

# VWOA NEWSLETTER

Email Issue #37

Francis T. Cassidy Editor

2008



The **2008 VWOA AWARDS LUNCHEON** went as planned on **Saturday, April 26, 2008** on the Top Deck of the Seamen's Church Institute in Manhattan.

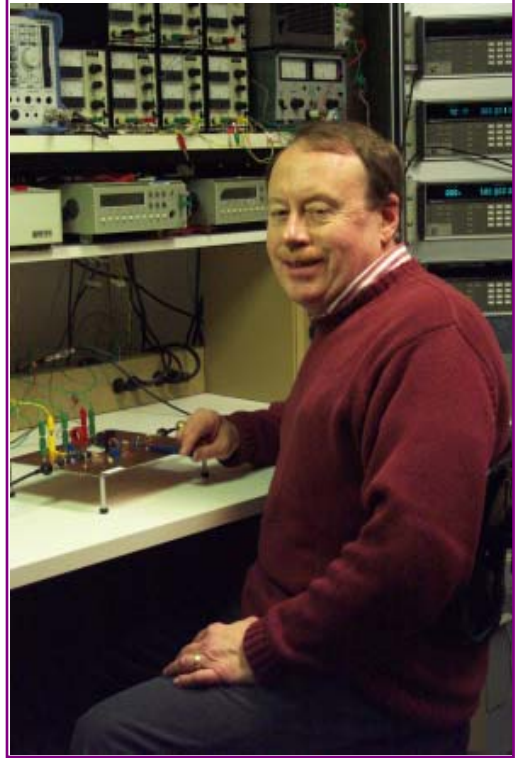
Frederick H. "Fritz" Raab, Ph.D. in Electrical Engineering, with Call Sign W1FR and owner of consulting company Green Mountain Radio Research of Colchester, Vermont was the main speaker at the Luncheon. As Photos and reactions of the Luncheon are received, they will be published in this VWOA Newsletter.

He spoke on "The Revival of 600 meters" in his present capacity of Experimental Project Manager for The 500 KC Experimental Group for Amateur Radio.

The DeForest Audion Medal was awarded to

**Frederick H. Raab Ph.D.**

HONORING HIS TECHNICAL ACHIEVEMENTS IN  
THIRTY FIVE YEARS OF RADIO ENGINEERING



Frederick H. Raab Ph.D.



John Curtis received the VWOA MARCONI MEMORIAL AWARD PLAQUE for his lifetime efforts of perfecting electronic circuits to generate Morse Code as exemplified by the development of the Curtis Keyers.

## The History of Curtis Keyers

By Brad Mitchell, N8YG

February 5, 2002

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*Modern transceivers incorporate many features that not long ago were considered accessories: CW keyers and SWR meters come to mind. John Curtis, K6KU, created an electronic iambic-keyer circuit and subsequently offered an IC chip to do the job. He revolutionized keying, as we know it.*

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**John Curtis, K6KU.**

Born in Bradford, Pennsylvania in 1930, John Curtis became the typical boyhood ham. He and several high school friends got licenses at the same time, then built and operated Amateur Radio equipment. Then other things--work and college--came along and John did not attain the Extra Class license until later in life. He decided to get a feel for the requirements of the Extra Class test by undertaking a circuit design project. John built a keyer circuit and learned about digital electronics.



**The prototype keyer EK-38.**

His prototype worked. In fact it worked quite well, according to his ham radio friends. They convinced him to produce keyers. With prototype in hand he put an ad in *Ham Radio Magazine* announcing the Curtis Electronic Devices EK-38. The -38 was John's age--a product numbering scheme that would continue. *Ham Radio* reported there was a slight problem with the ad. The name Curtis Electronic Devices was too long for the small ad. So with a swipe of an eraser, Curtis Electronic Devices became Curtis Electro Devices.

John spent many hours preparing to produce the EK-38 and keep his normal day job as well. But eventually he formed his own business. The EK-38 was a great keyer, but it only had dit memory, and lacked weight control. Many hams were

interested in weight control because various transmitters had different keying characteristics. In 1969 he introduced EK-39. It included dah memory as well as weight control.

What else could a ham want from a keyer besides dit and dah memory weighting? Memory of course. In the late '60s, memory? Yes, memory. The EK-39 was modified to include a special-order memory feature. But the technology was just emerging for read-only-memory (ROM). In fact the first EK-39M keyers were programmed with "SC-ROM." Hams who ordered his keyer might have been surprised to know that Curtis used a pin to scratch their call signs into a ROM chip that was positioned under his microscope--hence the name SC-ROM. A programmable diode matrix and ROM soon replaced this tedious process.



**The EK-39M with SC-ROM. (See text for explanation of this unique nomenclature.)**

Curtis' electronic keyer business soon had a loyal following.

Quite a few hams followed Curtis' every move and would order any new keyer he created. More success followed. The EK-402 had a 20-character programmable memory. It sold for \$289.95 in 1971.



**The elegant EK-4900 with speed meter and a host of other features.**

Up to this point, Curtis could have been just another keyer designer but what happened next was truly revolutionary. John had established a lot of contacts while working at Signetics in the '60s. These paid off for him when he decided that a keyer circuit could be implemented on a chip. He started with not one design, but two. The 8043 and the 8044 were announced at the same time. The 8043 was designed as a completely custom integrated circuit in CMOS. At the same time, International Microcircuits was looking for a chip in which to test their gate array technology. The first chip down the line was the 8044, produced for Curtis. The 8043 worked first try. It was limited to dit memory, and sold for \$7.95 in quantities of 50 or more in 1973. The 8044 also worked right

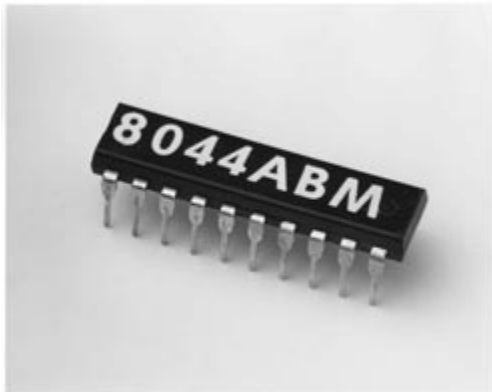
off the bat. It offered dah memory in addition and sold for \$24.95 in 1975. The 8044M was introduced in 1980. M stood for meter. A meter could be hooked up to a pin of the 8044M to indicate sending speed.

In 1981 Curtis found that many people liked the mode B keying characteristics of Ten-Tec, Heath, Nye, and Accu-keyers. Mode B simply added an extra dit or dah when the operator stopped sending--depending on which was sent last. If a dit was sent last, an extra dah would be sent. If a dah were sent last, a dit followed. John's keyers did not do that, so he added the feature in the 8044B (according to John, Mode B was actually a design error by an unnamed company). Curtis introduced several keyers incorporating his new full-featured ICs. The first was the EK430 incorporating the 8043 chip. John also introduced a fully integrated keyboard chip called the 8045.

Finally in June 1982 Curtis Electro Devices produced its last keyer, the Lil' Bugger. Offered as the K5 or K5B, it incorporated the 8044 or the 8044B chip, respectively. It sold for \$39.95 and was quite popular. The company had relatively few manufacturing problems. John tried overseas production of his circuit boards and encountered quality control problems. In England where the keyer was quite popular, the name Lil' Bugger wasn't acceptable, and hams there asked John to ship the unit in unmarked boxes.



The Lil' Bugger, K5.



The final Curtis IC--the 8044ABM. MFJ now offers an improved unit--the 8045ABM.

The K5/K5B was the last Curtis keyer. But wait, there was another Curtis chip--the one that probably was best known--the 8044ABM. This final keyer chip was introduced in the spring of 1986. It incorporated selectable A or B modes and the speed meter. This truly was a top of the line chip, and became an industry standard. However, microcontrollers debuted in the '80s and Curtis chips were no longer in demand. John stopped selling them. MFJ purchased the 8044 line and now offers an [improved 8045ABM](#). Curtis ceased operations April 1, 2000.

*ARRL member Brad Mitchell, N8YG, lives in Brockport, New York. He and co-inventor Gary Diana, N2JGU, started Embedded Research Co and developed the TiCK keyer-chip line. Mitchell studied the Curtis Electro Devices products to learn as much as possible about their design and the history of iambic modes A and B before creating his own chips. Mitchell is no longer associated with Embedded Research Co. He can be reached at [n8yg@arrl.net](mailto:n8yg@arrl.net).*





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## *WENDELL'S NEWS CORNER*

After sending out VWOA Newsletter #34 with the Featured Author Jim Farrior, Wendell just received this message, which is attached and includes the most recent photo. Suggest those of you who requested all of the FOUR PARTS of his Book, file this photo with his story.

----- Original Message -----

From: Jim Farrior

To: [Wendell R Benson](#)

Sent: Wednesday, April 23, 2008 6:04 PM

Subject: Photo attached

Wendell,

I appreciate very much that my CCC paper that is being run and hope that some who like ancient history will find it interesting. I'm getting terribly forgetful, and I just remembered having been asked for a more recent photo to go along with the article.

The attached photo is quite recent as it was taken this morning. Please let me know if it is suitable.

Incidentally, the receiver on the top shelf is an old Hallicrafters S20R that I bought in 1940. It still works. Underneath it is the TenTec Century 22 that I took each year to the jungle in Guatemala for a number of years each summer.



*James S. "Jim" Farrior W4FOK  
April 23, 2008*

On the lowest shelf is my old TenTec Omni, external Oscillator, Power Supply, and antenna tuner that I bought in 1980 when I retired. It still works like a charm.

I wouldn't buy a new rig now since I can't see well enough to use all of the little buttons, etc. Also, at the right on the middle shelf, you will see a telegraph sounder in a resonator. The unit at the left of the Hallicrafters is a converter that will operate the sounder from a tone input. Underneath it is a tape deck that I use mostly for playing American Morse tone tapes that operate the sounder.

73, Jim

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*Larry & Ann Waggoner celebrating their 40<sup>th</sup> Anniversary in Las Vegas*

----- Original

Message ----- From: Larry Waggoner To: Wendell R Benson ; Francis T Cassidy  
Sent: Saturday, April 05, 2008 10:38 AM  
Subject: Magazines

Wendell and Francis, Old radio magazines seem to gather around this QTH. I have five issues of Communications magazine from September 1941 to June 1942. Each issue has a least a page of VWOA news. I've attached copies of the five VWOA reports that I found. 73's Larry

Larry P. Waggoner WØKA  
Broadcast Technical Consultants  
8112 West Meadow Pass  
Wichita, Kansas 67205-1647

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----- Original Message -----

From: <John McGonigle>

To: "Wendell R Benson"

<[wenben@nyc.rr.com](mailto:wenben@nyc.rr.com)>

Sent: Monday, April 07, 2008 10:10 AM

Subject: Re: : Magazines

Hi Wendell:

Many thanks for sending me these, they mean very much to me. I have been down with the super bug all last week and still have not recovered. Again I appreciate your thinking of me. 73, John

From: Wendell R Benson

<[wenben@nyc.rr.com](mailto:wenben@nyc.rr.com)>

Date: 2008/04/05 Sat AM 10:27:47 CDT

To: John McGonigle

Subject: Magazines

John: You may be interested in this email from one of our vwoa members. The copies of the vwoa news from those years when your father was President. I noted at least one photo of him. 73 Wendell ww2g+++

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#### EDITOR NOTE:

These VWOA Newsletter are the first that I have seen, since joining the VWOA. They are from a time when one of our existing VWOA Directors (John McGonigle) remembers his Father as the President of VWOA. I will attach a copy of these old Newsletters as last pages in forthcoming Issues. Thanks again Larry for thinking about us.

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## More News from Finland

----- Original Message -----

From: "stig-olof jokinen"

To: "Wendell R Benson"

<[wenben@nyc.rr.com](mailto:wenben@nyc.rr.com)>

Sent: Saturday, April 05, 2008 1:31 PM

Subject: uscg

Hi Wendell,

Regarding Your fabulous Coast Guard, I can tell You that many Åland people are very grateful for their efforts at sea. This is only one story.

On December 26th 1968 an Åland tanker named "Ragny" broke in two in apsn 38'48"N 60'58"W in a heavy storm on a run from Freeport to Trondheim.

The cut was a little aft midships and immediate. The crew in the rear part of the ship never saw their midship again. Experts think it sunk quite fast and took the mate on the bridge, chief steward, a messroomboy, ships captain, chief officer and chief engineer with it. The latter three dining in the captains saloon as it was dinner time.

The rear part of the ship was still afloat with 31 crewmembers onboard. The 2<sup>nd</sup> officer, who was dining in the officers mess aft,

became a hero as he insisted that the crew should stay onboard and not launch the lifeboats while the stern still was afloat. Using the emergency transmitter (telegraphy only) in one of the lifeboats, the R/O, who also was dining aft, could send a SOS and establish contact with ships in the vicinity. If it had not been dinnertime the R/O would have been midships as well.

On the 28th Your CG evacuated from the still floating rear part of the ship, in very rough and severe conditions, all 31 crew into a CG Cutter using a line and a boatswains chair.

Åland is a small island with ca 26,000 inhabitants, so many has a relative, or knows someone who had a relative to somebody onboard.

I came to be a very small part of this drama. M/V Agneta/OFYY where I worked at that time had just passed Gibraltar on a voyage from Italy to Canada when we got the news.

I had the very sad job to be a messenger to tell our chief engineer onboard that his brother, who was M/T Ragny's chief engineer was lost at sea.

PS I came to know this 2nd Mate, as we were both signed on the small passenger ferry Viking2.

73 Stig-Olof+

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----- Original Message -----

From: "stig-olof jokinen"

<stigolof@aland.net>

To: "Wendell R Benson"

<[wenben@nyc.rr.com](mailto:wenben@nyc.rr.com)>

Sent: Monday, April 07, 2008 7:33 AM

Subject: merits

Hello Wendell!

I feel I have to add following to the description of my R/O career.

I quitted the work at sea by 1979 and joined the Finnish Coast Guard in 1980. My base was Finnish CG Center Mariehamn/OGA, which at that time also served as a Maritime Rescue Subcenter (MRSC) for the Åland region. Later, all responsibility of the International Maritime Rescue Operations in finnish waters were concentrated to one and only MRCC in Finland operated by the Finnish CG, namely Turku.

Operators in these CG MRSC:s and MRCC:s did not work on 500 kHz at all, only monitoring 2182 kHz and VHF ch 16 (h24). As a fact there were only 2 other international R/O:s employed by the CG when I joined.

As a head operator in Mariehamn and also responsible for the education of the other operators working there, I believe I was able to bring about some knowledges from the years at sea and from my work at Mariehamnradio.

I was retired from The Finnish Coast Guard as a LtN in 2004.

PS The Finnish Coast Guard is sorting under the Authority of The Finnish Border Guard, which is ruled by the Ministry of the Interior. DS.

73

Stig-Olof+

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Comments received on VWOA Newsletter #36 on Featured Author [Walter Prang](#) KZ5WP

> ----- Original Message -----

> From: "John C. Timmel"

<[JohnTimmel@americanvictory.org](mailto:JohnTimmel@americanvictory.org)>

> To: "Walter Prang"

> Cc: "Jay Martin" "TimTeahan"

> Sent: Friday, February 14, 2003 3:10 PM

> Subject: Re: KKUI 1951

Dear Mr. Prang:

I was delighted to receive your e-mail! We are always excited to meet former AmVic crew members. I have forwarded your note to a Mr. Charles Fuss who helps us track individuals such as yourself. As he is very knowledgeable about the ship, I am sure you will enjoy corresponding with him. I hope to be able to welcome you back aboard someday.

All the best,

Captain John C. Timmel  
Founder & President



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American Victory Mariners Memorial & Museum  
Ship

705 Channelside Drive, Berth #271

Tampa, Florida 33602

Ph: (813) 228-8766

Fax: (813) 228-8769

Website: [www.americanvictory.org](http://www.americanvictory.org)

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----- Original Message -----

From: "Don Berger"

<dberger46@verizon.net>

To: "Wendell R Benson"

<[wenben@nyc.rr.com](mailto:wenben@nyc.rr.com)>

Sent: Wednesday, April 23, 2008 11:54 PM

Subject: Re: KKUI 1951

Thanks Wendell - We still have a foto of Walter Prang onboard the American Victory and I am grateful to have his e-address now. Several of us have the ship's equipment operational now and make regular CW contacts with KSM (old KPH) using ship's equipment on commercial frequencies. When I saw the recent newsletter I promised myself to contact Walter and ask/answer questions about the ship.

Capt John Timmel is a fine man, Tampa Bay pilot, and is greatly responsible for the American Victory being here in Tampa, as a museum ship which can navigate on her own power, and gives dockside tours to the

public all week and weekends.

We have a great time onboard the vessel and during the annual "Night of Nights", make contacts with multiple coastal stations by CW on commercial frequencies. We also have an active Ham station, W4AVM, set up next to the ship's Radio Room, with several active hams. W4AVM members meet onboard the ship the first Wednesday of each month.

I will send Walter an email tonight.

Thanks and 73

Don Berger W4CQC/WPD/KKUI

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We at the VWOA Newsletter would like to hear from you and try to pass along to the rest of the VWOA stories of events that you have experienced and that you feel the rest of the membership would enjoy hearing about. Send us a picture or two and we will try to include it in one of our Email Newsletters.

We would prefer to hear from you by Email at:

[ftcassidy@optonline.net](mailto:ftcassidy@optonline.net)

or

[wenben@nyc.rr.com](mailto:wenben@nyc.rr.com)

but if you must, send mail to:

VWOA

PO Box 1003 Peck Slip

New York NY 10272-1003





## VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

W. J. McGONIGLE, President

RCA BUILDING, 30 Rockefeller Plaza, New York, N. Y.

GEORGE H. CLARK, Secretary

OVER a coast-to-coast network of the Mutual Broadcasting System on Saturday, August 23rd, 1941, our Association presented the following program:

MR. McGONIGLE: "Thank you, Mr. King."

"On July 20, 1937, Guglielmo Marconi, the founder of the wireless art, passed away. The Mutual Broadcasting System arranged a memorial program that day, on which it was my sad duty to participate, as president of our association of veteran wirelesmen.

"In conversation with J. R. Poppele, Chief Engineer of WOR, Mutual's New York Station, preliminary to the broadcast, the first plans for a perpetual memorial to the memory of Marconi were formulated.

"The original plan called for the erection of a suitable monument in New York. One of the first contributors to the Marconi Memorial Fund, subsequently established by the Veteran Wireless Operators Association with Mr. David Sarnoff as Chairman, was Mr. A. J. McCosker, President of WOR and Chairman of the Board of the Mutual Broadcasting System.

"This plan will culminate in the erection in Battery Park, New York, of a memorial which will incorporate the Wireless Operators Monument now located just outside the barge office in Battery Park and the bas-relief of the head of the father of wireless, together with the large black marble slabs, enclosing it, which formed a part of the Italian Building at the New York World's Fair.

"In further tribute to the memory of wireless pioneer, Marconi, our Association established Marconi Memorial Awards. During the year, just passed, it has been our privilege to present a Marconi Memorial Service Plaque to the Defense Communications Board through its chairman, Hon. James Lawrence Fly; a Marconi Memorial Medal of Service to Major General Joseph O. Mauborgne, Chief Signal Officer of the Army; a Marconi Memorial Medal of Service to Rear Admiral Leigh Noyes, Director of Naval Communications, and a Marconi Memorial Code Proficiency Award to the winner of the recent Army Amateur Code Proficiency contest.

"In 1939, our Association undertook the sponsorship of a Marconi Memorial Scholarship Award. Through the cooperation of Mr. C. J. Pannill, President of RCA Institutes and the Radiomarine Corporation of America, himself a wireless pioneer, arrangements were completed whereby our Association would, each year, place a worthy young man in RCA Institutes, for a two-year course of instruction in Radio and Electrical Communication as a living tribute to the memory of Marconi.

"When first confronted with the problem of selecting a worthy candidate for the

scholarship, Mr. J. R. Poppele, Chairman of our scholarship committee, found it a difficult one. We had the good fortune, however, to become acquainted with the fine accomplishments of the American Institute of the City of New York, an organization founded 114 years ago, which during the past ten years has devoted its efforts towards the scientific culture of American youth. One of its activities along this line is the organization of Science and Engineering clubs in high schools throughout the entire United States. The activities of the American Institute covers 42 states and includes 1,000 high schools in which 35,000 science-minded, ambitious American youths form the nucleus of American Science on the march.

"The American Institute, each year, conducts a nationwide contest to obtain a candidate for our Annual Marconi Memorial Scholarship.

"I now have the pleasure to present the President of the American Institute, Dr. H. C. Parmelee who will tell us about this year's contest."

DR. PARMELEE: "As President of the American Institute of the City of New York, I take great pride in the knowledge that our organization has been able to aid the Veteran Wireless Operators Association in their selection of an American youth to whom the Marconi Memorial Scholarship could be awarded. Educational experts on the staff of the American Institute developed a series of comprehensive tests to determine each contestant's aptitude for radio engineering, his knowledge of physics, mathematics and general science—his general intelligence and the suitability and adequacy of his present training. In conducting the test among high school seniors throughout the country we have the cooperation of the science instructors who act in the capacity of faculty advisors to the Science and Engineering clubs sponsored by the American Institute.

"The spirit and enthusiasm of the participants in this year's contest should make us all less apprehensive about the future of technical Americans. It is apparent that young America appreciates the situation confronting the world and is willing and anxious to acquire further education in order better to solve the many problems, to which it is the duty of science to provide solutions.

"This year's contest had a larger number of contestants than previous ones and the spirit of the participants was particularly high. Because of the increased interest in the scholarship and the closeness of the contest we of the American Institute should like to present two candidates for Marconi Memorial Scholarships. I feel certain that these two sterling young men possess the necessary scholastic qualifications for marked success in their chosen field of Radio Engineering."

"Will it be possible, Mr. McGonigle, for

your Association to accommodate these two aspiring young men?"

MR. McGONIGLE: "Yes, Dr. Parmelee. Fortunately, Mr. C. J. Pannill, President of RCA Institutes, through whose good offices we have been able to offer this scholarship annually—fully aware of the present need and demand for more and better trained radiomen in furthering our National Defense, when apprised of the results of the contest conducted by your organization immediately agreed that we should place two students in the RCA Institutes under the Marconi Memorial Scholarship plan.

"Dr. Parmelee, I believe you should have the honor of presenting one of the scholars."

DR. PARMELEE: "In the contest conducted by the American Institute during the spring of this year, two high school students, members of our science clubs, proved outstanding. Stanley Goldfein, a graduate student of Erasmus Hall High School in Brooklyn was one of them. Stanley, will you please come forward and accept this Marconi Memorial Scholarship valued at \$1,000 under which you will obtain a comprehensive education in Radio and Electrical Communication at RCA Institutes? With the Scholarship I convey the best wishes of all of us for your successful completion of the prescribed course of study and your eventual success in this most important field of endeavor."

MR. GOLDFEIN: "Thank you, Dr. Parmelee. I fully appreciate the honor conferred upon me by this award and I express my sincere thanks for the part that you and the American Institute have played in making it all possible. I hope that my record of accomplishment under the scholarship may live up to the highest expectations of the Veterans of Wireless. I trust that some day I may be worthy of the name—Wireless Veteran."

MR. McGONIGLE: "We take you now to the studios of WCLE Mutual station in Cleveland, Ohio. The Hon. W. B. Spagnola, Mayor of Youngstown, Ohio, will present the second Marconi Memorial Scholarship."

MAYOR SPAGNOLA: "I was, indeed, happy when Mr. McGonigle telegraphed me that John Marsey, a graduate student of East High School of our City of Youngstown, Ohio, had been awarded a Marconi Memorial Scholarship at RCA Institutes in New York. In Youngstown, we have a city which is contributing its all in industrial production towards the best possible National Defense. All branches of the government, and civilian organizations as well, are becoming ever more aware of the importance of the best possible communications. In order that this objective may be achieved we must, all of us, do our utmost towards seeing that those of the coming generations occupy their rightful place in the panorama which is developing.

(VWOA—continued on page 35)



each of these devices. Thus, in the 33 1/3 r-p-m cutter position a low-frequency attenuator is automatically introduced, properly proportioned to prevent the overcutting of "lows."

Another essential is the provision of wide impedance - matching latitude, making the system of use with any existing or planned lines, input or output equipment.

## VWOA

(continued from page 18).

It is truly inspiring that such an organization as the Veteran Wireless Operators Association exists and in its activities includes scholarships in radio for aspiring and worthy young men. The American Institute deserves much credit for their fine cooperation with science students in high schools throughout the land. To these organizations I express my profound thanks for the honor accorded a young citizen of my city. John Marsey, during my public career, I have had many happy moments. This is one of the most enjoyable. The deep significance of the situation at present confronting our very existence makes it ever more important that you accredit yourself well. Mr. Marsey, as your Mayor, I dispatch you as a representative of the people of Youngstown, Ohio, to make the best possible use of the splendid training in Radio you will receive under this Marconi Memorial Scholarship."

MR. MARSEY: "Thank you, Mayor Spagnola. I feel deeply indebted to the Veteran Wireless Operators Association and the American Institute of the City of New York for the opportunity afforded me to secure a comprehensive education in Radio under the Marconi Memorial Scholarship. I deem it a signal honor that you, the Mayor of my home city of Youngstown, Ohio, made the presentation. And, then, too, Mayor, I certainly enjoyed the ride from Youngstown to Cleveland in your official car."

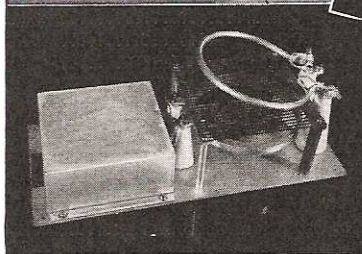
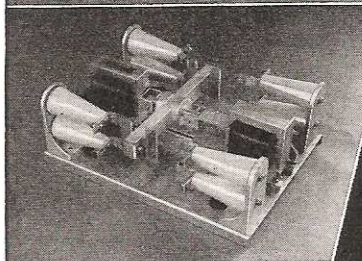
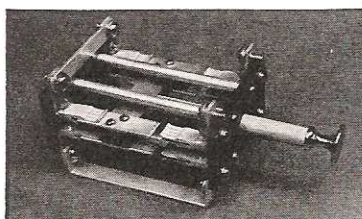
MR. McCONIGLE: "In the first contest conducted in 1939 for the Marconi Memorial Scholarship Robert Barkey, a graduate of Stuyvesant High School in New York City, was the winner. During the past two years Mr. Barkey has applied himself diligently and just last week received his diploma from RCA Institutes. Robert, I believe Mr. Poppele, Chief Engineer of WOR, has some interesting news for you."

"Jack" Poppele engaged Robert in an extemporaneous interview which concluded with an offer to Mr. Barkey to become a member of the engineering department of WOR. Mr. Barkey gratefully accepted the position and is now contributing his bit toward the further success of WOR.

## MATERIALS

(continued from page 21)

alloy for cable sheathing, some 2,000,000 pounds of lead sleeving for cable splices, over 5,000,000 pounds of bronze wire bar, some 500,000 pounds of brass billets, over 3,000,000 pounds of solder in various forms, and more than 373,000 pounds of redistilled slab zinc. This year's totals are expected to mount considerably higher.



*Hard to Get*

## COMPONENTS FOR BROADCASTING STATIONS

Illustrated are just a few of the many special items designed and built by Johnson. The R. F. Make-Before-Break switch permits the insertion or removal of a meter without breaking the circuit. The R. F. Contactor employs knife-type contacts and requires no holding current. Shown also is an Isolation Transformer for feeding a phase monitor or remote meter. The other illustration is

a terminal fitting for a 2 1/2" concentric line on which an adjustable safety gap is provided.

Johnson Engineers design and build many pieces of apparatus for specific applications. If you have a problem, write to them for suggestions and recommendations.

ASK FOR THE NEW CATALOG 967E



**E. F. JOHNSON CO**

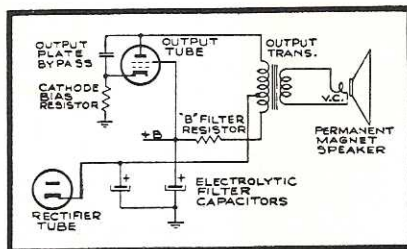
WASECA, MINNESOTA

EXPORT: 25 WARREN ST., NEW YORK, N. Y.

"MANUFACTURERS OF RADIO TRANSMITTING EQUIPMENT"

## HUM BUCKING IN RECEIVERS WITH P-M SPEAKERS

IN RCA a-c, d-c receivers that use a p-m (permanent-magnet) speaker effective hum bucking is obtained through the use of an output transformer with tapped primary. The tap is established at a point where the "ampere turns" of ripple in the direction of the output plate balances the



"ampere turns" of ripple in the direction of the screen and other plate circuits.

High residual hum (at zero volume setting) may be due to incorrect balance, and can usually be remedied by one of the following steps:

(a) Output tube with off-standard characteristics.

(b) Filter capacitor too low capacity, or too high internal resistance.

(c) B filter resistor not correct value. Measure resistance and change if necessary.

(d) Cathode bias resistor of output tube with incorrect value.

(e) If hum persists change the output-tube-plate by-pass to the rectifier cathode instead of to the output-tube cathode.

(f) If none of preceding steps reduces the hum to a satisfactory level, replace the output transformer.



## WAXES AND COMPOUNDS

FOR INSULATION and WATERPROOFING of ELECTRICAL and RADIO COMPONENTS

such as transformers, coils, power packs, pot heads, sockets, wiring devices, wet and dry batteries, etc. Also WAX SATURATORS for braided wire and tape and WAXES for radio parts. The facilities of our laboratories are at your disposal to help solve your problems.

FOUNDED 1846  
**Zophar MILLS, Inc.**  
120-26th ST., BROOKLYN, N. Y.