Indiana Historical Radio Society

BULLETIN

Vol. 10 April, 1981 No. 1

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245 N Oakland Ave, Indianapolis, IN 46201

FOR INFORMATION WRITE TO:

Vice President - For legal matters of the I H R S.

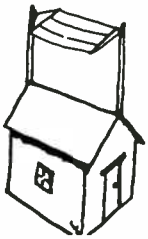
Secretary - For general correspondence and membership applications.

Treasurer - For membership payments and address changes. (1981 I H R S membership dues are $6.00.)

Historian - For history of the I H R S and for donations of material for the Society Scrapbook.

Please use a Self Addressed Stamped Envelope when corresponding.

the President's Corner



Once again, the Big One -- The Auburn Meeting is just around the corner. Mark your calendar -- May 9. The Auburn-Cord-Duesenberg Museum, Auburn IN, will be the location of our meeting. See the details of the meeting in this bulletin.

Don't hesitate to take advantage of the Hospitality Room at the Starlite Motel in Auburn. It will be available on Friday, May 8 and Saturday, May 9. Do stop in and socialize for awhile before and after the activities.

This time, two additional features will enhance the meeting. In addition to our regular auction, the collection of Joe Duray is being offered. Joe was a discriminating collector and I'm sure the addition of his material will make our auctions even more appealing.

Now, for the other feature. Just in case you were debating as to whether or not to enter a set in the contest -- DO! This year -- for the very first time -- the beautiful "Best of Show" trophies donated by Glen Rogers and the late Ron Scranton will be awarded. These were on display at the Indianapolis Meeting in February, and they are beauties! Only IHRS members are eligible, however. See this bulletin for details. So -- get those sets polished up and go for the big one!

The Committee has been very busy working to make this Meet bigger and better. We are all anxiously waiting to see what they have in store for us.

Have a safe trip and we'll see you in Auburn.

73

Don Johnston

I H R S MEETING SCHEDULE - 1981

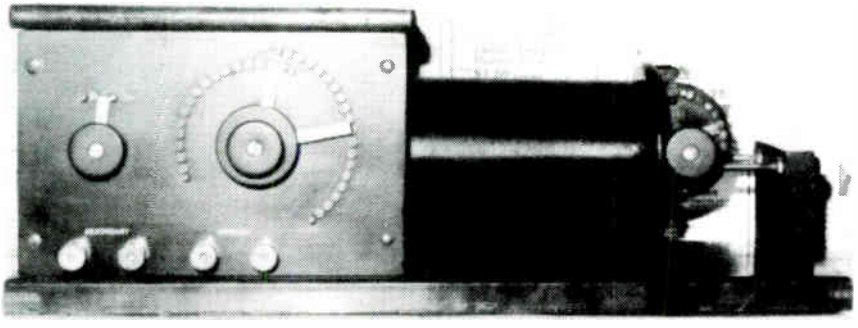
Auburn, Indiana
Friday, May 8 and Saturday, May 9, 1981
(See program in center of this Bulletin.)

Logansport, Indiana
Saturday, June 27, 1981
Members can look forward to another great pitch in lunch, plenty of swap space, and a popular vote contest.
For the contest, bring:
Ugly Radios (like the repwood Crosley)
Crystal Sets
Zeniths
Age limit to 1950 on contest items.
Meet at the Riverside Park Pavillion, Logansport, Indiana. Frank Heathcote, host.

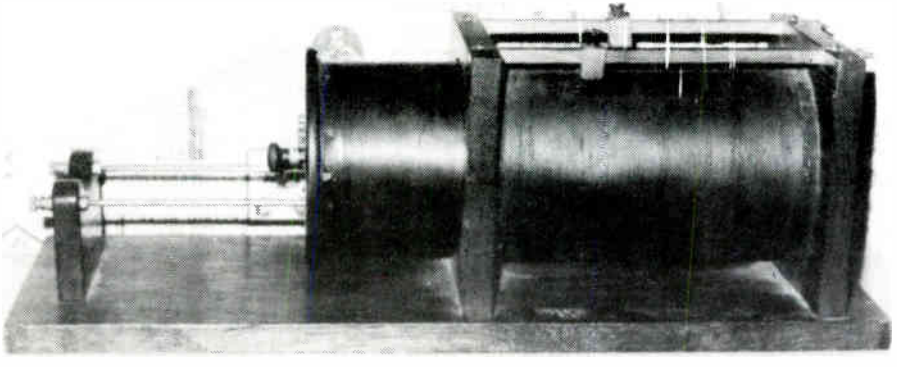
Richmond, Indiana
Saturday, September 19, 1981
Lionel Haid, host.
Mark your calendar now!

I H R S WINTER MEETING - INDIANAPOLIS

Approximately fifty I H R S members, friends, and visitors attended the I H R S Winter meeting last February. (Gave Bonanza the best Saturday business they have had in years). The day consisted of an active swap and sell, good companionship for lunch, a short business meeting and a demonstration of a scanning disc TV system by Ed Taylor. During the business meeting Glen Rogers presented the "Best Of Show" trophies to be awarded at Auburn this year. (See page 16 of this Bulletin.) Turn to the following page for more information on the scanning disc demonstration.



Loose Coupler on display at Indy - Glen Rogers



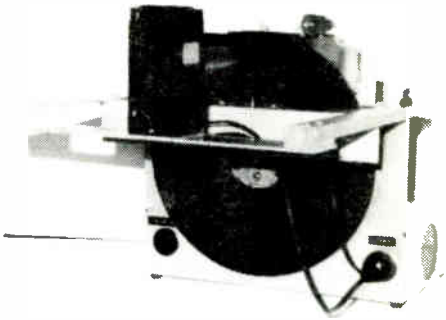
Loose Coupler on display at Indy - Fred Prohl

PIONEER TELEVISION

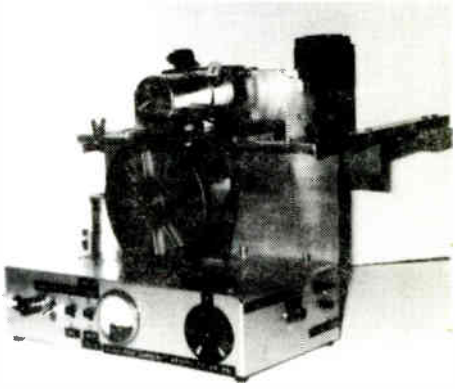
SCANNING DISC TELEVISION

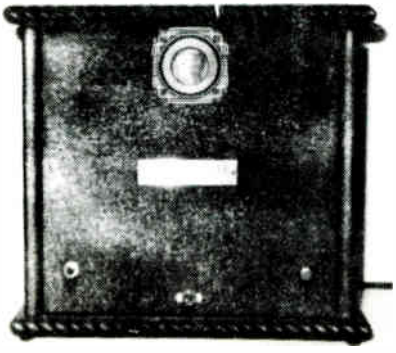
There has been some discussion as to the first successful demonstration of television. The names of C. Frencis Jenkins, in the U. S., and John L. Baird, in England, are closely associated with the early work in radio television. A "revolving wheel haveing holes arranged therin in a spiral line" was patented in the U. S. by Nipkow and Sutton in 1884. This was apparently the first "scanning disc." It was used in connection with a selenium cell in an early attempt to see by means of electricity. Jenkins employed a spiral scanning disc in 1923, and has the priority patent rights on radio television in the United States.

"Radio Theory And Operating"
M. T. Loomis - 1930



The Scanning Disc System that Ed Taylor has constructed had it"s beginnings a number of years ago when Ed had his father drill discs for such a system. Over the years since then Ed has gathered materials, knowledge and the finally the time to assemble a system. The resulting system combines current technology with the technology of sixty plus years ago. Ed is willing to provide specific information to those that send him a SASE with their request.

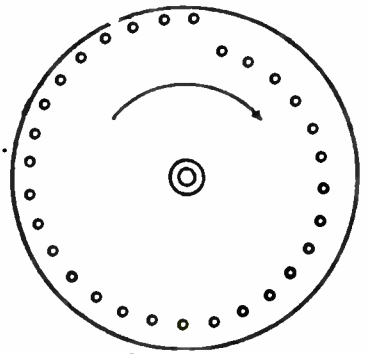




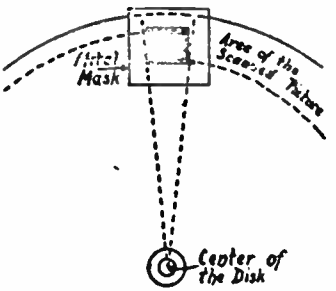
EXPERIMENTAL MECHANICAL TELEVISION

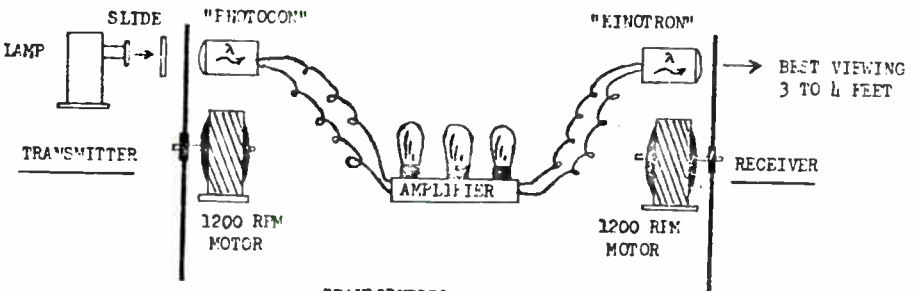
1920
BAIRD
JENKINS
ALEXANDERSON
IVES
SANABRIA
PECK

1980
McINTOSH
LOZIER
TAYLOR
INGRAM
BREWSTER
BURGESS



—The Nipkow Scanning Disk.





"TAYLORVISION SYSTEMS"
SPECIFICATIONS

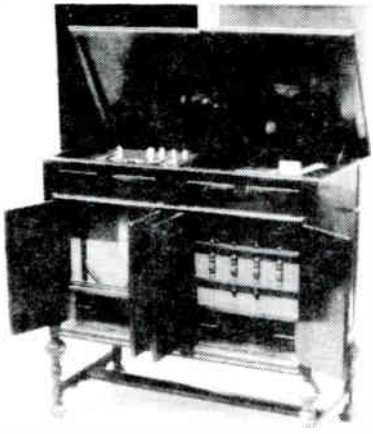
10" Scanning Disc
25 Hole Spiral
20 Pictures per Second
1" Picture Size
Beau Electronics Co. Synchronous Motors
"PHOTOCON" : Motorola Phototransistor MRD-300
"KINOTRON" : Data Display Products. LED 200-B-CR
Solid State Amplifier & Power Supply

ED TAYLOR RADIO MUSEUM
245 N. Oakland Avenue
Indianapolis, IN 46201
(317) 638-1641

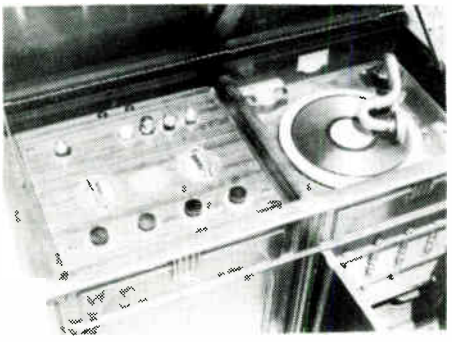
RADIOLA 20 COMBINATION

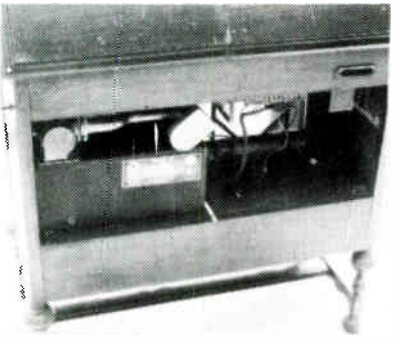
How many times has fate played a major role in your acquisition of an item for your collection? Several years ago my son Eric made an RCA AC audio amp from parts in our junk box, but we didn't have the two metal rings that press into the panel around each tube. During a visit to Ron Scranton, we noticed that there were five of the rings we needed on a Radiola 20 chassis with a phonograph panel he had, so we traded for it, took off the two rings, and completed Eric's AC.

Two years later, Eric noticed an ad in the Indianapolis Star offering a "Radiola 20 Phonograph". Inquiry revealed that it was indeed a radio-phonograph combination produced originally with a Radiola 20, but someone had removed the radio leaving a large hole in its place. I thought "No problem. I'll just drop my panel in there."



We brought it home and I hunted up the radio to install, but it didn't fit! It was exactly the right width but about 3/4 inch to long from front to back. (Luckily too large rather than too small.) So, I removed everything fron the panel and sawed a little off both front and back and presto -- a completed radio-phonograph.





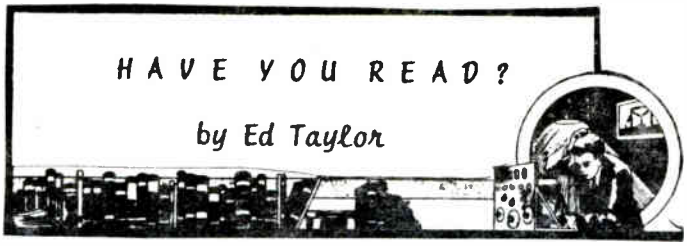
I have seen a number of RCA Victor radio-phonograph combinations and many ads for the same, but they always have been for the catacomb superhet receiver, so I was surprised to see the panel when Ron had it, and never expected to find the phono for it. And then I find that there were at least two models of it!

Figure 1 shows the complete combination and Figure 2 shows the radio and phonograph units, with the horn changeover switch lever at the extreme right front. Figure 3 shows the speaker driver above the Radiola 20 name tag. The slot at upper right is for aerial and ground access when the back panel is in place.

I think these early radio-phonograph combinations are intriguing, and if they weren't so darn large I would aggressively search for them.

Oh yes; now we are looking for two of the brass rings again!

Walt Sanders
15 Todd Place
Terre Haute, IN
47803



"ILLUSTRATED HISTORY OF PHILIPS RADIO VALVES TO 1935"

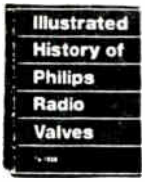
Compiled by Fin Stewart

This work is beautifully illustrated by 37 photographs of 57 tube types and printed on heavy, glossy paper.

Starting with the Philips Co. making light bulbs in 1891 and radio tubes in 1918, many variations are listed from the smallest receiving tube to large rectifiers and transmitting types. In all some 285 tube characteristics are chronicled.

As the author states,"This book has been prepared for the education of tube collectors, museums, radio technicians and the like". The author has a lively running commentary including how Philips tubes are numbered. These numbers and letters may be used to identify the type and use.

This 32 page booklet is available from IHRS member FIN STEWART, 673 Great Western Highway, Faulconbridge N.S.W. 2776, Austrailia. $5.50 surface mail or $8.00 airmail.



Auburn

IHRS - AWA

1981

INDIANA HISTORICAL RADIO SOCIETY
and the
ANTIQUE WIRELESS ASSOCIATION

Regional Spring Meet, Saturday May 9, 1981 - Auburn

At the Auburn - Cord- Duesenberg Museum

Schedule Of Events:

Friday, May 8 - 6:00PM Early registration at the Starlite Motel.
7:30PM Old Time Movie, Starlite Hospitality Room.

Saturday, May 9 - 9:00AM Registration ot the Museum.
Swap Meet, in the South Parking Lot.

10:00AM Register items for the afternoon Auction.
Register items for the Old Equipment Contest. (Both must be registered by 12:00 noon.)

10:00AM Open sale of donated equipment for the I H R S Museum Fund. (Your chance to move surplus parts and sets for a good cause.)

1:00PM AUCTION OF PERSONAL ITEMS. A 10% donation is asked for the Museum fund.

4:00PM Contest Judging, Jerry Hueber, Chairman.

6:00PM Reception at the Starlite Motel Hospitality Room.

7:00PM The I H R S and A W A Spring Meeting Banquet at the Lucky Steer Resturant.

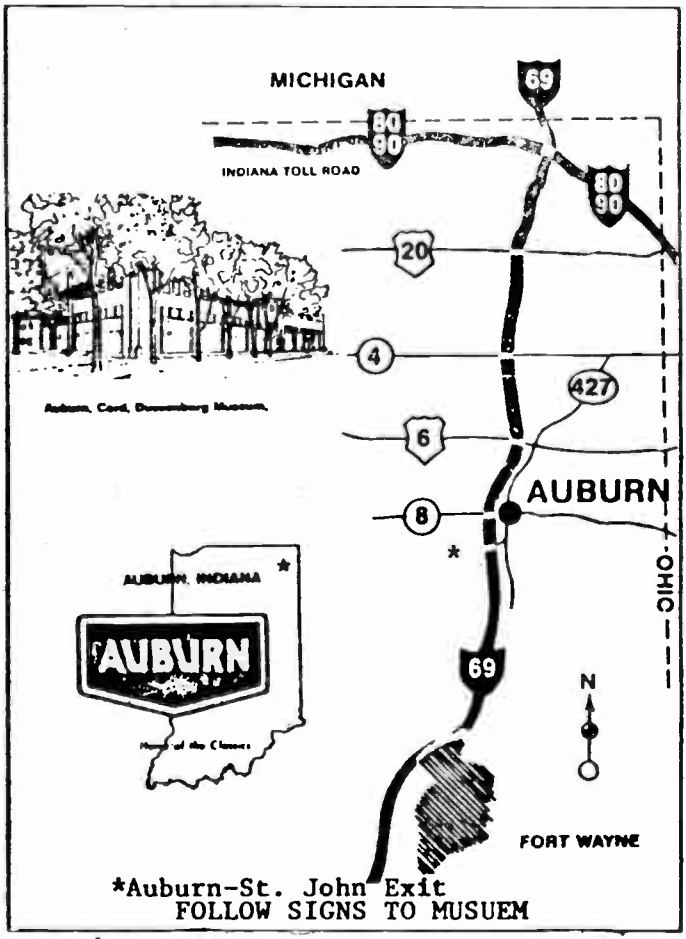
THE BANQUET - The Old Equipment Contest Awards and Best Of Show Trophy will be presented. The Program for the evening is "20 Days In Exotic Red China". Shown and narrated by Julian Stark.
Pre-registration for the Banquet must be received before May 5, 1981. Banquet and registration fee $12.00. Museum and meet registration fee only (excludes banquet), $2.00 at the door. Make checks payable to I H R S and mail to Ross Smith, 1133 Strong Avenue, Elkhart, Indiana 46514.

Old Equipment Contest Classifications -

1. Playing Battery Receivers, pre-1928 (must operate on display). Antenna and ground provided.
2. Playing AC Receivers, Pre-1940. Antenna, ground and 120VAC provided.
3. Non-playing Receivers with six or more tubes, AC or DC, commercial manufactured.
4. Non-playing Receivers with six or more tubes, AC or DC, Homebrew.
5. Pre-World War I Wireless Gear - open transmitters, keys, receivers, crystals, loose couplers, detector boxes, slide tuners, etc.
6. Radio publications:
    A. Pre-1926 Catalogs.
    B. Pre-1926 Magazines.
7. Vacuum Tube Display, Transmitting and Receiving:
    A. DeForest
    B. Western Electric
    C. Arcturus

Please make your own motel reservations at the L&K Motel 800-447-4470 or the Starlite Motel 219-925-0500, both are on State Road 8 West, Auburn Indiana 46706.

Indiana's
Auburn·Cord·Duesenberg Museum
AUBURN, INDIANA 46706



MAKE MOTEL RESERVATIONS NOW!

L. K. Motel, I-65 & US 27, Auburn, Indiana 46706
Phone 1-800/447-4470

Star-Lite Motel, 936 West 7th St., Auburn, Indiana 46707
Phone 1-219/925-0500

SHADES OF THE PAST

I enjoyed reading the article on the early days of the Purdue radio station - 9YB and seeing the picture of the operators sent in by Noah Pearcy of Gainesville, Florida. In the photograph was my old high school friend from Goshen, IN who graduated in 1921 and went to Purdue to study engineering, Jerry Raffensperger.
I wrote to Jerry and sent him a copy of our Bulletin. He and his wife reside in Henry, Ill., but were spending the winter in Naples, Florida.
I have been told that Jerry and another station operator were the first to broadcast a live football game from the field at Purdue University. A telephone line was set up between the field and the broadcasting room in the EE building, and a play by play description was given by the man on the field to the one in the studio. At the half time the men exchanged places so that got to see the game.
9 Y B later became W B A A, Indiana's oldest broadcasting station.

Marshall Howenstein

* * * *

Thankyou Glen Rogers for the loan of an electric typewriter for Bulletin use.

* * * *

Worth Reading:

In the April 1981 issue of IEEE SPECTRUM is an excellently written article, with 6 illustrations, by IHRS member Alan Douglas.

This is a history of the crystal detector with special emphasas on Greenleaf Whitier Picard and his research which let to the PERIKON detector.

****
* Indiana Historical Radio Society *
* member Bob Hanlon passed away *
* January 14, 1981. *
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NEW! FOR THE I H R S SPRING MEETING - A BEST OF SHOW TROPHY!

To qualify for the BEST OF SHOW award the radio article must have won a first (best) in it's class at the Indiana Historical Radio Society's spring meeting.

Only members of the I H R S are eligible for this award. Members must indicate their desire to enter BEST OF SHOW contest on entry blank at the time the article is entered in the show.

The winner of award shall agree to display the winning radio article at a designated location (museum, etc.) from the winning date until after the Labor Day Holiday of that year. Officers of the I H R S by majority vote may waive this requirement under circumstances deemed necessary by them.

BEST OF SHOW radio article can be a one time winner only. The winning radio article may never again be entered in this contest. The owner of the winning article may, however, be eligible for future entry(s) with another item(s).

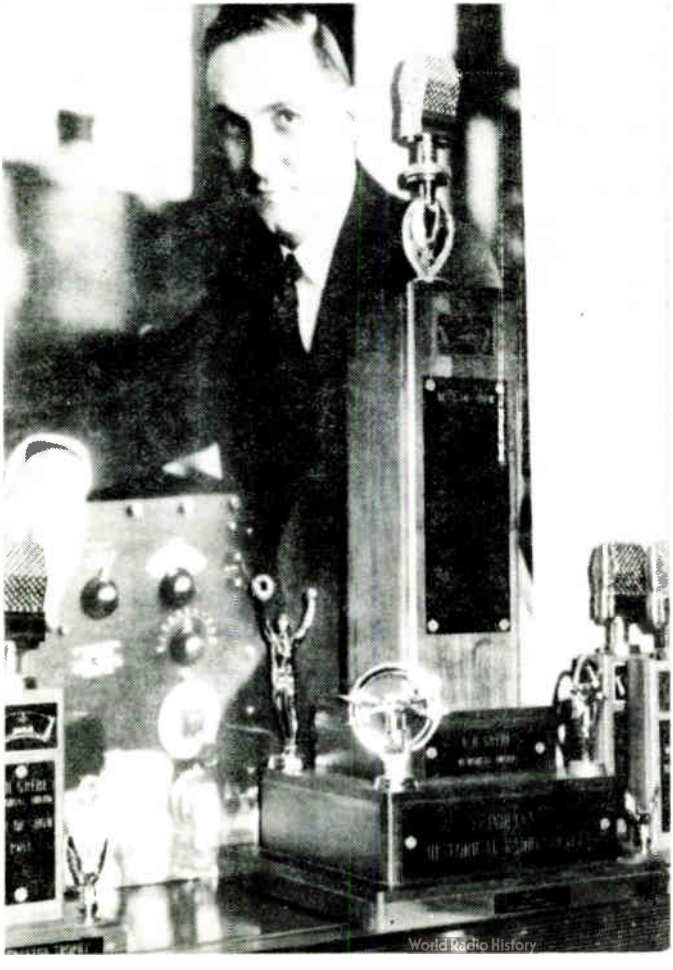
Judges of this award shall be members of I H R S for at least three(3) years. There shall be no less than three(3) or more than five(5) judges. Judges may not cast a favorable vote for eligible items owned or entered by them. They may, however, abstain. In the case of a lack of majority, the President of I H R S or member designated by him shall cast a vote to create a majority. The decision of the judges shall be final and no appeal may be made except on evidence of a misrepresentation on the entry or fradulent owner entry. If fraud or misrepresentation is proven to the satisfaction of the judges, they shall rejudge the remaining articles and select another winner and the original winner will be disqualified.

BEST OF SHOW AWARD continued:

Donors, Glen Rogers and Ron Scranton, shall not be eligible for entry of this award.

The large trophy will remain on display with the winning article and the miniature trophy will be permanently awarded to the owner of the radio article. The large trophy shall be enscribed with the name of owner and winning article along with the year date of the award.

Rules listed shall be in effect for two years from the time of the first year of the award. Rules may be changed after that period of time by consent of the donors and/or majority vote of the officers of the I H R S.



The Best Of Show Trophy for the IHRS Spring Meet.

A REPORT FROM AUBURN

At Auburn, Indiana, May 9th, we will have our largest Auction ever!
Items being offered at this Auction include 36 complete early Radios; 23 Horn and Cone Speakers.
We have four AK 20's, W.E. 13A four tube amplifier, three tube Kennedy portable, WWI W.E. Field Telephone, Fleming shocking machine (quack) Harris Physicians battery, G.R. frequency bridge.
Thirteen pieces of early test equipment, some of it military, both receiving and transmitting; many early Radio Magazines, Crystal Sets, Phones and Variometers.
There are many chassis, parts, empty cabinets and boxes, assorted parts, horns with out drivers, several separate drivers, goosenecks and bases.
Due to the large number of items, many of the incomplete receivers, chassis, parts, etc., will be sold in the morning at the flea market tables.
The complete receivers, speakers, test equipment, will be sold at the 1:00PM auction.
Be sure to tell Museum Personnel at the door that you are members of I H R S or A W A, and you will be charged only the group rate of $2.50. Otherwise the admission charge is $3.50.

If you have not been to the Auburn-Cord - Duesenberg Museum, you will enjoy seeing over sixty of the Classic and Historical cars in addition to the I H R S Museum.
Do hope to see you at Auburn!

Co-Chairman, Ross Smith and
Del Barrett

PARTIAL LIST OF ITEMS
FOR THE AUBURN AUCTION

SPEAKERS
Radiola 100 ok
Radiola 100 open
AK F7
Radiola 100A ?
Philco Horn ?
AK mod E ok
Radiola Needlepoint-rough
Temple Open
AK Drum
Crosley type F
AK mod L ok
Tower Horn open
Camco 66H ok
AK mod L no driver (4)
American Electric
Northome Cone

RECEIVERS
Crosley 5-38
3 tube Kennedy Port.
AK 35
AK-20 compact (3)
AK-20 large
Homade Neutrodyne
AC Dayton XL20
Radiola VIII
King 5
Fada Neut.
Freed Eismann
SC Dayton XL10
AK mod 47
Apex - 5 tube
Crosley 3R3

MISCELLANEOUS
AK Unisparker 1904 patent
Fleming shock machine
Harris physicians battery
Gen Rad Freq Bridge
Loop antenna
Jansky-Bailey ?
14 pcs test equip
Early Triplett tube tester
Small Mike (novelty)
WE field telephone w/ringer
Radio magazines
Tubes
Tuning condenser in case
Philmore Xtal Rec.
2-Variometers on board
Weston ammeter
Reliance ammeter
WE amp 13A w/tubes

FEATURE FATHER OF INDUSTRY

Guglielmo Marconi, b. April 25, 1874

Marconigram—synonomous to radiogram, a message transmitted by radiotelegraphy.

Marconi, Guglielmo Marchese (1874-1937). If one could envision an idyllic childhood set in the picturesque hills of northern Italy, and great thoughts of an attentive young boy, one would be imagining the beginnings of the world-reknowned Guglielmo Marconi.

Born in Bologna, the second and youngest son of a well-to-do banker, Marconi grew up in the company of university professors—friends of his father. Some of the professors were his tutors.

At age 14, after reading and hearing of Samuel Morse's inventions, Marconi independently developed an intense interest in the science of electricity. Driven by the thought of making universally practical the discoveries of Samuel Morse, Heinrich Hertz, etc., he put together in 1894 a wireless transmitter which consisted mainly of a telegraph key, an induction coil (to produce a voltage charge), and a spark gap.

Determined to find a practical meaning for his experiments, Marconi set out to dispel the pessimistic line-of-sight predictions of the day. By using his new technique to "attach" radio waves to the ground, he thereby prevented them from shooting off into space. Differing from his contemporaries, Marconi connected terminals to two antenna wires: one elevated well above the ground, the other buried deep into the moist earth. Using this method, he was able to send his "grounded waves" around the earth's bulge to previously undreamed-of distances.

At first Marconi's experiments received little encouragement. The test equipment and manpower involved was too expensive for his family and too risky a venture for the Italian government to invest in. Thus, in 1896, Marconi moved to England where William Preece, a prominent engineer and official, helped him win recognition.

Marconi's epoch-making installation of transatlantic transmission (which ensured him lasting fame) was realized in 1901. On the American coast of Newfoundland, he stood with two other gentlemen (George Kemp and Phil Paget) waiting—for a time it seemed in vain—to receive the signal from England, the Morse code letter "S." Finally, they chanced to adjust the receiving pole and placed it even higher. Amidst the wind and rain beating the barren American coast, the signal "S" was received—and then again, and again!

Guglielmo Marconi, we honor you this month as a most important contributor to our systems of world-wide communication.

Happy birthday, Guglielmo.

★ ★ RADIOADS ★ ★

FOR SALE: AK 21, AK 41, Crosley's 50, 51, 4-29, Echophone V-3, Dayfan OEM-7, Zenith Transoceanic, 201A tubes - tested $4.00 each. SASE for list of other radios, tubes, speakers and literature. Al Jochem, 2047 College Avenue, Quincy, ILL 62301.

FOR SALE: "United Unidyne" Four tube and rheostate panel set combination with crank phonograph. Radio uses phone horn. Good working condition - $200:00. Bill Wiley, 968 West Market, Akron, Ohio 44313

WANTED: Old Electro-Medical and Quack devices and literature. O. Lindan, 1404 Dorsh Rd., Cleveland, Ohio 44121

WANTED: Folowing parts for restoration completions: National SW-3 coil sets. Carborundum detector equalizing unit. AK variables for BREADBOARD, or at least cans for two such. Full information please. All offers answered. Thanks, George Haymans, Box 2478, Gainesville, GA 30503

WANTED: Junker Radiola IIIA panel and case - can be poor condition. FOR SALE: Scott allwave 15 receiver chassis, amplifier, power supply, speaker tubes and working. Good chrome finish. No cabinet reprint instruction manual and technical service data. $150.00 plus shipping. Herb Balmer, 610 North 14th Street, Marysville, KS 66508

WANTED: Still need badly a Sonatron 3 tube resistance coupled Amplifier. G. B. Schneider, 6848 Commonwealth Blvd., Parma Hgts, Ohio 44130

ZINCITE DETECTOR

(PATENTS PENDING)

Here is a detector which has been especially developed by us for the new Crystodyne circuits. This detector while using the natural mineral zincite can be used with any other crystal as well. Several unique features are embodied in this detector. To begin with it is the only detector that has a sliding crystal cup with perfect contact arrangement and which cup not only slides but rotates with an eccentric motion. (Note slot A). By means of the small knob the cup slides easily so that any point of the crystal can be brought into contact. A new crystal can be inserted immediately by unscrewing the small knob. The contact plate which at the same time forms the catwhisker is made of spring steel. The combination of steel-zincite is the only one that was found practical for the Crystodyne oscillating crystal. Note the micrometric adjustment that can be made by means of the large knob bearing against the steel spring. This raises and lowers the steel point to the finest possible degree. The base is of bakelite, all parts nickel plated and polished

Ochiid Crystodyne Zincite Detector..... $1.75

Ochiid Natural Zincite Mounted Crystal especially tested for Crystodyne work, fits any crystal cup 50 60

(Note: Natural zincite is the ONLY mineral which in connection with a fine steel point will produce sustained oscillations in the Crystodyne circuits. Natural zincite is one of the most expensive minerals and the supply has been practically exhausted. It sells now from $25.00 to $30.00 per lb. In the open market. Artificial zincite, a much inferior article, will not produce oscillations at all.)

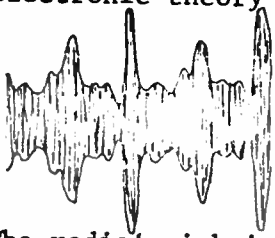
★ ★ RADIOADS ★ ★

FOR SALE or TRADE: AK 49, AK 20, Philco 84, Silvertone Cathedral, Bestone V60, Citizens Call Book Magazine and many other sets and publications. Send SASE for list 4-81. WANTED: Restorable Hallisets, Echophones, National SW3 with coils, National 1-10. Also want early crystal sets commercially made.
David McKenzie, 170 West 53rd Street, Hialeah, Florida 33012

FOR SALE or TRADE: Majestic 60-70 Cabinet page 148 Vintage Radio, Philco 14 or 91 chassis, AK L chassis parts, Sparton 589 chassis and tubes, Firestone R-316A 10 tube console, RCA 19K 9 tube console, Crosley Showbox parts. Many dial escutheons and AC set parts. WANTED: A glass or mirror radio, Steinite Mantel Radio.
Frank Heathcote, 1235 N. Third, Logansport, IN 46947

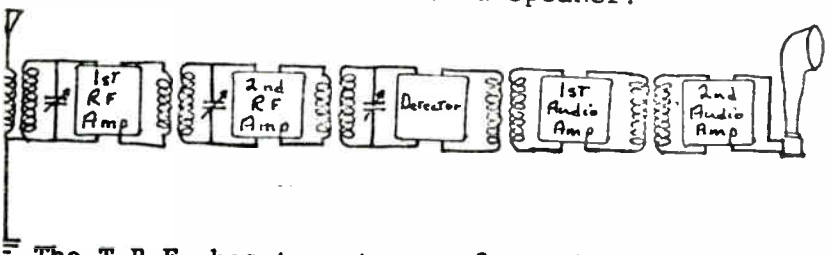
The T R F

One of the most frequent circuit designs of battery sets during the early and mid 20's was the T R F - Tuned Radio Frequency. The intent of the following paragraphs is to provide a brief overview of the electronic theory required to trouble shoot the T R F



A transmitting station radiates a carrier wave at some designated frequency between 535KHz and 1605KHz. Modulated on the carrier is the audio information (voice - music).

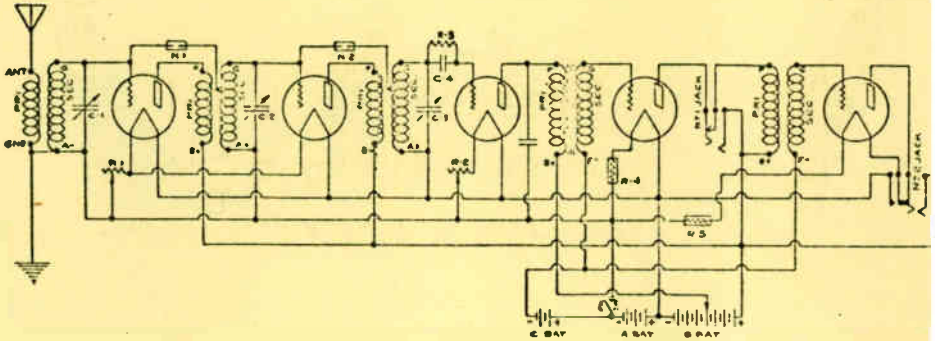
The radio's job is to receive the carrier, separate it from the other carriers, amplify the carrier, separate the audio from the carrier (detect) and amplify the audio to drive a speaker.



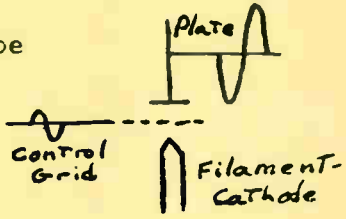
The T R F has two stages of carrier amplification (RF amplification), a detector, and two amplifier stages.

The antenna, left side of the drawing, will receive all carriers; their strength will depend on the length and direction of the antenna and the distance of the station. The first stage of tunning is at the antenna and the input to the first RF Amp. The variable capacitor and fixed inductor (coil) will resonate at different frequencies depending on the position of the capacitor. When the capacitor plates are meshed together, carrier frequencies on the low AM dial are being received. Unmesh the plates and the resonating point of the circuit will increase in frequency. The additional tuned circuits improve the selectivity of the receiver (separation of the carriers). Note that they are duplicates of the first stage.

The T R F Circuit (continued)

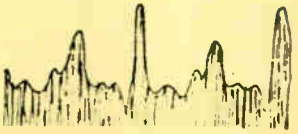


The function of the vacuum tubes between the tuning circuits is to amplify the carrier frequency. The four pin tubes, 01A's, operate with three to five volts DC on the filament and 45 to 90 volts DC on the plate. The tube amplifies when a small varying voltage on the grid (input to the tube from the previous stage), causes the plate voltage to vary at the same rate but higher voltage. The tubes control grid may be "biased" with a negative voltage in reference to common.



The resulting effect then of the first three stages is to select or tune to a carrier and amplify, tune to the carrier a second time and amplify, tune a third time and then detect (remove the carrier). The signal tie between the stages is inductive coupled (transformer coupling).

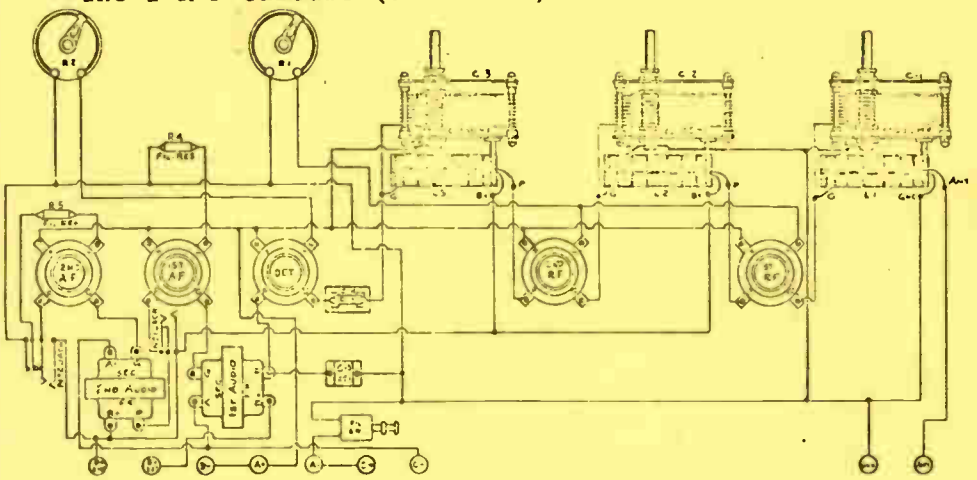
The tuned carrier is placed at the grid of the detector tube and appears half wave rectified at the plate - effectively removing the bottom half of the carrier.



The remaining audio signal is transformer coupled from the plate circuit of the detector to the grid circuit of the first audio amplifier. The process is then repeated for the final stage of audio amplification. The head set or speaker is in the plate circuit of the second audio amplifier.

cont. on following page

The T R F Circuit (continued)



The circuit layout in many of the T R F receivers is similar to the schematic (previous page) and wire diagram (above). Lift the lid and the tuning stages progress left to right with the detector and amplifier stages on the right. Don't always depend on this however, you may have to search out the different stages.

Common problems in battery sets are:

- - open windings in the audio transformer.
- - tube problems - open filament - grid to plate short - weak - gassey - loose base - poor pin to socket connection - cracked glass.
- - variable capacitor plates touching.
- - broken solder joints.
- - improper fix by a previous owner.

Much more can be said about the theory, trouble - shooting and repair of the T R F battery radio. The editor invites questions, comments and advice from I H R S members concerning trouble - shooting procedures, methods of repair and techniques for maintaining originality.