455kHz, compensates the deterioration of gain and selectivity caused by the 3MHz IF1 filter, so the following IF2 amplifiers exhibit good performance in the required bandwidth.

Example - the 1st tuned heterodyne:

$$Fs\ (9MHz) - Fo1\ (6MHz) = IF1\ (3MHz)$$

The 2nd, constant frequency heterodyne:

$$IF1\ (3MHz) - Fo2\ (2.545MHz\ constant) = IF2\ (455kHz)$$

This eliminates the image frequency signals. However, a new problem has been created. The major sources of audible noise in the old superheterodyne receivers are the converter tubes. The typical multi-grid converter tube generates about 40 times more noise than a common pentode. When two consecutive vacuum-tube converter stages are employed, as in my old Hallicrafters SX-71, the noise level is high. Fortunately, the noise level produced by semiconductor heterodynes is much lower, and the audible noise in modern solid-state analog communication receivers is negligible.

In my vacuum tube Hallicrafters SX-71 dual conversion communication radio, IF1 = 2.075MHz, IF2 = 455kHz. In the solid-state Panasonic RF-2600 the intermediate frequencies are: IF1 = 3MHz, IF2 = 465kHz.

In both receivers there are tuned radio frequency amplifiers preceding the first converter stages. It improves selectivity and the signal-to-noise ratio, and the mirror-image signals are unnoticeable.

The Panasonic RF-2600 dual conversion radio

Oxybenzylmethylenglycolanhydride

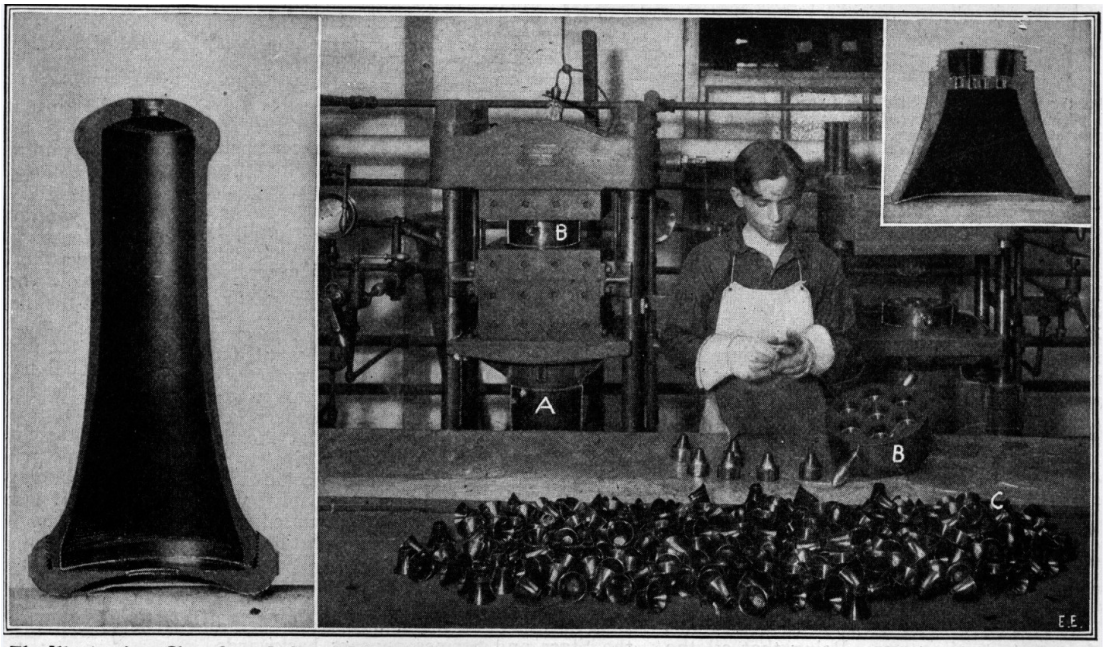
By

A re-print that was originally printed in the March, 1917 issue of "The Electrical Experimenter" submitted by CRC member Steve Touzalin

With a cunning surpassing that of the alchemist of old, the modern chemist combines two strong smelling liquids to form a solid that is utterly devoid of color or taste. Under conditions known to that deft magician – the chemist – those two odorous and unpromising materials, carbolic acid (Phenol) and formaldehyde, unite and form a transparent, amber-like solid (Oxy-benzyl-methyl-englycol-anhydride), better known as BAKELITE.

Bakelite is a condensation product of carbolic acid and formaldehyde. In its final form it is a hard, amber-like substance, having none of the chemical characteristics of the raw materials from which it is made.

Bakelite has no melting point, but at temperatures in excess of 575°F. (300°C.) gradually carbonizes and disintegrates. It is not merely a mixture, like compounds of rubber, shellac, or resin, which have characteristics of their components. Bakelite is an American invention, the process having been originated by Dr. L. H. Baekeland, already widely known by his discovery of so-called *gas-light* photographic papers, notably Velox.



The Illustrations Show from Left to Right—Section of a Moulded "Bakelite" Telephone Receiver Shell; Process of Moulding "Bakelite" Transmitter Mouthpieces, "A" Being the Hydraulic Press and "B" the Multiple Moulding Die; Upper Picture Shows Section of a Mouthpiece.

Molded Bakelite finds great favor in the electrical field as an insulating material – it is hard and strong, has great electrical resistance and successfully withstands high temperatures. Water, steam, oils, solvents and most chemicals have no detrimental effect on it.

Exactness of shape and size is characteristic of Bakelite molded insulation. Every piece comes from the die exactly like every other piece; the edges and lines are sharp and clean and the piece fits in place as in interchangeable machine construction.

Because of its permanence and chemical inertness, this new insulator is the ideal material for electrical instrument construction. No acid-sulphur compounds are emitted as in the case of hard rubber, nor does Bakelite turn green, or bloom. The finish, too, is all that can be desired – it comes from the mold with a beautiful luster and with every detail and relief sharp and clean; no buffing is necessary.

This remarkable insulation meets every requirement for molding in metal inserts. The inserts are in to stay, securely and accurately positioned when the piece comes from the mold. To put metal inserts in hard rubber or fibre requires drilling, tapping, and fitting – a slow and expensive process. Molded Bakelite can readily be machined and polished. Each of the standard colors – brown, red, and black – is rich and handsome in appearance.

Bakelite has many valuable qualities which make it especially for mechanical pieces, sometimes made as die-castings. It is strong and light – weighing only about one-third as much as die-castings and has a specific gravity of 1.35. The beautiful finish is permanent; there is no enamel or other surface coating to wear off, no plating or japanning. It is moreover extremely homogeneous, the same all the way thru. Unlike many die-cast alloys, Bakelite does not lose its mechanical strength or deteriorate with age. In a critical time test with a

gear made from Bakelite-Micarta driven by a steel pinion, practically no wear was evidenced after 20 months' service. The speed of the special gear varied from 560 to 1100 r.p.m.

The new insulation in the form of sheets, rods, and tubes is fast taking the place of hard rubber, fiber, pressboard, and similar materials. It combines high dielectric strength and heat resistance with unusual mechanical strength. It is hard, tough and homogeneous and fairly flexible. Supplied in sheets, rods, and tubes of standard sizes it can readily be machined to any required form. Standard colors are brown and black.

Telephone apparatus has benefited greatly by the advent of Bakelite. The accompanying illustrations show a sectional view of a Bakelite receiver shell as well as a section of transmitter

mouthpiece. The machinery shown comprises powerful hydraulic presses which press the dies together and thus form the accurately shaped mouthpieces seen on the bench in front of the operative. Here “B” represents the die, “A” the hydraulic press, and “C” the molded mouthpieces.

The new Bakelite receiver shell is without a doubt the most perfect receiver shell to-day. It is a great improvement over the old style hard rubber and composition shells and has none of the disadvantages of either. It will not turn green from age or lose its luster. It will last indefinitely which helps to reduce maintenance cost. Not only are the receiver shells made of this material but the mouthpieces and certain other parts are made of it as well. The mouthpieces can be washed can be washed and thoroughly sterilized as moisture, acids, or steam leave no effect on Bakelite.

The general physical properties of Bakelite molded material are given below. They vary according to the composition used.

Specific Gravity: 1.33 to 1.89
Temperature Resistance: 300° F. to 400° F.
Dielectric Strength (average): 250 to 425 volts per mil.
Tensile Strength (average): 3700 to 4500 lbs. per sq. in.
Colors: Dark brown, reddish brown, and black.

An important form of the insulator is known commercially as Bakelite-Dilectro. This hard marble-like material, which is used for switch panels, especially on wireless sets where the very best of insulation is demanded, has an average dielectric strength of 700 to 1,150 volts per mil (1 mil equals .001 inch) according to thickness. The insulation value increases somewhat at temperatures up to 212° F. Sheets approximately 1/8 inch in thickness have been repeatedly tested in excess of 100,000 volts.

Bakelite-Dilectro will not expand, contact or soften under the influence of heat, even up to the point of carbonization. It is not inflammable, like hard rubber or resinous materials, but will eventually support combustion if brought into contact with a flame for any length of time. It will however, continuously withstand a temperature of 300° F. without deterioration. It cannot be molded but is supplied in a number of special shapes for certain requirements, such as sheets, rods, and tubes.

BAKELITE-MICARTA is the name of a remarkable material developed a few years ago by Westinghouse research specialists. Primarily it is an insulating material, but is also a superior product for various other purposes.

Bakelite-Micarta is a hard, insulating material of high dielectric and mechanical strength, which will not warp, expand, or shrink with age or with exposure to the weather. It is infusible and remains unaffected by heat until a temperature is reached that is sufficiently high to carbonize the material. Heat does not warp it, and it will stand an electric arc better than hard fiber, hard rubber, built-up mica, or any molded insulation of resinous or fibrous material. The coefficient of expansion is low – about .00002 per degree Centigrade. It is insoluble in practically all the ordinary solvents such as alcohol, benzene, turpentine, weak solutions of acids and alkalis, hot water, and oils, and is not affected by ozone, a feature that makes it superior to hard rubber, resin, etc. for electrical purposes. It is water-resisting and non-hydroscopic. Bakelite-Micarta can be sawed, milled, turned, tapped, and threaded. It can be punched only in thin sheets and cannot be molded. It takes a good polish, and is accurate in thickness within close limits. It is made in various grades in plates, tubes, and rods, all having the same general characteristics, but differing in specific points to adapt them to different kinds of service.

The Bakelite-Micarta plate is made in various grades, having different characteristics. Each grade is designated by a number.

For instance the No. 213 plate is the standard one and is tan in color. It is useful for all applications where high mechanical strength is required, or for general application, on account of its electrical and mechanical qualities. For short periods it will stand temperatures as high as 140 degrees Centigrade and has a breakdown voltage of approximately 400 volts per mil. It will stand continuous service at 25 to 50 volts per mil. Its specific gravity is 1.25, its tensile strength approximately 19,000 lb., per square inch with the grain, and its strength under compression approximately 40,000 lb., per square inch across the grain. It can be sawed to size and drilled and tapped against the grain; it can be punched with simple dies in thickness up to 1/8 inch. It is furnished in sizes from 1/64 to 2 inches thick, up to 36 inches square. No doubt about it – Bakelite fills a distinct want in the commercial electrical field.

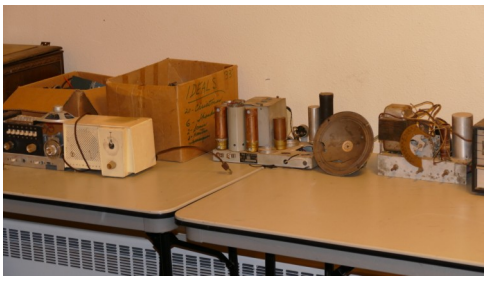
Photos from the last meeting.

Great turnout

What did you say?

Merrill's Grandson talks about his radio.

Raffle Table



Raffle Table

Raffle Table

Tam Pouliot talks about a wood filler that he has good luck with.

Bill Eccher talks about modifications he has made to this tube tester.

Tom Zaczek talks about his radio restoration—Great Job.

Club officers at work

Steve Touzalin gets an award for service to the club.

The Open Trunk

Member submitted advertisements

REPAIR SERVICE:
Radio repairs for club members. Reasonable rates. Good references.
Call David Boyle
303-681-3258 11/09

For Sale: by Dave Boyle
Most of the following instruments have been completely refurbished, repaired as needed, and calibrated. Most have manuals and test leads.
Prices are negotiable...please make offer.

1) Eico 5 inch oscilloscope. Model 425. Perfect for old radio repair work. Completely electronically rebuilt with **new CRT**! $68.00
2) Eico "Professional" VTVM, 6 inch meter $40.00
3) Ballantine Labs. Model 321 VTVM. True RMS and p-p measurements. 19 inch rack mounting $25.00
4) Eico Capacitor and Resistance tester. Model 950B, tests all values and other capacitance functions.
Uses a tuning eye as an indicator $65.00

Radio Chassis For Sale:
1) RCA Radiola Model, 80,82, 86 complete dual chassis and mounted speaker. VG condition, with tubes including 2ea VG 45 tubes. Make offer.
2) Philco Model 91. Complete *working chassis* with 12" good speaker. Working tuning meter too!
Make offer.
3) Philco Model 37-610 complete chassis with tubes, good condition complete with bezel and glass.
Make offer.

Call David Boyle,
303-681-3258 09/15

Wanted: 1920's Wooden Horn Speakers and a Crosley Musicone Speaker.
Also 1920's battery sets, especially Neutrodyne sets, Pre 1930 AC Radios and a Crosley Widget Console Radio
Michael O'Leary 602-354-7011
moleary9@cox.net.

WANTED: To buy: 1948 Motorola 5A9B portable radio, Maroon color. Good condition only.
Dewey Reinhard 719-596-5516
deweyfly30@gmail.com
WANTED: Broadcast or recording mics, especially from 20's to 1950's.
Crosley Pup Info
NBC chimes, all eras.
Tom Keeton **303-797-8073**

For Sale: Patterson PR-10, 1933 Amateur Radio Receiver.
10 tubes, fully electronically restored.
View on the internet.
Best reasonable offer.
David Boyle. **303-681-3258**

I have collected radios of all types for 30 years and now it is time to let them go to new homes.

Please call me for an appointment to see if any of them would fit in your collection.

I have tube radios including Tombstone, Cathedral, and Novelty etc.

I also have a large collection of transistor radios both shirt pocket and Novelty type.

Please call 303-238-1384
Thanks in advance,
Ron Smith

RADIOS4US@aol.com

For Sale: Rare 1927 Victor 9-54 Radio / Phonograph in a magnificent Walnut Cabinet.
Original, unrestored condition. For details and pictures please see this website:
www.pier52.net/victor954/
Mark Whalin
mark@pier52.net

WANTED to buy: 1980s Atari 520 or 1040 ST computer components (keyboard, monitor, etc.). I still need it for several specialized programs I wrote including a simulator for transistor and tube circuits.
Dave Laude dlaude1@msn.com

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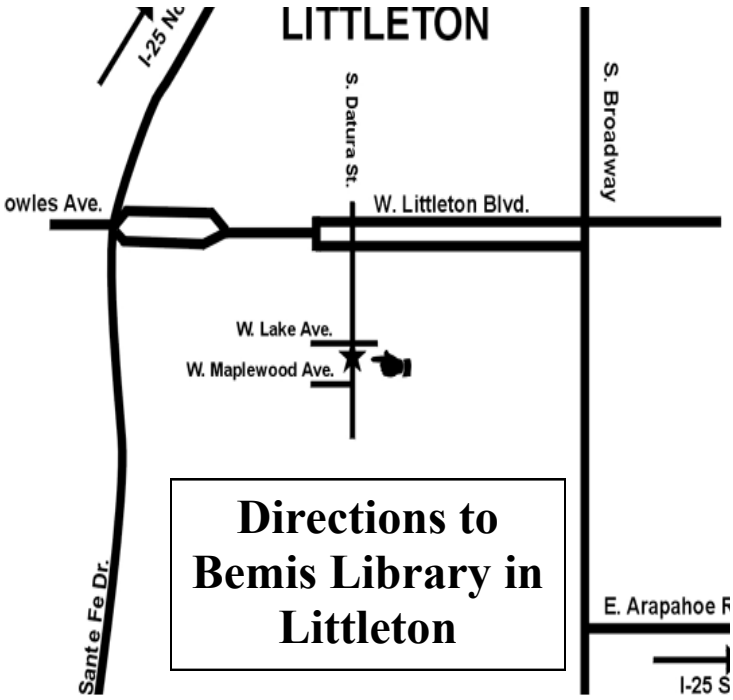
Castle Rock, Co.

SUBMISSION OF ARTICLES &AND ADVERTISEMENTS

Classified Ads for The Open Trunk and articles of any radio/electronic or historical related subject to be published in the Flash are encouraged and welcomed. The article(s) should be submitted in Microsoft Word, RTF, or as text cut/paste into your email. Submit to Steve Touzalin by email at: stevetou@comcast.net or by postal mail to 417 So. Queen Circle, Lakewood CO 80226.

Formatting isn't necessary, but if you do, set the font to Times New Roman, size 10, left justified. If you have graphics (.jpg files) to be inserted, please name them and be specific about how you would like them placed. We will do our best based on space limitations.

The January 10th 1:00 meeting will be at the Miller Library in Castle Rock



Directions to Bemis Library in Littleton

Directions to Miller Library in Castle Rock

From I-25: Take the Plum Creek Parkway, exit #181.

Turn East onto Plum Creek Parkway. Turn Left (North) onto S. Wilcox Street and continue north 2 tenths of a mile.

The Philip S. Miller Library is on the east side of the street at 100 S. Wilcox St.

The building is towards the back of the parking lot, past the Dairy Queen.

Topic for this meeting
Find a Volunteer to continue with the Newsletter
Prepare for March Show/Vintage Voltage

Colorado Radio Collectors
Antique Radio Club
417 S. Queen Cir.
Lakewood CO 80226

FIRST CLASS MAIL