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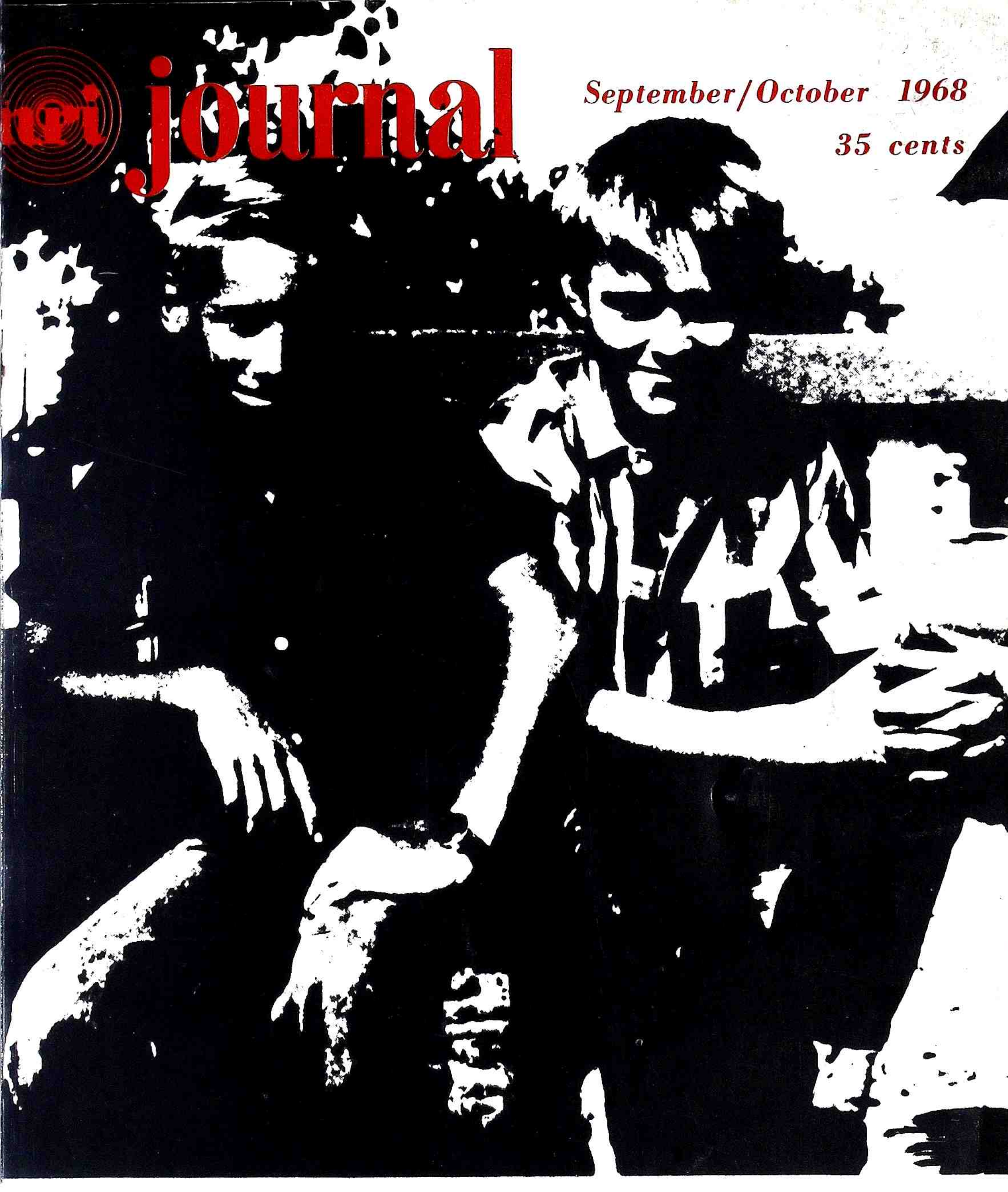


ny Mechura (right) is NRI's Child Prodigy (story on page 10)

N THIS ISSUE:

Identifying Series-Resonant Circuits

Tom-Tom to Electron

Identifying Series-Resonant Circuits

By WILLIAM F. DUNN

Two of the most important circuits found in electronics are series-resonant and parallel-resonant circuits. Resonant circuits are used to select one signal and reject others. For example, when you want to tune in a radio station operating on a standard radio broadcast band you adjust the resonant circuits in the receiver to select the signal you want and at the same time reject the many other signals also being picked up in your locality. Similarly resonant circuits are used in television receivers to tune in the desired channel. They are also used along with tubes or transistors in the amplifier stages that are used to build up the weak received signals to signals that are strong enough to drive the picture tube or the loudspeaker.

Both series-resonant and parallel-resonant circuits are widely used in electronics. The basic series-resonant circuit is shown at A in Fig. 1 and a parallel-resonant circuit is shown at B. The important difference between these two resonant circuits is the manner in which the voltage is applied to the circuits. This determines whether the circuit is a series-resonant or a parallel-resonant circuit. In the circuit shown at A, the voltage is applied in series with the coil and the capacitor. Therefore the circuit is a series-resonant circuit. In the circuit shown at B, the voltage is applied in parallel with the coil and the capacitor and therefore the circuit is a parallel-resonant circuit.

Now let's go ahead and study the series-resonant circuit in detail.

RESONANT VOLTAGE STEP-UP IN SERIES-RESONANT CIRCUITS

In any series-resonant circuit, there will be some resistance in the circuit due to the resistance of the wire used to wind the coil. In addition, there may also be a fixed resistance place in the circuit. In

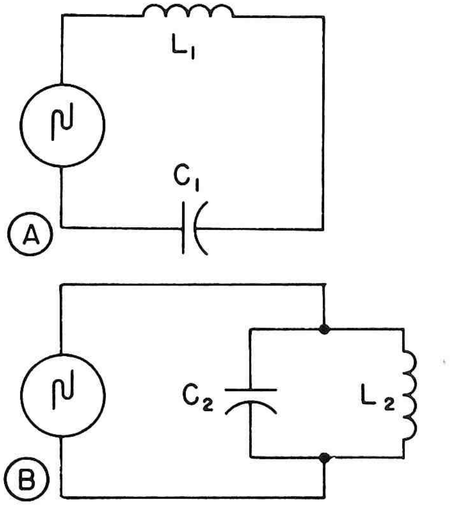


Fig. 1. A diagram of a series-resonant circuit is shown at A; a parallel resonant circuit at B.

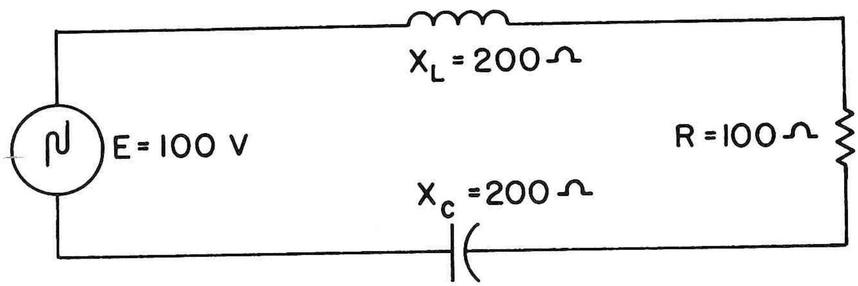


Fig. 2. A series-resonant circuit.

any case, all the resistance in the circuit including the coil resistance is usually represented by a single resistor.

In Fig. 2 we have a series-resonant circuit in which we have placed a resistance in the circuit. Now one of the characteristics of the series-resonant circuit is that the inductive reactance of the coil will be exactly equal to and cancelled by the capacitive reactance of the capacitor. Therefore, as far as the generator is concerned, the only opposition it sees in the circuit is the resistance of the 100-ohm resistor. This means that the current that will flow in the circuit will be limited solely by the resistance in the circuit; the effect of the inductive reactance is completely cancelled by the effect of the capacitive reactance. Therefore in the circuit shown in Fig. 2, the current flowing in the circuit can be found from Ohm's Law:

$$I = \frac{E}{R}$$

$$I = \frac{100}{100} = 1 \text{ amp}$$

In the series-resonant circuit where the only opposition to current flow is the resistance, the voltage and current supplied to the circuit by the generator will be in-phase. This means that the current flowing from the generator will be in-phase with the generator voltage. Furthermore, at the resonant frequency the opposition to current flow will be at its lowest value and therefore the current flow in the circuit will be at a maximum.

In the circuit shown in Fig. 2, the current of 1 amp flowing through the coil will develop a voltage of 200 volts across the coil. It will also develop a voltage of 100 volts across the resistor and a voltage of 200 volts across the capacitor. Therefore it might seem that from a generator that is putting out 100 volts we get voltage drops of 500 volts around the circuit. Actually this is not true because the voltage across the coil will be 180° out-of-phase with the voltage across the capacitor and consequently these two voltages will cancel. If we draw a vector diagram representing the voltage around the circuit we can get a good picture of what is happening. Fig. 3 is a vector diagram that shows the various voltages.

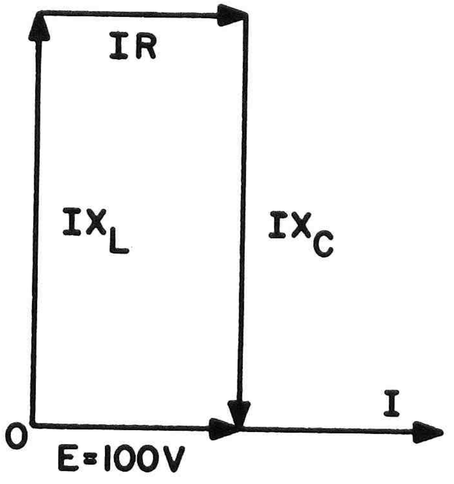


Fig. 3. Vector diagram of voltages in Fig. 1.

In constructing this vector diagram the first thing we draw is the current vector. Using a scale of 100 volts equals one inch we then draw the vector E = 100 volts one inch long. This vector represents the generator voltage. We draw this vector starting at point 0 and coinciding with the current vector because the current and voltage supplied by the generator are in-phase.

Next, from point 0 we draw the vector IX_L. This vector is drawn leading the current by 90° because the voltage across the coil will lead the current through it by 90°. We draw the vector two inches long to represent a voltage of 200 volts. Next, from the end of this vector we draw a vector IR representing the voltage across the resistor. We draw this vector parallel to the current vector to show that this voltage is in-phase with the current and we draw it one inch long to represent a voltage of 100 volts across the resistor.

Now from the end of this vector we draw the vector IX_C to represent the voltage across the capacitor. We draw this vector pointing down to show that the voltage across the capacitor will lag the current by 90°. The end of this vector coincides exactly with the end of the generator voltage vector showing that the sum of the voltage drops around the circuit is equal to the generator voltage.

The step-up in voltage across the coil and across the capacitor is referred to as a resonant voltage step-up. This step-up in voltage is widely used in tuned circuits in radio and TV receivers in order to increase the voltage available at the output of a resonant circuit.

For example, in the circuit shown in Fig. 4 which is the circuit of a typical i-f transformer, the secondary circuit is the series-resonant circuit. There will be a resonant voltage step-up across the coil and capacitor in this circuit so that the voltage applied between the grid and cathode of V_2 will be considerably higher than it would be without this step-up in voltage. This resonant step-up in voltage contributes to the gain that can be obtained from the stage.

IDENTIFYING CIRCUITS

Frequently the circuit consisting of L_2 and C_2 in Fig. 4 is incorrectly identified as a parallel-resonant circuit rather than a series-resonant circuit. This is not too difficult to understand, because it certainly looks like the parallel-resonant

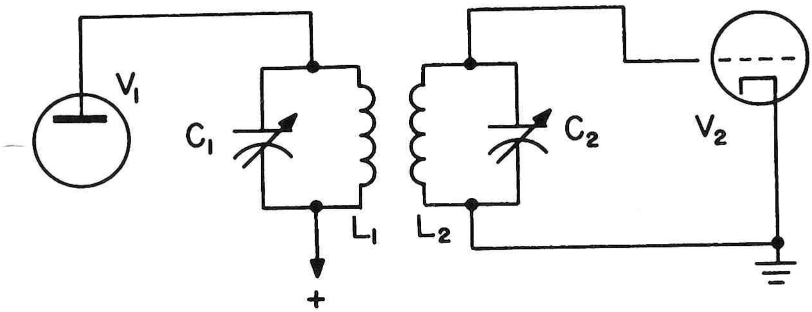


Fig. 4. L_2 - C_2 form a series-resonant circuit producing a resonant voltage step-up.

circuit shown in B of Fig. 1. However, remember that we pointed out that the difference between a series-resonant circuit and a parallel-resonant circuit is how the voltage is applied to the coil and the capacitor. If it is applied to the coil and the capacitor in series, then the circuit is a series-resonant circuit; whereas if it is applied to the coil and the capacitor in parallel, it is a parallel-resonant circuit. In the circuit made up of L_2 and C_2 the voltage is applied in series with the coil and capacitor. We can see better what is happening in Fig. 5.

Here we see that the coils L_1 and L_2 are inductively coupled together. The magnetic flux from L_1 cuts L_2 and generates a voltage in the turns of the coil. Actually, L_2 acts like it has a number of small generators connected in series with the turns of the winding. Thus the voltage is induced in series with the turns of the coil and therefore the circuit is a series-resonant circuit.

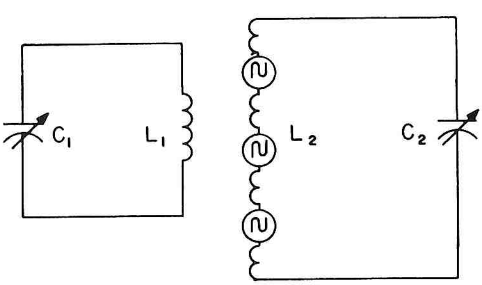


Fig. 5. L_2 - C_2 is a series-resonant circuit.

Another problem that sometimes puzzles technicians is the polarity of the voltage across the coil and the capacitor. Since we said that the voltages are 180° out-of-phase you might think at first that the voltages across the coil and the capacitor would cancel. However, let's look at Fig. 6.

We have drawn the series-resonant circuit and shown the direction of current flow at a given instant. When the current is flowing up through the coil then it must be flowing down into the capacitor as represented by the arrows. If we draw a vector diagram as shown at the left to represent the voltage and current in the coil, we draw the current vector and then draw the vector IX_L leading it by 90° to

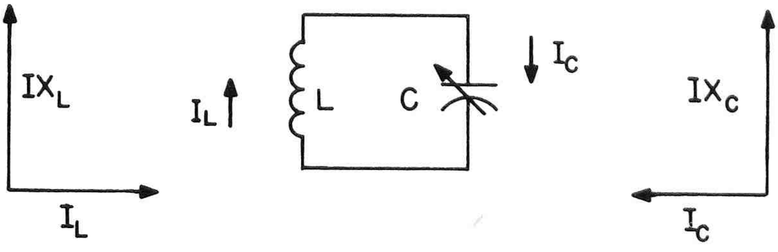


Fig. 6. Vector diagrams showing polarity of voltages across coil and capacitor.

represent the voltage across the coil. You know that in a coil the voltage will lead the current by 90°.

Next, we can draw the vector representing the voltage and current in the capacitor as shown to the right. Here we draw the current vector 180° out-of-phase with I_L to show that the current is flowing in the opposite direction. We know that the voltage across the capacitor will lag the current by 90° so therefore we draw the voltage vector IX_C as shown. Now you can see from the two vector diagrams that the voltage across the coil and the capacitor will actually have the same polarity. In other words, when the upper end of the coil is positive, the upper end of the capacitor will also be positive. So the two voltages will not cancel.

EFFECT OF RESISTANCE

We mentioned that there is some resistance in every series circuit. The effect of this resistance on the current in a series-resonant circuit is shown in Fig. 7. The curve shown at A shows the current in a resonant circuit having a very low resistance whereas the curve at B shows the current in the circuit having considerably higher resistance. Notice that in curve A, as the current rises quite sharply when approaching resonance, the current reaches its maximum value at resonance, and falls off sharply as the frequency is increased beyond the resonant frequency. On the other hand, in the curve at B the current rises rather slowly and reaches a broad peak at the resonant frequency, and then falls off slowly as the frequency is increased beyond the resonant frequency.

In radio receivers, particularly communications receivers where we must select one signal from a large number of signals near the frequency of the desired signal, we want resonant circuits with a very low resistance in them. This will provide

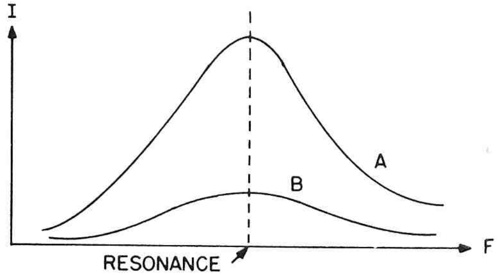


Fig. 7. A graph showing how the current in a series-resonant circuit is affected by resistance.

maximum selectivity. In other words, we'll get a very sharp rise in current at the resonant frequency so that there will be a much greater resonant voltage step-up at the resonant frequency than at any other. On the other hand, in television receivers where we need to pass a band of frequencies in order to pass the entire television signal, we are interested in broader resonant circuits so that we can get all of the required signal information through the resonant circuit.

Q OF A RESONANT CIRCUIT

The resistance of a resonant circuit is made up almost entirely of the resistance of the wire used to wind the coil, unless we deliberately add some extra resistance in the circuit. In any case, we refer to the Q of a coil as being equal to the inductive reactance divided by the resistance. (The resistance is the ac resistance, which is higher than the dc resistance.) In other words,

$$Q = \frac{X_L}{R}$$

In resonant circuits, the Q of a resonant circuit is usually determined entirely by the Q of the coil. In a high Q resonant circuit we will have a high Q coil; in other words a coil with very little resistance in it. We can lower the Q of a resonant circuit by adding resistance to the circuit. This is quite often done in the i-f amplifier of television receivers in order to get the i-f bandwidth required.

L-C RATIO

Another factor that will affect the voltage step-up at resonance is the L-C ratio in the circuit.

There are an infinite number of L and C combinations that can form a series-resonant circuit at any given frequency. For example, let's consider the coil that has an inductive reactance of 500 ohms at 1000 KHz. To form a series-resonant circuit at 1000 KHz, all we need to do is connect a capacitor that has a capacitive reactance of 500 ohms at 1000 KHz in series with the coil.

If the resistance in the circuit is 100 ohms, and we connect the series-connected coil and capacitor across a 1000 KHz generator that has an output voltage of 100 volts, we would have a current flow of 1 amp in the circuit. This would produce a voltage of 500 volts across the coil and across the capacitor at resonance. If we plot the voltage across the coil at different frequencies we would have a curve like that shown in A of Fig. 8.

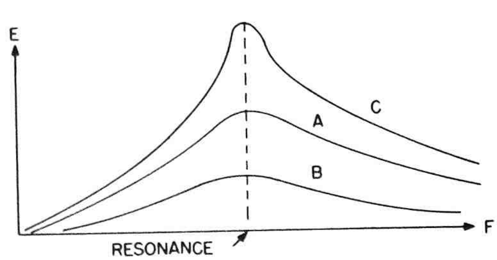


Fig. 8. A graph showing voltage versus frequency of series-resonant circuits with different L-C ratios.

We could also design a series-resonant circuit around a coil that has only half the inductance of the first coil. This coil would have an inductive reactance of only 250 ohms at 1000 KHz. We need a capacitor twice as large as the capacitor in the first example to give us a capacitive reactance of 250 ohms at 1000 KHz.

If the resistance in the circuit remains constant at 100 ohms, we will get the same current flow of 1 amp in the circuit when we connect it across the generator. However, in this case we will get a voltage of only 250 volts across the coil and capacitor at resonance. The voltage across the coil at different frequencies is shown at curve B in Fig. 8. Notice that this circuit, with a coil and a large capacitor (lower L-C ratio), gave us a much smaller resonant voltage step-up.

Now let's consider what happens if we design a resonant circuit that is resonant at 1000 KHz and select a larger coil and a smaller capacitor. If we go back to our first example, where the coil had an inductive reactance of 500 ohms and select a coil with twice the inductance of the first coil, this coil will have an inductive reactance of 1000 ohms at 1000 KHz. To cancel this inductive reactance, we need a capacitor with a capacitive reactance of 1000 ohms; one half the size of the capacitor in the first example will have a reactance of 1000 ohms.

Now in this circuit, if the resistance remains at 100 ohms, a generator voltage of 100 volts will again cause a current flow of 1 amp in the circuit. This will produce a voltage of 1000 volts across the coil and the capacitor at resonance. A curve showing the voltage across the coil at different frequencies is shown at C in Fig. 8. Notice that this circuit with the high L-C ratio has produced the greatest step-up in voltage at resonance.

The curve shown in Fig. 8 might at first lead us to think that the higher the L-C ratio in a series-resonant circuit the better. However, this is not the case. As we increase the coil inductance, the resistance will increase unless we use a larger size wire. There is a limit to how far we can go in this direction. In addition, the high L-C ratio circuit has a very restricted bandwidth and in most cases we need to pass a band of frequencies through the resonant circuit rather than just a single frequency. In radio, where we have a limited band of frequencies to handle, we can use a much higher L-C ratio than in TV where we have a wide band of frequencies in the picture signal.

TRAPS

We mentioned that series-resonant circuits are used in radio and TV receivers to select one signal and reject others. They are also used to reject one signal and permit others to pass. When used in this manner they are referred to as traps. An example of a series-resonant circuit used as a trap is shown in Fig. 9A. Here the coil and capacitor are connected in series. Either the inductance of the coil or the capacity of the capacitor is adjustable.

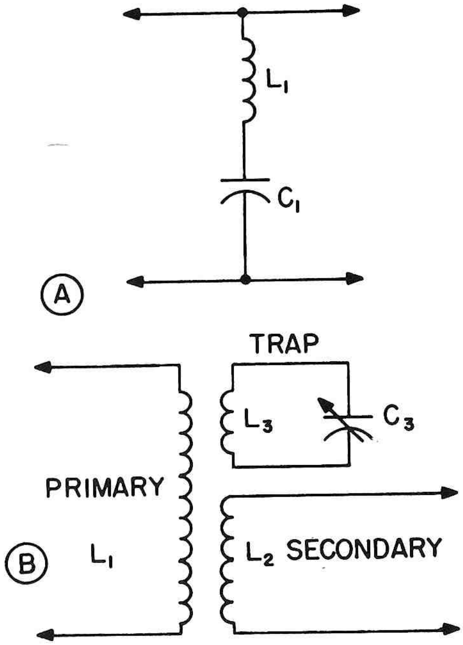


Fig. 9. Series-resonant circuits are often used as traps. The trap shown at B is called an absorption trap.

The adjustable element is tuned to resonance at the frequency of the undesired signal. The circuit then will offer a very low resistance path for the undesired signal so it simply is shorted out of the circuit by the resonant circuit. Traps of this type are used frequently in television receivers to prevent interference outside of the channel to which the receiver is tuned from getting through the picture i-f amplifier. They are also used to keep the sound signal out of the picture circuit.

Frequently in TV receivers you will find i-f transformers where in addition to a primary and secondary winding there is a third winding with a capacitor connected across it. The schematic symbol of the transformer looks like Fig. 9B. The coil L_3 and capacitor C_3 are what is called an absorption trap. The coil and capacitor are adjusted to resonance at the frequency of the signal to be rejected. The signal produces a high circulating current at the resonant frequency and the signal at that frequency is dissipated or used up in the resonant circuit consisting of L_3 and C_3. The trap, in effect, sucks out the signal frequency to which it is tuned so that this signal is prevented from getting from the primary winding L_1 to the secondary winding L_2.

VISITS TO LOCAL CHAPTERS OF THE NRI ALUMNI ASSOCIATION

Anyone who heard Executive Secretary Tom Nolan's lecture/demonstration at their local chapter last season can hardly fail to remember it vividly. His subject was the theory and servicing of Color TV. The program brought forth more enthusiastic comments than any ever conducted at the local chapters before.

The program he has selected for the 1968-1969 season promises to be equally as impressive. His subject will be Servicing Transistor Color TV Receivers. These receivers are just now being put on the market. It's an ideal time to learn how to troubleshoot them -- get the jump on the fellows who don't. Tom will demonstrate the techniques to use in troubleshooting and repairing the new sets.

His schedule for bringing this important lecture/demonstration to the local chapters is given on page 28. See "Directory Of Alumni Chapters" for time and meeting places.

All NRI students and graduates in the areas of the local chapters are cordially invited to attend these lectures and NRI urges them to do so.

The picture above is taken from the cover of the book, The People in Brazil, by Jan O. Mechura. Mr. Mechura's wife printed it, bound it and drew the above picture for the cover. The book tells the vivid story of their exciting lives in Brazil from 1949 to 1957 when they left Brazil to move to the United States. A lot of talent to have in one family? Read the following story about their son!

NRI's PRODIGY

He has completed 65 lessons in the NRI "TV-Radio Servicing" course and maintained an average grade of "A".

He has earned a white, yellow, and orange belt and skipped a pink belt in judo.

He is a champion speller.

He can convert an old lawn mower to a go-cart.

He has competed in the $64,000 question.

He has made headlines in several Metropolitan newspapers.

Who is he? His name is Johny O. Mechura and the most shocking thing about him is that he is only 13 years old.

Johny Mechura is the son of Mr. and Mrs. Jan Otahal-Mechura and he is NRI's youngest student. He enrolled in the course when he was 12 and has completed it in one year.

We wrote to Johny requesting more information about his family and school. A few days later we received an unbelievable letter from Johny's father. The letter is printed below exactly as it was sent to us; we thought we'd let Mr. Mechura tell his own story.

NRI Journal
3939 Wisconsin Avenue
Washington, D. C. 20016

Dear Sir:

I am the father of JOAO OTAHAL-MECHURA, your student No. B12-F725. You asked me about information of my son.

Joao was born in Brazil in 1954. We came to Brazil 1948 as refugees from Czechoslovakia, where my Drivers school, my cars, and my house had been nationalized and I had been fired from technical teaching. I escaped in company of my wife to Austria. We lived in Refugee Camp in Salzburg three months. Then we were transported to Brazil, where I was working as technician rebuilding a factory for higher production. Later I opened my own shop for repairs on automobile electrical systems, later bought a small farm in wilderness. And there was born our Joao.

In 1957, we moved to Houston, Texas. Our little Joao did have fantastical memory and will to learn something. He was perfectly speaking in Portuguese, Czech and English but with European accent.

Being three years old, Joao showed on TV all 48 states of USA with all Capitals and big rivers, on huge map. Then, the map of USA had been changed for the map of whole world. Joao showed all countries, big islands, canals, and rivers, Master of show wanted to mix up Johny asking: "Which is the Capital of London?" Johny replied angry: "You should know that London is the Capital of Great Britain!" That happened on Dec. 1957. Joao was able to tell names of eight hundred automobiles of the world production.

Next year, Joao was called to $64,000 Question in New York. There, he had been tested of knowledge of 3,000 cars and he did not miss a single one.

At the age of 6, he entered kindergarten with knowledge of reading. He read in one minute 230 words in English, 100 in Czech and the same in Portuguese. He could not enter first grade being born Sept. 12. But, he had been lent to 1st grade to teach the children in reading when the teacher left the school room. Next year, Joao entered directly the second grade and the next year, the fourth. He skipped the first and third grade.

At 10, Joao won yellow belt in Judo. The Judo school was a necessity. Joao was younger than the other boys and being the best in spelling and other knowledges, he had to defend himself. One boy, two years older, wanted to spank Johny only for the reason that Joao won the school spelling contest. The boy ventured one dollar and lost.

Another day, another fight. On the school playground, an older boy ran on Joao with club in hand, to hit Joao on head, in front of the teachers. My son told me: "I had to soften him a little. I hit his hand strongly, he lost the club and then I hit with him on grass, using a Judo trick. Then I did "Uci Mata" over his stomach. (He made a somersault so that he hit his stomach with his head)."

There was another fight, but in spelling. Joao attended summer school for

A. A. students. The teacher divided the students of fourth grade into two groups: the Yankees and the Confederates. They were soldiers fighting in spelling. Joao was a southerner, for he was born in the deep south (Brazil). The others were born in the southern part of Houston. Joao got only six soldiers. Being two years younger, he did not have a big reputation, nobody knew him. When he won, he was carried around the classroom, his "soldiers" singing southern songs.

Everyday - new victory. The enemy could not win at all. After each victory, Joao got ten more difficult words from the teacher, but she could not win.

One day, the teacher left classroom for a while. The winning southerners were carrying their Major General around the room and then struck the angry Yankees with overwhelming power on Johny. Joao explained to me: "I dropped on floor, became furious and hit with all my Judo and Karate tricks on enemy. I know I am forbidden to use them, but it was the case of emergency. My friends were stronger than me, and they started to imitate my tricks. I have found the enemy weaker and less valiant on left wing and I directed our attack on this soft point. The female part of the enemy's army was sitting beyond the desks. Girls were scared to death seeing such a battle. The enemy was leaving the battlefield in hurry, when the teacher entered. Then had been restored law and order. The teacher knew I never attacked anybody by myself."

Then came the last day of summer school. The teacher called Johny telling him: "John, you go to the next room and will fight in spelling with the fifth grade. If you win you will be given this box full of balloons." Joao returned in short time and told: "I did it." At this moment something happened what nobody has expected. The whole room stood up and started to sing not "Glory, Glory, Hallelujah" but "The Star Spangled Banner". Joao told: "I have been moved to tears, nobody knew I became U.S.A. citizen a couple weeks ago. The students were proud of me - I was proud of them. I knew it is worth to fight for them in another field besides spelling."

Joao has found your courses extremely easy. I did not help him at all. I am retired from my electrical automotive business and being 68, I have no intention to start another job. We wanted to return to Brazil during this vacation, after selling our house.

Joao has finished ninth grade junior high school. We find him too young for senior high. Not for reason of knowledge - his grade is 99, the highest of his junior high (Average = 50). But he is two years younger than the other students and they try to fight him. And soon they will start bad examples with narcotics and pranks. For this and other reasons, we shall move to Brazil in a couple of months, after selling our house. Staying here, Joao would continue in other of your courses. It depends upon where we shall be settled, the mail service in Brazil is difficult. I, being a former teacher, can teach him in wilderness, too.

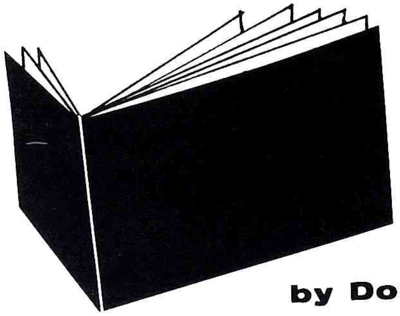
I mailed to you my book *The People of Brazil* to understand better the country where Joao was born and probably will return. I wrote the book and my wife printed and bound it. She painted and printed the picture in 3 colors. We made 1600 books only for our friends and customers.

I thank you cordially for all you did for Joao,
Yours truly

Jan O. Mechura

Jan Otahal-Mechura

Joao Mechura, (right), and friend converting old lawn mower to go-cart.



NEW BOOKS

by Donald A. Smith

EDITOR'S NOTE: Mr. Smith, an instructor in electronic technology at Walter Johnson High School in Montgomery County, Md., is himself the author of three books, "ABC's of Electronic Test Equipment", now in its third printing; "Medical Electronics Equipment Handbook", and "The ABC's of Vacuum Tubes", all published by Sams. He is a frequent contributor to electronic trade magazines, and a graduate of NRI's Radio-TV Communications, and Appliance courses.

Radio Handbook
by William I. Orr, W6SAI
Editors and Engineers, LTD
New Augusta, Indiana
848 pp $12.95

There are some electronics books which are so well received, and used so often by so many people, that they are constantly being up-dated and coming out in a new edition. Such a book is the "Handbook." This 17th edition is the largest and best of all.

The Handbook is designed primarily for the Radio Amateur, but because of its depth and scope, is used by many other electronics personnel, including engineers and technicians. It has 33 chapters, plus Appendix and Index. There are many chapters on electronic theory, with many fine examples of common circuits and equipment. There are also chapters on transistors and semiconductors, various types of vacuum tube amplifiers and special amplifiers as well.

Chapters on radio receivers and transmitter fundamentals, as well as modulation principles cover the subject very effectively. Single sideband and frequency modulation are treated in several chapters. Equipment used by everyone in the electronics field, such as meters, oscilloscopes, frequency measuring devices and so on are well covered and explained. Transmission lines, antennas, television interference and shop practices are illustrated and explained so that everyone can understand them.

One of the greatest features of the Handbook is that many circuits and actual construction projects are presented. For example, if you are interested in VHF equipment design for VHF Amateur equipment, you would find a number of VHF transmitter construction projects which you could build. As a matter of fact, projects in VHF equipment include several transmitters, converters, receivers, transceivers and test equipment!

For many years the amateur has had an edition of this book on his shelf. Generally what you would see when going into the "Ham Shack" would be a dog-eared copy of the Handbook, with burn marks on it from the times the soldering iron was accidentally put on it, and other signs which indicate that this book gets extensive use! This is one book I have always had on hand, and I can report to you that this latest edition is definitely the best yet!

The VHF Amateur
by Robert M. Brown
Editors and Engineers, LTD
New Augusta, Indiana
160 pp, $4.50

"The VHF Amateur" is something a little different in a book. It has been written for the VHF enthusiast and some of its material was taken from a previously published magazine called the "VHF Amateur." It has some VHF theory, but consists mostly of good, practical VHF construction projects, conversion of surplus equipment and so on.

It is a very interesting book to read and it makes you reach for your gun (soldering gun that is), as you become interested in building this or that project from its pages. It has some modification on very popular VHF equipment too, such as details on how to increase the power of the popular Heath "Sixer" and "Twoer".

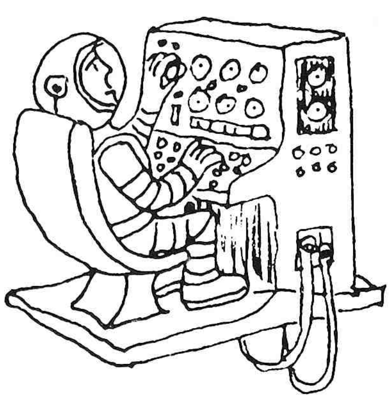
The author has the same viewpoint on increasing the power and range of a VHF signal as I do. That is, build a better VHF antenna, rather than increase transmitter power. Therefore you will find considerable information on antenna and antenna construction in the book.

Some of them are interesting both in the theory of operation, and in the mechanical details of construction. Each of the antenna building projects are types which anyone can build, even if they don't have all the tools and equipment which they might like to have.

If you like VHF operation or would like to know more about it, then this book will be a welcome edition to your bookshelf as it has been to mine.

TOM-TOM

TO ELECTRON



The following article is taken from a brochure on Mobile Radio Communications by the Link Radio Corporation, and is reprinted with the permission of Mr. Fred Link. Keep in mind while reading that this article was written 20 years ago, although most of it still applies today.

DRUMS

In darkest Africa the black man developed one of the earliest forms of Wireless Communication, the Drum, how long ago no man knows. He needed it for in the heart of his vast country, which was one unbroken forest without roads, traversed only by footpaths, it became necessary to communicate messages to his fellow man.

War, hunting, fishing, sickness, death, were all of prime importance to the savage.

Men went away out into the jungle forests to hunt. Women traveled to cultivate far distant garden clearings. Word came to town that enemy tribes were on the warpath; or perhaps some important member of the tribe had met death, his funeral was of major importance; a man's wife ran away, messages must be sent along her pathway to escape to catch and hold her.

The practical answer to all these important needs was the Drum which, by relay, sent messages from one town to another covering great distances. Messages are sent by "tone" rather than by words spelled out. Certain tone rhythms convey certain understood sentences.

FIRE

The torch appearing between the flags on the insignia of the Signal Corps is one of the oldest forms of communication known to man - Fire...

Beacons kindled on high elevations to communicate vital messages are referred to in early classical literature:

"Set up a sign of Fire in Beth-haccerem, for evil appeareth out of the north."

Jeremiah 6-1

From Jerusalem to Babylonia the early Jews had a system of fire signals along a chain of hilltops.

The ancient Greeks flashed home the news of the fall of Troy by a sequence of prepared beacon fires built at strategic points on the Aegean Islands and on the mountain tops.

Down through the centuries fire was a most important form of communication. As late as 1775 Paul Revere still used the light of his lantern to carry his message of warning through the night.

SMOKE

Before the Christian era, when the Romans sent expeditionary legions to Britain, it was discovered that the aboriginal Picts had developed a very complete set of communications through the use of smoke puffs produced by blanketing a fire.

Later, when our covered wagons trekked their weary way westward, those hardy Pioneers, looking for new homes in the wilderness, found that the Indians used these same smoke signals to announce well in advance the coming of the pale-faces. In many cases this made possible the annihilation of wagon convoys crossing the western prairies.

At that time no white man had perfected any system of signals so effective.

GALILEO

Early in the seventeenth century, the Italian astronomer, Galileo, invented the Telescope, making it possible to magnify a visual signal from a source too far away to be seen with the naked eye. This was a vital step forward in the realm of communication.

Galileo was greatly honored for the telescope's application to signalling. A device that would bring advanced tidings of the arrival of "treasure laden" ships was highly appreciated by commercial man.

SEMAPHORE AND TELESCOPE

In the eighteenth and early nineteenth centuries the word, "telegraph," was applied to long visual signalling lines.

The prefix, "tele," means "far off." The words, telescope, telegraph, telephone, teletype, and television, all bearing this prefix, show the sign of a new phase in signal communication.

A telegraph station consisted of an observer with a telescope to pick up signals and a semaphore to relay them to the next station. This system of semaphore lines was constructed from Cape Code to Boston and from Coney Island to New York City; still another such system was located on San Francisco's Telegraph Hill, all to report in advance the arrival of some important clipper ship.

MORSE

Samuel F. B. Morse was by profession a portrait painter. In 1832, returning to America from England on the sailing ship, Sully, he conceived the idea of a magnetic telegraph -- and at the same time worked out a code of dots and dashes to carry the message over wires. Three years passed --

Morse was penniless -- nothing happened.

In 1835, Morse was appointed instructor of Art at New York University. He rented a garret room where he ate and slept; every spare minute he could find he worked on his discovery. He finally obtained the help of a brilliant young student, Alfred Vail, and, in a factory loft in Morristown, N. J., the Electro-Magnetic Telegraph was finally born.

On March 3rd, 1843, after eight years of heartbreaking difficulties, Morse was granted an appropriation of $3,000 by Congress, to build a telegraph line from Washington to Baltimore. The first message sent was:

"What Hath God Wrought."

Now many millions of miles of wires carry messages to all parts of the world.

BELL

Alexander Bell in an attic room and his assistant, Thomas A. Watson, in an adjoining room experimented with tuned harmonic reeds. We quote Watson's statement of what happened on June 2nd, 1875:

> "I was plucking a stuck reed, when a sound-shaped electric current passed through the wire from my work-room to Bell's; he heard for the first time the tones and overtones of a sound transmitted by electricity."

There followed nine months of ceaseless effort before Bell's "brain child" uttered its first sentence.

Bell had moved to 5 Exeter St.,

Boston, where he rented two rooms, a shop and a bedroom for $4.00 per week, A wire ran from one room to the other. On March 10th, 1876, Bell was in his shop and Watson was in the bedroom with a receiver to his ear. Bell accidentally upset a jar of battery acid over his clothing. Excitedly he called: "Mr. Watson, come here, I want you." The instruments were so adjusted that Bell's voice carried distinctly over the wire to Watson. Bell's vision had become a reality -- it talked.

1876 was the year of the Philadelphia Centennial Celebration. Bell reserved an exhibition space but his funds were so low that he had to borrow money for train fare from Boston to Philadelphia. His small display table was lost in the vast expanses of the hall. No one paid any attention to his fantastic story.

Towards the close of a hot, muggy summer day about the time Bell had given up hope of obtaining any financial help, he saw a group of influential looking men approaching. Suddenly the leader stopped and extended his hand. "Professor Bell, I'm delighted to see you again!" It was Dom Pedro, Emperor of Brazil, whom Bell had met in former years. The Emperor said, "What have we here?" Bell demonstrated his instrument. Dom Pedro placed the receiver to his ear, listened a moment and sprang to his feet exclaiming, "God save us, it talks!"

Lord Kelvin, of Atlantic Cable fame, next listened, saying, "It does speak, gentlemen! This invention is the most wonderful thing in America!"

The next morning, the newspapers blazoned the story, bringing great attention to Bell and his invention.

STEPPING STONES TO WIRELESS

Theory. JAMES CLERK MAXWELL was born in Edinburgh, Scotland, in 1831. He entered the University of Edinburgh and later went to Cambridge. From 1860 to 1865 he was professor of physics at Kings College in London. There he met Faraday, whose theories and surmises on the subjects of "Time" and "Space" intrigued him greatly.

Science. HEINRICH HERTZ was born in Hamburg, Germany, in 1857, the son of a lawyer. He became a student of technical science but soon decided to devote himself entirely to physics. After three years of study in Munich and Berlin he became assistant to Helmholtz and later entered Kiel University. He taught at Karlsurhe Technical High School in 1888 and there the Hertzian or Radio Wave was born.

Invention. GUGLIELMO MARCONI was born in Bologna, Italy, in the year 1874. His father, Giuseppe Marconi, was an able business man and a gentleman of means. His mother, history tells us, was a keen-witted blue-eyed Irish girl. Their son was destined to bring everlasting glory to Italy. Marconi grew up to be a clever electrical engineer with a keen mind for business.

WIRELESS COMMUNICATION

Near the beginning of the twentieth century, a new unit of energy was being investigated by many leading scientists. It was the "electron," which was destined to advance the science of communication to undreamed-of horizons. The phenomena of our modern radio have resulted largely from the mental feats of an English mathematical physicist, James Clerk Maxwell.

Maxwell correlated the theories and surmises of Faraday and other electrical pioneers and through intricate mathematics established on paper the fundamentals of radio. He also discovered the speed of light to be 186,000 miles per second. Einstein later found this to be the general speed of the universe. Maxwell concluded that the light by which we see is a form of electro-magnetic radiation, a conclusion which stands confirmed by modern science.

Heinrich Hertz, a German scientist, put Maxwell's theories to work at Karlsruhe, Germany, in 1888. Hertz first demonstrated in his laboratory the super-swift transmission of electro-magnetic oscillations using two large metal balls and a loop of wire with a gap in the center, across which line sparks jumped through space. Hertz never realized the importance of his vast discoveries, since he died soon after this at the early age of thirty-seven.

Guglielmo Marconi, a brilliant young student of the theories of Maxwell and the accomplishments of Hertz, had the intuition that these waves might furnish mankind with a new and powerful means of communication. At his father's estate in Italy, at the age of twenty-one, Marconi began making his own tests. After several years of hard work he developed sensitive instruments and was able to send "The Message" for a distance of two miles. Hertz had used two metal balls for his oscillator; Marconi's conception was different. He used the earth, itself a metal ball, as one of his terminals and a great length of wire reaching upward into the heavens as the other. Then and there the Radio Antenna came into being.

One hundred and fifty years after Benjamin Franklin sent his kite aloft to learn the secret of electricity, another inquiring mind was sending a kite into the heavens along the coast of Newfoundland to bring out of the ether a message carried by electric emanations from far across the sea.

Guglielmo Marconi had, in 1899, sent wireless communications across the English Channel and in 1901 we find him and his assistants on the bleak coast of Newfoundland. Marconi sat for an hour with his ear glued to a receiver attached to a kite antenna. He knew Fleming was at his sending instruments in Cornwall, England, tapping out Morse's code letter "S" which is three dots. Finally, just after noon faint clicks were heard. He listened intently -- then with a never-to-be-forgotten thrill he heard distinctly the first wireless communication across the broad Atlantic.

STEPPING STONES TO ELECTRONICS

THOMAS A. EDISON, in 1884, unintentionally built the first Vacuum Tube. While developing the electric light he noticed the effect of the play of electrons in the semi-vacuum of an incandescent lamp. To confirm his suspicions that something new was happening, Edison set up a metallic plate in such a position that he was definitely conscious of the flow of electric current through "space" in the tube. He thus established the basis of the modern Electronic Tube. However, two decades passed before this Edison Effect was utilized.

JOHN AMBROSE FLEMING, Marconi's chief engineer, found, through experimentation, that this Edison Effect placed between the antenna and the ground connection of a receiver could be used as a "valve", offering means of detecting radio signals. Thus, early in the twentieth century, the Fleming valve theory added to the Edison Effect created the Diode Tube Detector, which marked a new milestone in the advancement of electric communication.

LEE DeFOREST at this time saw great possibilities in this electronic "Tube-in-the-making." He realized that means must be found to further direct the electrons' course through space. Fleming's valve had acted as a "do not enter" sign on a one way street; DeForest added a grid to the diode tube which established "stop" and "go" signs. This grid also acted as a speed control system for the regulation of electronic traffic. DeForest's "Triode" tube became the Electronic Amplifier which ushered in a new day in radio Communication.

RADIO ENTERS

In 1907, Lee DeForest had produced and patented the Triode or audion Tube; later Dr. H. D. Arnold of Bell Telephone Laboratories and Dr. Irving Langmuir of General Electric Research Laboratories added their contribution of "high vacuum" to the DeForest tube and radio started on a dramatic career destined to revolutionize the scope and trend of all modern living.

What a thrill to watch "Junior" in the basement with a table full of contraptions, earphones glued to his head, trying to make his crystal set work! Later another thrill to switch on your first set, turn the dial and pick up KDKA or some station nearer home. Quality of reception did not matter, the important thing was to brag next day at luncheon that you "got Davenport, Iowa," or that just after midnight you "almost had Los Angeles."

Broadcasting and reception were in a very formative state. On July 23, 1909, the steamer, Republic, flashed an S.O.S. by means of its new wireless equipment. The message brought nearby ships to the scene of the disaster and many lives were saved. April 14, 1912, the Titanic went down but not before its radio signalled for help. This greatest sea tragedy of all time proved the value of radio as seven hundred lives were saved. Wireless was becoming an absolute necessity for ocean traffic . . .

World War I again brought radio dramatically to the front as modern science and unlimited sums of money were made available for its development. Scientific investigation for war purposes had done much to improve radios. They could now be found in an increasing number of homes. The demand came for radios in automobiles; these were soon developed and operated successfully. At this juncture an urgent need was felt for police communication to aid in crime detection and the enforcement of law and order in our communities.

THE WHOLE BROAD SUBJECT OF RADIO NOW BRANCHED INTO TWO MAJOR DIVISIONS, BROADCASTING AND COMMUNICATIONS. Broadcasting confined itself to the fields of education and entertainment while communications devoted itself to man's information and protection on sea and land. At this point we stress the accomplishments of man's ingenuity in the field of Mobile Radio Communication, which has assumed tremendous proportions in the past few years. Following is the story of the achievements in this field of a small group of earnest radio engineers headed by Fred M. Link.

In the early days of civilization, man fought for his very existence in order to live in competition with the animal world around him. Finally God gave him dominion over the lower orders of life; he developed a civilization in which the forces of law and order predominated over the forces of evil. Never in the history of the human race has there been a time when man could relax for a moment his effort to uphold that balance of power for good.

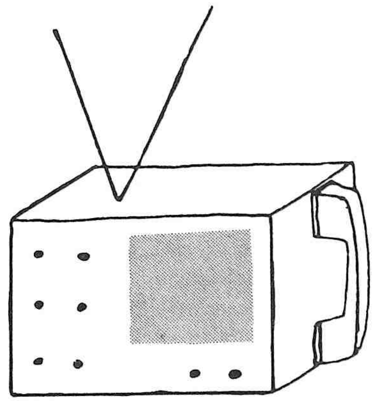
Now in the advanced twentieth century we find organized crime flourishing throughout the entire world. Man carries on a ceaseless fight against such crime and also to protect his fellow man from the ravages of the elements, from flood and fire, from disease and famine. Through man's ignorance and stupidity, unnecessary accidents take a staggering toll in all walks of life.

Mobile radio is playing a great role in the world today, doing its part in upholding these important forces of law and order. Statewide Police Radio now covers the greater portion of the United States with the Eastern Seaboard almost solidly protected by modern Link FM equipment. Public utilities all over this broad land are realizing that the cost of radio equipment, its installation and maintenance, is paid for many times over through the "speed up" of all their activities. Railroads and highways will soon be radio controlled. Our government uses mobile radio communications systems in the U. S. Armored Forces, Field Artillery, Signal Corps, Navy, Marine Corps, Coast Guard, Secret Service, Civil Aeronautics Administration, FCC, FBI, and many others.

As the motor car speeds over superhighways which have replaced the old wagon trails, as palatial steamers plow across the ocean where slow sailing ships fought the waves only a short time ago, and as the modern clipper ship wings its way into the heavens, annihilating time and space, so has come into being a method of radio transmission known as FM (Frequency Modulation) which is revolutionizing the entire field of emergency radio communications.

AM (Amplitude Modulation) is the most generally used method of broadcasting over certain prescribed air lanes. By this method you hear the programs coming from your home radio; but it is not entirely free from interference. Man-made and nature-made static overrides the AM carrier wave and often raises havoc with some favorite program to which you are listening. One could overlook this disturbance on his home radio, but emergency radio communication, especially in war time, was a different thing. Interference was an obstacle that had to be eliminated if possible.

Major Edwin H. Armstrong, internationally prominent radio expert and unquestionably one of the foremost inventors in the field of communication of all time, worked out a successful method of radio transmission and reception; this is called Frequency Modulation simply because the radio signal was varied in frequency rather than in amplitude in order to get variations in volume and tone. This relatively new method of radio inherently reduced the interfering effect of both nature-made and man-made static, thereby greatly improving the art of communication.



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J2

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☐ Franklin Lucas, East Orange, N. J. ☐ W. S. Tatum, Hattiesburg, Miss.

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For outstanding grades throughout their NRI course of study, the following May and June graduates received Certificates of Distinction along with their NRI Electronics Diplomas.

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(Continued from page 9)

Chapter	Date
S.E. Massachusetts*	September 25
Flint (Saginaw Valley)	October 10
Detroit	October 11
Hagerstown	November 14
Philadelphia-Camden	November 25
Springfield, Mass.	December 4
New York City	December 5
North Jersey	April 25
Pittsburg	May 1
San Francisco	May 8
Los Angeles	May 10
San Antonio*	May 23

***EXCEPTION: The lecture on the theory and servicing of Color TV will be delivered at these chapters.**

Alumni News

John Pirrung	President
Franklin Lucas	Vice-Pres.
James J. Kelley	Vice-Pres.
Arthur Howard	Vice-Pres.
E. J. Meyer	Vice-Pres.
T. F. Nolan, Jr.	Exec. Sec.

WALTER ADAMIEC LEADS IN '68 PRIMARY

If the primary results of an election campaign are a reliable indicator of the ultimate winner, and they frequently are, then it looks like Walter Adamiec of the Southeastern Massachusetts Chapter will likely be President of the NRI Alumni Association for 1969.

Walter first came to the attention of National Headquarters when he proposed establishing a new local chapter of the Alumni Association in Massachusetts. National Headquarters gave him the go-ahead signal. The result? The Southeastern Massachusetts Chapter, which he together with his co-workers succeeded in organizing in 1957.

Coming in second for nomination for President was Robert F. Smith, Burlington, Vt. Since he is not a member of a local chapter of the Alumni Association, National Headquarters is unable to furnish any information of Mr. Smith's background.

Among the nominations for Vice-President, three of the incumbents were nominated to run again. Two of them are James Kelley of the Detroit Chapter and Franklin Lucas of the North Jersey Chapter. Should they be elected again this time, they cannot run again for three years. The third incumbent is E. J. Meyer of St. Louis. Of the five remaining nominees, none has ever run for office before and none is affiliated with a local chapter.

Please indicate your choice of the candidates on the ballot on page 26, then mail the ballot well before September 25 when the polls close. The winners will appear in the November/December issue.

Chapters Have Social Events, Honor Oldtimers

DETROIT CHAPTER. As customary, at the final meeting of the 1967-1968 season the chapter elected the officers to serve for the next season. This year the entire slate of officers was re-elected to serve for the 1968-1969 season. They are: James J. Kelley, Chairman; John Nagy, Vice-Chairman; F. Earl Oliver, Treasurer; Charles Cope, Secretary; Gilbert Sager, Assistant Secretary; Leo Blevins and Asa Belton, Financial Committee; Prince Bray, Librarian; and Asa Belton, Sergeant-at-Arms. Our congratulations, gentlemen!

Detroit Chapter members attending annual fish-and-shrimp dinner.

The chapter wound up the meeting with its traditional fish-and-shrimp dinner served at its meeting place, St. Andrews Hall. The members always look forward to this event.

FLINT (SAGINAW VALLEY) CHAPTER. Arthur Clapp attended a course on safe servicing and how to avoid exposure to X-Rays. At the next meeting Arthur relayed to the members what he learned and explained the precautions to take while servicing TV receivers.

Oldtimer Clyde Morrissett dropped in for a visit. A charter member of the Chapter, he is now retired and lives in Beaverton, Mich., a summer vacation area where he spends his time fishing and boating and doing some TV servicing. More power to you, Clyde!

LOS ANGELES CHAPTER. Former secretary G. A. Daugherty was compelled to resign his office because the pressure of his daily work has become so great.

An indication of his reliability and loyalty to the Chapter is the fact that he has to make a round trip of 64 miles to attend the meetings, yet he rarely misses a meeting.

Norman C. Durbin was elected to replace him. Our congratulations to the new Secretary!

NEW YORK CITY CHAPTER'S second Vice-Chairman, Frank Lucas, gave an excellent talk on the high voltage system based on troubles he had encountered. It turned out to be an occasion where theory and practice met, and many doubts, misconceptions, and uncertainties were clarified. There was considerable participation from the floor.

Pete Carter gave members the benefit of his experience in servicing, cautioning the members, among other things, not to leave a convergence board in a customer's house; the board often contains components not directly connected to the color setup.

Jim Eaddy contributed on the subject of pulling, which could come from an intermittent heater cathode short.

Willie Fox related his experience with his new color set, which he operates successfully here in the city with only rabbit ears. It was both entertaining and instructive. Since he purchased direct from the factory, he had to make the initial adjustments himself, depending on his B/W experience --- he had never worked with color before.

A. Russell Thompson of the Bell Telephone Company gave a most interesting and informative talk on the company's undersea cables, placement, problems, and maintenance. This was a most enjoyable talk.

NORTH JERSEY CHAPTER. An entire evening was given over to the showing of motion pictures borrowed by George Schalk. One was on vacuum tube manufacturing and the other on safe driving. They were shown by the chapter's projectionist, Louis Koci.

A 21-inch television set was donated to the Chapter by Frank Szpiech for practical training purposes and demonstrations at future meetings. He also donated an RCA automatic record player with a combination radio and amplifier for

At North Jersey Chapter's fifth anniversary meeting were, left to right, former Secretary Frank Lucas, NRIAA Associate Executive Secretary Ted Rose, chapter organizer George Schalk, Secretary Harry Weitz and Chairman William Colton. The gentleman in the plaid shirt was not identified.

Mr. George Walker holding the Certificate of Membership presented to him as an Honorary Member by the Philadelphia-Camden Chapter. At left, Mr. Jules Cohen, Chapter Secretary. At right, Mr. E. J. Koznarek, GE Manager, Product Service, Mid-Atlantic District.

sound. The set was raffled off, proceeds to be added to the chapter's treasury balance. It was won by Secretary Harry Weitz, who will use it for pre-meeting entertainment until a later date when it will again be raffled off for the same purpose.

Frank Szpiech took the Chapter's transistor radio demonstration board to use at a young men's club to stimulate interest in electronics as a career.

At the following meeting William Whitely gave an absorbing demonstration with his B +K TV Analyst on the Chapter's television set and on a portable TV set brought in by George Stoll. This demonstration was so well received that the program will be continued at the next meeting.

Due to his physical condition, George Schalk resigned as Program Committeeman. The members gave him an ovation and expressed well-deserved praise for his many contributions to the welfare of the Chapter.

PHILADELPHIA CAMDEN CHAPTER has always been proud, and justly so, of the Honorary Members it includes in its membership. The latest to be added to the list is Mr. George Walker, Special Products Service Supervisor for the General Electric Company.

Mr. Walker has been conducting very fine meetings for the Chapter for the last eight years and the Chapter felt it was time to grant him the recognition he has deserved.

This was done at the General Electric Auditorium in Philadelphia. With the help of Mr. E. J. Koznarek, Manager, Product Service Mid-Atlantic District, Mr. Walker was inducted into the chapter as an Honorary Member. He was obviously pleased with the honor.

There were door prizes and refreshments afterwards, and the members enjoyed themselves as much as Mr. Walker.

SAN ANTONIO CHAPTER members enjoyed an excellent exposition and blackboard demonstration on FM circuitry by Sam Dentler.

This is a belated report on the officers serving the Chapter for the current season. They are: C. W. A. Hoffman, Chairman; Rev. J. Lawson, Vice-Chairman; Sam Dentler, Treasurer; and Robert Bonge, Secretary.

SAN FRANCISCO CHAPTER members Pete Salvotti and Mr. Tomlinson demonstrated the adjustment of the vertical and horizontal in a television receiver.

One of the members brought a set that was having vertical and horizontal trouble. Messrs. Salvotti and Tomlinson demonstrated how to adjust the vertical and horizontal control.

The station selector was not making good contact, so Art Ragsdale sprayed some cleaning solution on the contacts, which corrected this trouble.

All the members are urged to bring in any tough dog receivers they may have.

As a chapter project, the members are constructing a diode checker.

SPRINGFIELD (MASS.) CHAPTER. John Parks presented a demonstration with an NRI television set and oscilloscope. His subject was the horizontal output stage. As usual, John performed admirably. Norman Charest assisted.

DIRECTORY OF ALUMNI CHAPTERS

DETROIT CHAPTER meets 8:00 P.M., 2nd and 4th Friday of each month, St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mich., VI1-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 7:30 P.M., 2nd Wednesday of each month at Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint. Chairman: Arthur Clapp, 705 Bradley Ave., Flint, Mich. 234-7923.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P.M., 2nd Thursday of each month at George Fulk's Radio-TV Service Shop, Boonsboro, Md. Chairman: Robert McHenry, RR2, Kearneysville, W. Va.

LOS ANGELES CHAPTER meets 8:00 P.M., 2nd and last Saturday of each month, at Chairman Eugene DeCaussin's Radio-TV Shop 4912 Fountain Ave., L.A., Calif., NO4-3455.

NEW ORLEANS CHAPTER meets 8:00 P.M., 2nd Tuesday of each month at Galjor's TV, 809 N. Broad St., New Orleans, La. Chairman: Herman Blackford, 5301 Tchoupitoulas St., New Orleans, La.

NEW YORK CITY CHAPTER meets 8:30 P.M., 1st and 3rd Thursday of each month, St. Marks Community Center, 12 St. Marks Pl., New York City. Chairman: Samuel Antman, 1669 45th St., Brooklyn, N. Y.

NORTH JERSEY CHAPTER meets 8:00 P.M., last Friday of each month, Players Club, Washington Square (1/2 block west of Washington and Kearney Avenues), Kearney, N. J. Chairman: William Colton, 191 Prospect Ave., North Arlington, N. J.

PHILADELPHIA-CAMDEN CHAPTER meets 8:00 P.M., 2nd and 4th Monday of each month, K of C Hall, Tulip and Tyson Sts., Philadelphia. Chairman: John Pirrung, 2923 Longshore Ave., Philadelphia, Pa.

PITTSBURGH CHAPTER meets 8:00 P.M., 1st Thursday of each month, 436 Forbes Ave., Pittsburgh. Chairman: James Wheeler, 1436 Riverview Drive, Verona, Pa.

SAN ANTONIO (ALAMO) CHAPTER meets 7:00 P.M., 4th Friday of each month, Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 Block of North New Braunsfels St. (3 blocks north of Austin Hwy.) San Antonio. Chairman: C. W. A. Hoffman, 4215 Shelton Dr., San Antonio, Texas.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 2nd Wednesday of each month, at the home of J. Arthur Ragsdale, 1526 27th Ave., San Francisco. Chairman: Isaiah Randolph, 523 Ivy St.,

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P.M., last Wednesday of each month at the home of John Alves, 57 Allen Blvd., Swansea, Mass. Chairman: Oliva J. Laprise, 55 Tecumseh St., Fall River, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7:00 P.M., last Saturday of each month at the shop of Norman Charest, 74 Redfern Dr., Springfield, Mass. Chairman: Br. Bernard Frey, 254 Bridge St., Springfield, Mass.

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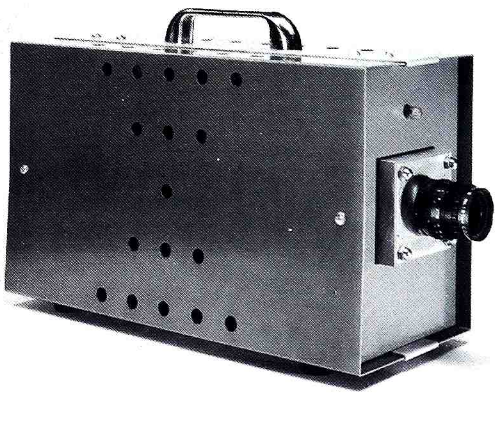

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