NATIONAL RADIO NEWS

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Changing Raw Quartz Into Crystal Oscillators

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"You've Got Something There"

It's funny how a slang expression will catch on with people. We hear it for the first time in some theater or talkie. Or perhaps it is emphasized by some character over the air. The first thing we know we hear it among our friends and then we find it easy to use too.

Today a popular slang expression is, "You've got something there."

You've heard it. You explain an idea to someone, and the reply frequently is, "you've got something there!" I want to use the expression myself, to urge you to take advantage of every opportunity to prepare yourself for the bigger and better things which are coming with the growth of Radio. It is an industry with a real future.

Man, *"we've got something there!"*

More than 33,000,000 Radio sets in American homes; more than $891,000,000 spent in Radio during the last year; more than $75,000,000 spent in servicing sets during the last year; more than 8,000,000 new receivers sold last year; more than 4,464,000 auto sets now in use; more than 600 broadcasting stations; more than 10,000,000 homes will want television sets eventually—that's the Radio picture. A live mammoth business of today.

Radio broadcasting is the parent of "talking pictures;" electrical surgery, Radio prospecting for mineral, metals and oils, facsimile transmission, aviation and police Radio and remote Radio control. These are just a few developments. Every expansion means jobs for men in the field, men whose training qualifies them to move up. This makes room for new men. And television is making rapid strides. It is interesting to anticipate to what extent this new baby of Radio may expand this industry. It's marvelous to feel that we—you and I—are in an industry with such remarkable prospects for growth. We face a brilliant future.

Let's hitch our belts a notch tighter and dig in just a bit harder. Let's be ready for any and every opportunity which may come to us. We made a good choice when we picked Radio as our business of opportunity. To again use the expression to emphasize my point, let me say simply—Make the most of your chances in Radio—you've got something there!

J. E. SMITH,
President.

Checking Voice or Musical Instruments for Correct Pitch and Quality

The Resonoscope, a new electronic device as it is called, developed by the Allen B. DuMont Laboratories of Upper Montclair, New Jersey, permits the vocalist or musician to see with his own eyes just how his or her voice or musical instrument sounds. This allows adjustment of the voice or instrument for correct pitch and quality while watching the screen pattern on a cathode-ray tube.

The Resonoscope consists of a special cathode-ray oscillograph used in conjunction with a standard set of musical frequencies representing the twelve notes of the chromatic musical scale. These standard frequencies, produced by twelve

Singer testing pitch of her voice by observing wave form on cathode-ray screen of Resonoscope.

electrically-driven tuning forks, are utilized to synchronize an oscillator in step with them. The oscillator is employed to provide a horizontal sweep circuit for the cathode-ray tube.

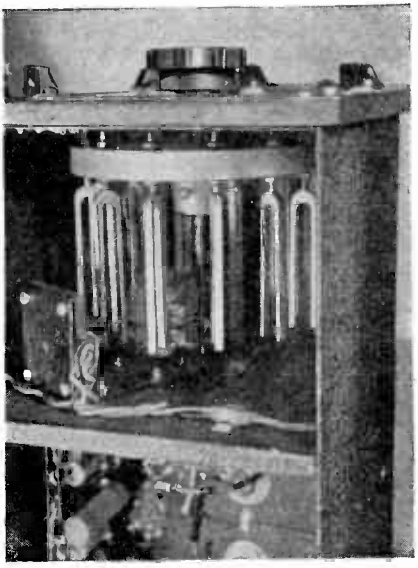
A voltage amplifier is used to pick up the music of any single musical tone by means of a microphone. The amplifier output is placed on the vertical plates of the cathode-ray tube. This provides a visual image of the wave form of the musical note under observation. If that musical note is of the same pitch or frequency as the standard being used, or any harmonic of same, the wave form appears to stand still on the screen. If the note is flat or lower in pitch than the horizontal sweep standard, the wave form appears to be moving to the left. If higher in pitch or sharp, it moves to the right. The speed with which the wave form moves across the screen therefore indicates the extent to which the voice or instrument is off pitch.

Any of twelve standard frequencies in the Resonoscope can be selected one at a time by the turning of a marked control knob on the front panel. These twelve frequencies represent the twelve notes of the chromatic scale.

Each setting of the control accommodates all octaves of the particular note. The middle octave notes appear as simple wave forms on the cathode-ray screen. The higher octaves appear as multiple waves, while lower octaves are simply portions of the waves.

One of the special features of the circuit of this oscilloscope is that the horizontal sweep circuit is automatically changed in frequency to compensate for the change in frequency in going from one note to another. This allows the sweep circuit to be readily synchronized at all times by the standard frequency of the tuning forks, and assures the observer of the number of wave forms on the screen is a direct indication of the octave he or she is playing or tuning to.

The Resonoscope seems definitely destined to become an indispensable aid to every branch of the musical art.



Underneath side of Resonoscope chassis, showing master tuning forks and driving solenoids.

L. J. Markus

Electronics, Inc.

By L. J. MARKUS

N. R. I. Technical Editor

Electric eyes, radio-controlled doors and ultra-short wave radio sets play prominent parts in this fantastic science-fiction story of an electrical wizard who tried to kidnap the entire city of Washington.

ON a sultry, storm-threatening day in July, just about the time in the morning when people begin to wonder what they will order for lunch, Jay Green triumphantly wiped the sweat off his brow. He had been struggling for over an hour with a particularly annoying case of intermittent reception, but with effect-to-cause reasoning and the ever dependable cathode ray oscillograph had at last located the trouble.

"There's a bum cathode bias resistor in the second detector of this set, Ozzie. Put in a new one, check the performance on a few local stations, and we'll clean up for lunch."

At the mention of lunch Ozzie perked up quite amazingly. Grabbing the always hot soldering iron from the bench, he flipped it back and forth a few times deep down in the chassis of the receiver, yanked out the bum resistor as if it were a sore tooth and had a new unit in place in short order.

Ozzie was chubby, and ordinarily so languid in his movements that people wondered why Jay had chosen him as partner in the radio servicing business called *Electronic, Inc.* Jay knew, however, that there wasn't another man in Washington who could handle radio tools as efficiently and could solder as neatly as Ozzie. They made an ideal radio servicing team—Jay did the trouble shooting, designing and research work, while Ozzie did the actual repair work and routine receiver alignment jobs. Together they could go through a stack of ailing receivers in one-two order.

Just as Ozzie was completing his work on the set, the power in the laboratory went off—suddenly and mysteriously. The receiver happened to be a new farm model designed to operate entirely from a storage battery, and consequently remained in operation; the local program stopped coming in, however. Jay sauntered over to the fuse box, found everything okay there, and came back to hear Ozzie exclaim, "That's funny: I can get Baltimore and New York all right, but not a single local station is on!"

To see if the local police transmitter was in operation, Jay tuned to the police band. Nothing was heard, but he left the receiver tuned to that setting on the chance that a police broadcast would be put on in a few minutes. They discussed this unusual happening, with Jay predicting that the entire local power plant was temporarily out of operation. Suddenly they both jumped to attention; a strange and powerful carrier hum was coming from the loudspeaker, and then a steely, commanding voice cut in:

"*Heliotra speaks. By cutting off the electric power, the city of Washington, D. C. has just been kidnapped. The ransom shall be five million dollars in small bills, placed at the foot of the Washington Monument before midnight on the last day of this month.*"

"Gee!" exclaimed Ozzie. "That's a break for the candlestick makers, but what'll we do without power for our instruments and tests?"

"We won't need any power, Ozzie, if that fellow really means business, for no one will have any servicing business to give us until this mess is cleared up. All business in Washington will be at a standstill—no trains, street cars, or elevators will run—theatres will be closed, and millions of

dollars will be lost each day," prophesied Jay.

Just then the lights in the shop flashed on. The pointer of the line voltage meter on the test panel swung wildly back and forth across the scale as the lights flickered, then power went off again. Twice more in the next fifteen minutes, as Jay and Ozzie discussed the situation, the same procedure was repeated. It was as if some unseen force allowed the power plant generators to get up to speed, then came into action, making the generators run wild and blowing the circuit breakers.

As day after day passed, the helplessness of the police became more and more evident. Regularly at noon each day Heliotra repeated his message, at which time some of the best radio engineers in the country sprang to the controls of their direction finders in an endeavor to locate the position of this mysterious transmitter. Police searched every building in Washington; power plant engineers checked over every foot of the network of wires spreading out through Washington, but to no avail.

People all over the world anxiously awaited news from a city so completely bewildered and helpless. No one knew what devilment Heliotra would attempt next; there was always the possibility that he eventually intended, with the influence of ransom-filled coffers, to gain control of the entire world. Preliminary steps were being taken to collect the ransom money, for shrewd Washington businessmen figured that their share of the ransom money would be insignificant compared to what they would lose if this situation were prolonged.

In the laboratory of Electronics, Inc., Jay and Ozzie worked tirelessly far into the night, with candles for illumination, experimenting with one piece of hastily assembled radio apparatus after another, trying to locate the mysterious transmitter and solve the mystery of why power plant generators could not run and yet showed no visible signs of damage. Their orange and white delivery car was a familiar sight on the streets of Washington each noon, Ozzie at the wheel and Jay at the controls of the radio equipment. Jay now knew why the government radio engineers were helpless in tracing the signal—it seemed to come from everywhere and nowhere, having no definite direction and yet coming in with greater signal strength than had ever existed in the Nation's Capital.

Jay, temporarily baffled, finally gave up his field tests and remained in the shop. Knowing the fundamental principles of radio and realizing that whatever Heliotra was doing must be based on these principles was maddening—there must be some solution. While Ozzie reclined on the service bench, with the cathode ray oscillograph for a back-rest, Jay analyzed the situation over and over again, seeking that logical explanation which appeared to be right at his finger tips. Idly he thumbed the pages of his correspondence textbooks, one after another. The book on transmitting antennas caught his attention; eagerly he studied one radiation pattern after another, then called out to Ozzie, "Get out that direction finder again—quick! He'll be on in ten minutes."

Out in front of the shop they set up the equipment, with batteries strung out all over the sidewalk. Straight up into the sky Jay directed the loop antenna, making Ozzie wonder if some demon on Mars might really be the villain. Tensely Jay waited at the controls until, at the stroke of 12, the voice of Heliotra was heard gain. Feverishly Jay adjusted the controls; at last he secured a null reading, indicating that the signal did have a direction after all. Adjusting the position of the loop antenna, a fraction of an inch at a time, he checked and rechecked the amazing figure which he was getting—88.7 degrees.

"Signals coming down from the south at this angle after reflection from the ionosphere, which must be about 70 miles up about this time of the day—let's see what the old slipstick says about all this," muttered Jay to himself as he manipulated his slide rule.

A look of astonishment came over his face. He checked and rechecked—yes, it was correct. Heliotra's transmitter was *within one-half mile* of them, and right in the heart of Washington! "Come on, Ozzie, and I'll introduce you to the most sought after man in America!"

Ozzie snorted his disapproval of the whole affair, but obediently gathered together the various pieces of equipment which Jay called for. A powerful ultra-short wave portable transmitter designed and built in the shop of Electronics, Inc., together with a telescoping fishpole antenna, were piled in the car. "Just in case we'll have to call for help," explained Jay. "Incidentally, you will remember that the antenna of this job can deliver a knock-out jolt when touched; we may make use of that power before the day is over."

Then came a radio metal locator capable of locating buried metal objects of any size or detecting the presence of tunnels deep underground; two flashlights and the special tool kit which Jay had arranged for electronic jobs completed the array.

With everything in readiness, they piled into the truck. Jay studied a map of the city for a few moments, sketched in a circle corresponding to a distance of one-half mile from their shop, then instructed Ozzie to drive down past the White House on 17th Street. Right alongside the reflecting pool Jay signaled to stop the car. "Here's where we start our hunt, Ozzie," announced Jay. "Within two blocks of this spot, we are going to find Heliotra."

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Electronics, Inc. (Continued from page 5)

Ozzie scanned that entire two-block radius area with his eyes, then looked up questioningly at Jay. Not a single building was in that region—that is, nothing except for the Washington Monument, which to Ozzie was just a pile of stone and didn't count. "Looks as if we'll have to dig for him," commented Ozzie caustically.

"For that wisecrack, Ozzie, you shall receive the honor of doing the digging—if we have to dig. Drag out the radio metal locator, and we'll see if we can locate our man somewhere underground."

The apparatus consisted of a high-power radio frequency oscillator whose frequency was governed by the amount of iron in the vicinity of the loop antenna used. A separate and super-sensitive receiver picked up the high frequency signals radiated by the oscillator. In the receiver a locally generated R.F. signal was mixed with the incoming signal, producing a beat note which could be heard in the headphones. Any variation in the frequency of the transmitting oscillator, resulting from metal buried in the ground or from metal-lined underground rooms, would change in the frequency of the beat note, and this change was readily detected in the phones.

With Ozzie acting as pack-horse for the battery container, the powerful oscillator and the amplifiers, and with Jay holding the antenna coils and the control unit, they paced back and forth across the Monument grounds while listening to the monotonous signal tone in the ear phones clamped over their ears. Each underground pipe and wire announced its presence by a change in the tone, but to these interruptions Jay gave no heed. He was after bigger game, but what it was he could not venture to say. Suddenly the squeal in the headphones increased in pitch, quickly passing out of the audible range.

"I found him, Ozzie, old boy"! exclaimed Jay. "Now we'll trace out the boundaries of his underground hideout."

Back and forth they trudged across the grassy hillside where but a few weeks ago thousands of Boy Scouts had frolicked during the Jamboree. So sensitive was their indicating instrument that even room partitions could be detected by changes in the tone. On the Potomac River side of the unseen underground chambers they encountered what appeared to be a tunnel.

"Ah," exclaimed Jay. "This should lead us to the secret entrance."

With headphones glued to their ears, Jay and Ozzie walked along the ground directly over the tunnel, and traced it right up to one of the massive stone piers of the Arlington Memorial Bridge. There it stopped; no sign of an entrance could be seen as they leaned far over the bridge rail.

Ozzie was sent back to get the truck, which contained some rope; upon his return Jay rigged up a sling so Ozzie could lower him down within a few feet of the water. Carefully Jay examined every inch of the wall, then gave the signal to hoist away.

"Yes, that's the entrance to Heliotra's little cavern," announced Jay as he clambered over the rail, "but there's not a sign of a door knob or even a hole through which a beam of light could be flashed to operate a photoelectric-controlled door opener. There is just one other way in which that door could be controlled and I think I know what it is. We'll have to go up river to get a boat, pile all our apparatus in it, then drift down under this pier."

A half hour later the two were under the piers of the Memorial Bridge, directly in front of the place where the tunnel appeared to end. To Ozzie the problem of getting through that massive stone wall seemed almost hopeless, but Jay set up the 5-meter transmitter, clamped the aerial to the side of the boat so that it extended outward parallel to the surface of the water, and connected up a sending key to the transmitter.

"Here's how I figure, Ozzie: this door must have one of the latest radio-operated controls, with a heavily insulated pick-up antenna running on the bottom of the river. We'll have to experiment a bit to find the right code, for opening one of these affairs is just like trying to open a combination lock when you don't have the numbers," explained Jay. "I know that they use three groups of dashes, with not more than five dashes in any one group; this means that we have about 200 possible combinations of signals to try."

In mathematical order Jay tried one combination after another while Ozzie looked on with eager interest, until suddenly, just as he completed the sending of 3-4-1, a whir of motors was heard and a huge section of the pier wall swung inward.

The fiery-red rays of the setting sun revealed a gigantic vaulted chamber inside, with a low dock alongside which were tied a small barge and several boats. Cautiously they rowed inside, and Jay tapped out the code signal which he knew would close all radio-operated doors. As Ozzie protested, he explained: "We don't want any one coming in after us to sound an alarm and spoil our surprise party for Heliotra."

In a darkness pierced only by the narrow beams

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The Laboratory Page

By GEORGE J. ROHRICH

The purpose of this department is to furnish supplemental experiments to students who have completed their Home Laboratory Course, but who wish additional laboratory experience. You are not required to perform these experiments, but you will gain increased knowledge by doing so. Most of the material required will be that received as part of the Laboratory Course. Any other material necessary can be purchased very reasonably and will constitute an investment rather than an expense, as it will serve as replacements in service work or be useful in your shop later.

George J. Rohrich, Engineer in Charge N. R. I. Laboratory

EXPERIMENT NO. 59

Objects: 1. To show that the use of a meter will change the voltage distribution in a circuit which contains appreciable resistance. 2. To show how resistance in a circuit will affect the measurement of voltage. 3. To show that the highest resistance meter produces the least change in voltage distribution while making measurements for voltage.

Apparatus Required: 0-50 voltmeter (item No. 12); 0-5 milliammeter (item No. 1); 0-10,000 ohm potentiometer (item No. 13); audio transformer (item No. 24); test prods; one 45 volt battery, tapped at 22 volts.

Apparatus Assembly: 1. Connect the parts as shown in Fig. 88. Note the method which is suggested for attaching the red test prod to the positive terminal of the voltmeter while the black test prod is connected to the negative terminal of the meter. This will make it easier to use either meter later by itself, by removing only one wire as will be directed in the experimental procedures.

2. Use a short piece of wire to join the positive terminal of the battery with terminal P on the transformer. Also use another short piece of wire to join terminals B and F on the transformer.

3. Rotate the potentiometer dial to 100. Then hold the test prods across the battery terminals and rotate the dial of the potentiometer until a comparative reading is obtained on the milliammeter. In other words, if the voltmeter indicates 44 volts, adjust the potentiometer until a reading of 4.4 is obtained on the milliammeter. This is a repetition of the Experimental Procedure in the previous experiment No. 57 and you now have two voltmeters both (or either) of which are suitable for indicating voltages which exist across a pair of terminals.

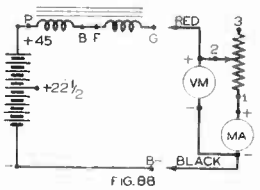

FIG. 88

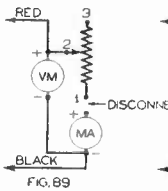

FIG. 89

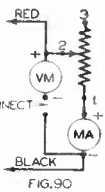

FIG. 90

Experimental Procedures: 1. Hold the black test prod on B— and hold the red test prod on terminal P. Read the values on both meters. See results of this test for our case in Table No. 1. Make a note of your own readings in a similar table. (Observe that you may conduct Procedures No. 4 and No. 7 at this time, simply by holding the test prods on the terminals as directed.)

2. Disconnect the wire temporarily from the plus terminal of the milliammeter as shown in Figure 89. Only the first meter is now used for testing voltages. Again hold the test prods on terminals B— and P. Note your reading on the single voltmeter now in use.

3. Restore the connection on the milliammeter and temporarily remove the wire from the minus terminal of the other meter so you will have the circuit shown in Fig. 90. Only the second meter is now used for testing voltages. Again hold the test prods on terminals B— and P and note the reading on the single voltmeter now in use.

4. Restore the wire disconnected in Procedure No. 3, so both voltmeters are used together as in Fig. 88 for the first procedure. This time hold the test prods on terminals B— and B of Fig. 88.

5. Temporarily disconnect the wire as directed in Procedure No. 2 so the first voltmeter is used alone and test the voltage again across terminals B— and B.

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The Laboratory Page (Continued from page 7)

6. Again change connections as directed in Procedure No. 3 so the second voltmeter is used alone and test the voltage again across the terminals B— and B.

7. Restore connections for the voltmeters as used in Procedure No. 1. This time hold the test prods on terminals B— and G.

8. Temporarily disconnect the wire as directed in Procedure No. 2 so the first voltmeter is used alone. This time hold the test prods again on B— and G.

9. Again change connections as directed in Procedure No. 3 so the second voltmeter is used alone and test the voltage across terminals B— and G.

Observations: The purpose of these tests is to observe various facts and then by a process of reasoning arrive at the general conclusions which are stated in the three objects in this experiment. This is done best by studying the results of our tests in groups of three.

TABLE NO. 1

Test No.	Black Test Prod on	Red Test Prod on	Approx. Reading on Item No. 12	Approx. Reading on Item No. 1
1	B-	P	44	44
2	B-	P	44	Not Used
3	B-	P	Not Used	44
4	B-	B	36	36
5	B-	B	38	Not Used
6	B-	B	Not Used	42
7	B-	G	18	18
8	B-	G	22	Not Used
9	B-	G	Not Used	34

1. Observe that the readings across terminals B— and P in the first three tests are alike. It is evident that any one of the three devices would serve to tell us that the voltage remains at one value under various conditions.

2. Observe that the readings in tests 4, 5 and 6 are not alike. Here we would wonder what value of voltage actually is delivered from the source, if terminals B— and B were the only two visible connections, as would be the case if the winding of the transformer is used as a filter choke in a power supply unit. We may even wonder if the meters are highly inaccurate after having only made tests Nos. 5 and 6, where *single* meter readings are compared.

3. Observe that test No. 4 lets us *compare* the values indicated on both meters. This comparison for accuracy can be made *only when both meters are connected at the same time.* Slight differences naturally may exist, due to the fact that it is a difficult matter to make meters which are accurate over the entire scale. This was explained in Experiment No. 58.

4. If we make test No. 5 and then add the second meter as used for test No. 4, we immediately have proof of the first object in this experiment. In other words, connecting a meter will change the voltage distribution in the circuit. This is shown again by first conducting test No. 6 followed by test No. 4. It is also shown by first conducting test No. 8 or 9, followed by test No. 7. We can therefore conclude that the voltage indicated is the value which exists only at the time that the meter is connected.

5. Observe for the second object of this experiment that the addition of a meter *reduces* the value of voltage across a pair of terminals. This means that the applied voltage always is higher after the meter is removed. This conclusion can be drawn while comparing the several tests mentioned in Observation No. 4. By a process of reasoning we can also conclude that the voltage across terminals B— and G is 44 volts when *all meters and current consuming devices are disconnected.*

6. You are aware that the resistance of Item 12 is approximately 3300 ohms, from statements given in previous experiments. The resistance of the "voltmeter" used for tests Nos. 2, 5 and 9 is approximately 10,000 ohms. The resistance of the combination of the two meters in parallel as used in tests Nos. 1, 4 and 7 is approximately 2500 ohms. We can readily come to the conclusion that the highest resistance meter produces *the least change* in voltage when added to a circuit. This can be done by realizing that the highest voltage across any pair of terminals (across B— and B for example) would be 44 volts. The 10,000 ohm meter in this case almost indicates this value of 44 volts by registering 42 volts. The 3300 ohm meter doesn't do so well in this case although the fact that it registers 38 volts is not serious because this reading is within 14 per cent of the value which exists when the meter is disconnected. This is not a serious error because meters are considered satisfactory for use in most cases if they register within 20 per cent of specified voltages. The 2500 ohm meter in this case registers 36 volts, or within approximately 18 per cent of the 44 volts.

Explanations: The cause of the variations in voltage is due to connecting resistances in series and parallel. *Every part* in the assemblies we have been using has resistance. The battery, transformer windings, meters, connecting wire, and test prods have individual values of resistance. Some parts have more resistance than others.

The resistance inside the battery and in the connecting wires is so low in comparison to the other values which we have been using that their effect cannot be noted here. If we would use meters with lower resistance than used here, these internal effects also would change the distributions of voltage.

If we realize that a meter is a resistor, with the addition of an automatic indicator consisting of a needle and scale, which indicates current and voltage through this resistor, we can readily note the changes in current and voltage which exist when these or similar individual resistors are connected in various ways.

Electronics, Inc. (Continued from page 6)

of their flashlights, the two moored the boat and lifted the equipment onto the dock. A search revealed a single steel door as the only possible entrance to the tunnel. Jay selected an oddly shaped tool from his special electronic kit and attacked the lock. A minute went by before the mechanism yielded; with extreme precaution he opened the door until the aperture barely sufficed to put an arm through. He flashed a light over the inside of the door. There was a small, round mirror imbedded in the steel.

Jay dove into his tool kit for a pocket mirror larger than the one in the door. He held it in front of the imbedded mirror, opened the door wide, and signaled for Ozzie to stoop as he passed through with the transmitter. Jay then entered just as cautiously, closed the door after him, and then lowered the mirror.

The glass in the door served as reflector for an infra-red or invisible beam of light. Opening the door would swing the mirror out of alignment, the light beam would move off the photoelectric cell mounted somewhere on the tunnel wall, a circuit would be broken, and an alarm sounded in the underground headquarters. By holding a pocket mirror steady when the door was moved, Jay had kept the light beam in its proper path and no alarm had been sounded.

There were other photoelectric cells in the tunnel, at various heights above the tunnel floor, but the flashlight beams picked them out one by one, and the two men either stooped under or stepped over without interrupting the beams of infra-red light which they could not see but nevertheless knew existed.

The faint trace of a sardonic smile crept over Jay's lips as he thought of how Heliotra was this very minute feeling secure in the knowledge that his electronic gadgets would announce the presence of intruders. Jay was positive now that the book on electronic controls which he had mastered as a part of his home study radio course was worth its weight in gold.

After walking what seemed like miles through the damp tunnel, they came to a room filled with packing cases of various sizes. Jay signaled for caution, and they treaded stealthily through this room to a door which appeared to be of solid steel. Jay turned the knob cautiously, found it unlocked, and pulled it open just far enough to see that there was a mirror on the inside, as before. Again a mirror was brought into play, and soon they were in an elaborately furnished room which appeared to be an office. Ozzie sauntered over to the desk and was just ready to pull open a drawer when Jay pulled him backwards by the seat of his pants.

"This metal desk may be a push-button for one of Heliotra's doorbells," cautioned Jay. "It could be connected to a capacity-controlled circuit which goes into oscillation whenever someone touches the desk, operating a relay and sounding an alarm in the control room. This sheet bakelite flooring material insulates the desk perfectly from the ground."

Carefully Jay stepped up to within a few feet of the desk and pulled open one drawer after another with a pair of wood-handled lineman's pliers which he had taken from the tool kit. Finally he located what he wanted—a map of the entire underground establishment; this he lifted out of the drawer with the pliers.

Having completed a careful study of the map, while Ozzie grieved in silence over his sudden backward tumble, Jay finally gave the signal to move on.

Through one room after another, past silently operating Diesel engines, massive generators and benches cluttered with electrical apparatus, they trudged. The map had given the positions of all electric eyes and other detecting devices, so Jay was confident that their presence in the place was not yet known to Heliotra. Some doors had secret switches, which could be held closed with a thin knife-blade while the door was opened, while others had the already familiar electric eye on guard.

Finally they came to the door of what Jay knew was the master control room. Here the map had indicated that radio-operated controls were used, and also gave the code. It was but a matter of seconds for Jay to tap out this code on the 5-meter transmitter. The door swung open silently on oiled hinges, and they entered.

At the far end of the room, seated at a control board illuminated only by a green overhead light, was Heliotra. Ears glued to headphones while tuning a radio receiver, he had clearly not noticed their entrance.

Jay pulled off his shoes, took the transmitter from Ozzie, waited a minute for the tubes to warm up after he had turned it on, then extended the telescoping antenna to its full length, held it in the grip of an insulated lineman's pliers, and slowly crept up toward the control board. With the transmitter power on full, he lightly tapped Heliotra on the neck with the antenna. Wicked blue sparks discharged as Heliotra crumpled in his chair.

Jay sprang forward, calling to Ozzie: "Quick, tie him up with that roll of wire in the tool kit."

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Electronics, Inc. (Continued from page 9)

Jay sprang to the control board now, throwing one switch after another in the exact order he had memorized while studying the map. This done, he clamped the telescoping antenna to a chair, plugged the sending key into the transmitter, then sent out over and over again this message:
"QRR QRR Any five meter amateur—notify police immediately that Heliotra has been captured in underground chambers fifty feet northwest of Washington Monument, 30 feet underground. Notify power company that their generators can now be turned on safely."

"Instruct police to bring excavating tools and acetylene cutting torches, for they will have to cut through armoured steel walls. Ask police to hurry, for Heliotra's assistants may break down locked doors and reach us in master control room."

His work done, Jay leaned back in the chair with a sigh of relief. Glancing at Heliotra lying on the floor, he couldn't resist smiling at the thoroughness of Ozzie's work with antenna wire. Noting that Heliotra was beginning to recover from the shock, Ozzie walked over and sat down, by no means gently, on the copper-swathed body.

"Fine work, Jay; this should bring *Electronics, Inc.* some free front-page publicity and a lot of good business. But how did Heliotra manage to pull this stunt?" asked Ozzie.

"He took advantage of the fact that every generator has its own natural frequency of electrical operation," Jay answered. "By feeding into the power lines inductively, small amounts of power at the natural resonant frequencies of the generators used in Washington, he made these generators behave like bucking mules, blowing their circuit breakers. Each time power plant engineers turned on the generators, Heliotra's apparatus automatically came into action."

"That transmitter stunt of his had me fooled for a while, but now I can see that he was using the elevator cables in the Washington Monument as his transmitting antenna, feeding the various cables in a definite phase relation to each other in order to get a very steep sky wave with no ground wave. That door over on the right leads to a tunnel going right under the foundations of the Monument and from it a transmission cable leads up to the elevator pit."

"On this control board are indicator lights which are intended to trace the movements of any intruder. Each is connected to some detecting device; yes, here is one for the metal desk in the office. If police or any one else blundered into the river entrance, their presence would have been indicated immediately and Heliotra had only to press one of these buttons to lock them in any room which he selected."

As Jay finished his explanation, the first noises overhead were heard, indicating that the police were on the job. Soon the sputtering crackle of an acetylene torch was heard, then came a shower of molten globules from the ceiling, as an opening was cut through. Police clambered down a rope ladder one by one, with a flock of reporters close behind.

Jay explained to the officer in charge that the various doors in the place could be opened one by one from the control board, and thus all of the assistants would be captured without trouble, a few at a time.

Their work completed now, Jay and Ozzie moved over to the rope ladder in the blinding glare of photographers' photoflash bulbs, and climbed up to the open air once more. Though tired, they felt that exhilaration which comes from doing a tough job well. Tomorrow, after a good night's sleep, they would be back on the job at *Electronics, Inc.* as usual, servicing radio receivers until another adventure in electronics presented itself.

———*n r i*———

Wholesale Radio Service Co. Inc. Announces New 1938 Catalog

The Wholesale Radio Service Co., Inc., of 100 Sixth Avenue, New York, N. Y., announces the release of their new 1938 Winter Catalog No. 69. This 180 page catalog, like its predecessors is distributed FREE of charge. Really six catalogs contained in one, readers will find sections devoted to home, farm, and auto Radios, Public Address equipment, "Ham" equipment, replacement parts, tubes, test equipment and electrical appliances.

Catalogs may be obtained by writing to or calling at any of the six branches of Wholesale Radio Service Co., located at 100 Sixth Avenue, New York, N. Y., 430 W. Peachtree St., N. W., Atlanta, Georgia, 901 W. Jackson Blvd., Chicago, Illinois, 219 Central Avenue, Newark, N. J., 542 E. Fordham Road, Bronx, New York, 90-08 166th Street (Merrick Rd.) Jamaica, L. I., N. Y.

Business Problems in Radio Servicing

(*Continued from August-September issue*)

At the beginning, or even for a while after starting up a shop of your own, it is best to make arrangements with an established Radio set dealer in the vicinity whereby the serviceman sells receivers on a commission basis for the dealer.

There are quite a number of inexpensive items which can be sold at a profit right from the start, stocks of which do not require too great an initial investment. Noise-reducing antennas, line filters, all-wave antennas, phonograph adapters and remote control units are just a few of the things which can bring double profits, on the sale and on the installation.

Required: A Definite Service Selling Plan. Training is completed—the shop is equipped—a "shingle" is out—but how can customers be attracted? Some beginners, confronted with this question, make a few misguided advertising efforts with disappointing results and come to the false conclusion that advertising doesn't pay. A check of service businesses will show that in nine cases out of ten the independent serviceman who is not making money will be the man who does not advertise or who uses carelessly prepared schemes and does not consistently follow up his leads. Few successful service businesses have been built without the aid of *well-directed* advertising and merchandising plans.

The Value of Advertising. Radio servicing differs in at least one respect from other businesses; the average period of time between calls from any one customer is not one week, not one month, but about one year. Memory is very fickle; it does not take long for a customer to forget where he last had his radio repaired if he is not reminded of the name of the shop by friendly, snappy, human little messages which are sent to him at intervals during the year. When a favorite radio goes bad, a speedy repair is wanted; the first serviceman whose name, address or phone number the customer can locate or remember will generally get the business. Where competition is severe, the largest volume of work will very likely go to the shop which is best known in the community. The primary purposes of advertising a servicing business are therefore to keep the name before old customers in order to insure getting their future business, and to secure new customers by bringing the name of the shop to the attention of prospective customers *at or near the time when they are in need of service.*

The advertising schedule followed need not be at all elaborate or expensive—and will not be if the serviceman uses good business judgment in planning his sales promotion work. There are a great number of excellent and low-cost business-building plans which even the smallest shop can use; the beginner can experiment with a few of the less expensive ideas, feeling his way and checking closely on the results before going in for advertising in a big way.

The recommendation of a satisfied customer is advertising of the very best kind, indicating satisfactory workmanship and fair prices; its only cost is good work and a pleasing personality. Do the best possible job in the beginning, using high quality parts to minimize chances of failure. A certain number of repeat calls (calls received when a recently-repaired radio gives trouble) must be expected by even the best of servicemen, however, especially where complete overhauls are not made. Charges for service work must be sufficient to pay for the expense of making these repeat calls, for even though an entirely new trouble occurs, most customers will insist upon a free repair.

Methods of Advertising. It is easy to spend a lot of money for advertising and get nothing for it. Some advertising plans work well only in certain communities; some are effective only at certain times of the year, and there are others suitable only for large organizations which are able to finance the complete campaign. A serviceman should carefully consider the different forms of advertising open to him, then choose one or more mediums which best suit his particular situation and use these *consistently.* This is one of the most important secrets of successful advertising; whatever business promotion plan is selected must be carried out systematically and persistently if it is to be really effective. Spasmodic use of flashy or hit-and-miss advertising methods alone cannot be depended upon to bring profits; building up a business name requires a long, steady pull, with a good shove now and then through an attention-attracting ad.

A few of the advertising mediums available to the serviceman are: 1, ads in the classified section of the local telephone directory; 2, newspaper ads; 3, window displays and signs in the service shop; 4, business cards; 5, business forms such as letterheads, statements, tube stickers, etc.; 6, direct-by-mail letters, postcards, circulars, etc., either personally prepared or supplied by radio manufacturers; 7, buying short periods of time from Radio stations.

(Page 12, please)

Business Problems in Radio Servicing (Continued from page 11)

Many radio set, tube and parts manufacturers, recognizing that the serviceman is a very important cog in their merchandising machinery, offer a wide variety of tested advertising and merchandising plans, even supplying advertising literature, cuts, posters and displays free of charge or for a very small charge which covers a part of the cost. Some manufacturers, for example, offer very effectively printed ads on government postcards, with the serviceman's name and address included, for only the price of the card, one cent each. For the beginner who does not have the time to learn the best advertising procedure or the money with which to experiment, these manufacturers' services are ideal.

Radio manufacturers have made very thorough studies of the servicing business, and have prepared many books, booklets and leaflets describing business methods used by successful servicemen. If an individual feels that he has a good original plan for running a business he should by all means try it out—but the average person can profit greatly by studying the work of others who have succeeded.

Two large radio manufacturers have prepared tune-up plans, backed by national advertising, by direct mailing pieces and by other sales helps, which urge the customer to bring in his set for a thorough checking even though it may be in operating condition. The customer gets a complete check-up for $1.50 or $2.00, and the serviceman gets paid for his inspection work, makes a profit on any repairs which must be made or any tubes needing replacement, and gets new customers.

Measuring the Results of Advertising. The true cost of advertising is determined *only* by the results produced per dollar spent. The cost per call can be determined quite accurately for some advertising methods, such as newspaper advertising or mailings of literature; for example, if one thousand pieces costing a total of $15 are mailed out and fifty calls for service work are received as a result, it costs thirty cents to get each of those service calls. This is a very reasonable price to pay per call, but it is quite evident that you cannot give free inspection or free service on top of this and expect to make money.

Returns as low as 2% (two calls from each 100 pieces sent out) on a mailing of literature are considered quite good by many servicemen; 5% is excellent, as a rule, and anything above that is considered a landslide. It is not unusual, however, for some servicemen to get returns as high as 15%, or 150 calls per thousand cards or letters mailed where the advertising appeal used is particularly effective and the mailing list carefully chosen.

Once the percentage of calls obtainable from a sample mailing is known and is favorable, the same mailing can be sent to any reasonable number of persons (depending upon the population of the area served and upon other local conditions) with the assurance that the same favorable percentage of results will be secured.

A definite amount of money should be allotted for advertising, and this amount increased as the business is built up. A certain portion of the income from one advertising campaign can be used to pay for the next and larger campaign; pyramiding of results is important in developing a business, but never let advertising expenses exceed a reasonable percentage of income.

Figuring Costs and Profits. Two fundamental business principles determine the success or failure of a radio servicing business or any other business: *1*, It must be conducted to yield a profit to the business men; *2*, It must be conducted to the satisfaction of the customer. Failures in the radio servicing business today are due to neglect of one or both of these important principles.

When a man knowingly or unknowingly sells his services or merchandise at a figure which does not give a fair profit, to meet "chiseling" tactics of customers, price-cutting of competitors, or to take customers away from other servicemen, he is endangering the success of his own business. A serviceman *must know the value* of his own time and *must make a profit* on his labor; a serviceman must know what it costs to run his business, in order that he can spread that cost proportionately and fairly among his various jobs.

Keeping Records. Only by keeping records of all financial transactions in a business can costs be determined with any degree of accuracy. The starting point in figuring out costs should be *overhead*—the cost of operating the business. Figure out overhead costs for a definite period of time, such as one year, by adding together all expenses for that period. A few of the many items which should be charged to overhead are given below; while the list is by no means complete, it will serve as a reminder of other items in a particular business:

Salaries	Depreciation
Rent, Taxes	Collection Costs
Electricity	Insurance
Heat	Office Supplies
Telephone	Education
Advertising	Charity
Automobile	Bad Debts
Tools	Interest on Loans
Equipment	Association Dues

(*To be continued in next issue.*)

President Roosevelt Predicts Television Will Be Here Soon

On the occasion of the dedication of the handsome new quarters for Radio Station WRC and WMAL in Washington. D. C., President Roosevelt wrote a letter to Mr. Lenox Lohr, President of the National Broadcasting Company, in which the President of the United States predicts that Television will be established in homes throughout the United States sooner than many realize. Part of the letter from President Roosevelt to Mr. Lohr reads as follows:

"Although the ether is a comparatively new means of communication and lends itself nationally in many useful ways, we find ourselves continually amazed at the things which have been accomplished and the development of future potentialities.

"The watchword of science must be progress. It is not within the province of reactionaries to put obstacles in the way of orderly development nor to mark boundaries beyond which Radio may not go.

"I believe that sooner than many of us realize Television will be established in homes throughout this country. Indeed it may not be long before Radio will make it possible for us to visualize at the breakfast table the front pages of daily newspapers or news reports, no matter how remote we may be from the place of their publication and distribution.

"In the spirit of progress, I greet you and all others whose efforts are directed to the advancement of Radio; to the promotion of its way to ever increasing usefulness."

The many visitors who attended the opening of the new NBC studios in Washington, D. C., were particularly interested in two large glass-covered apertures in the largest of the seven studios which, it was explained by guides, are in readiness to be used when Television arrives.

GUGLIELMO MARCONI—1879-1937

Guglielmo Marconi, giver of wireless communication to the world—in memory of you we offer this tribute.

On that history-making day in 1895 when you heard the first whisper-like sputter of wireless across the fields of your father's estate near Bologna, Italy, you consecrated your life to Radio. In all the years that followed, up to the twentieth day of July in 1937, you labored patiently and tirelessly to make your great discovery of maximum value to mankind. Now at last you have found the peace and rest which was denied you by the enchanted world of wireless.

You flashed the first wireless signal across the English Channel in 1899 and across the Atlantic Ocean in 1901. You made possible that historic SOS from the sinking Titanic in 1912. You ripped aside old theories, laughed at experts who said Radio waves could never curve over the horizon, and first proved that no matter how many stations were on the air, messages could be separated with the aid of tuning circuits.

You left us at the threshold of Television, with a legacy to continue your work in the promising and enchanting field of ultra-ultra short-wave Radio. We who follow in your footsteps will carry on; we will further improve the world-encircling system of Radio Communication which you founded, and which now safeguards the lives of millions of people at sea, on land and in the air, speeds business transactions across the miles and brings the very best in entertainment to world-wide audiences.

Guglielmo Marconi—your name will live into the ages.

Changing Raw Quartz into

Science and Skill are Required---Ac

(Courtesy of Weste

WHEN a listener snaps on his Radio, turns the dial to a particular point, he expects his favorite station to come in, right on the dot. And it does. Why it does, he neither knows nor cares. But if it did not, his entertainment would be ruined and Radio broadcasting would instantly be thrown into a hopeless chaos.

In the early days of broadcasting, stations did not always come in on the dot and interference ruled the airwaves. Now, thanks to a small square of quartz crystal, one of which is in every broadcast transmitter, each station stays on its assigned frequency.

The making of these crystals calls for an accuracy even greater than that of the lens grinder, you learn, when you visit the quartz

Measuring raw crystal prior to sawing it into sections. Sections are cut into slabs—then rough blanks.

crystal manufacturing unit at Bell Telephone Laboratories. Here it is a science in itself, where working dimensions have been reduced to sub-millionths of an inch; where the finest mechanical methods of measurement ever devised will not suffice.

First impressions of the quartz shop are the roar of fast moving wheels—the steady rhythmic whirr of grinding disks—the grating of abrasive against metal—the soft trickle of water—a faint odor of chemicals—piles of quartz slabs on tables—machinery enclosed in glass—machinery hooded with rubber sheeting and pans of mucky gray paste.

In a closet-like partition in one corner of the shop rows of raw quartz like giant clusters of rock candy are lined up on shelves awaiting inspection. Dug from the quartz mines in Brazil, they have journeyed thousands of miles by muleback, truck, train and freighter to undergo a series of drastic operations which will reduce them to slivers. Here are smooth quartz and knobby quartz — long crystal-clear hexagonal pieces and yellowish brown chunks. Some are small enough to hold in one hand—others tip the scales at half a hundred pounds.

As you see one of these drab shapeless lumps actually change into fragile slices of crystal, which are destined to control the frequencies of Radio transmitters in airplanes, police motor patrol cars, luxury liners, trawlers and tugs, as well as broadcasting stations, you realize that Radio is still the eighth wonder of the world.

First the quartz must be given a light test to detect defects. Under powerful white arc lamps some of the inner secrets of the quartz are glaringly revealed. Those lovely smoky blue streaks are called needles—the cloudy finger-like lines, phantoms—and the bubble formations, veils. Specimens showing needles or phantoms are relegated to the junk pile. Those containing veils may be used, but the veils must be cut out, you are told.

Another defect known as twinning, appears when you scrutinize a piece of quartz under special polarized light. It shows up as a series of colorful red and green stripes. Most quartz has some degree of twinning, the supervisor explains. It is the result of molecules turning during the growth of the crystal. Twinning areas too are taboo and must be ground off. Another examination is made to determine the optical axis of the quartz. This is your introduction to the quartz axes which you later realize are THE determining factors in the whole process of crystal cutting. The word is bandied about so frequently that you become axis-conscious before the trip is ended.

Small Crystal Oscillators

:curacy to the Millionth of an Inch

rn Electric Company)

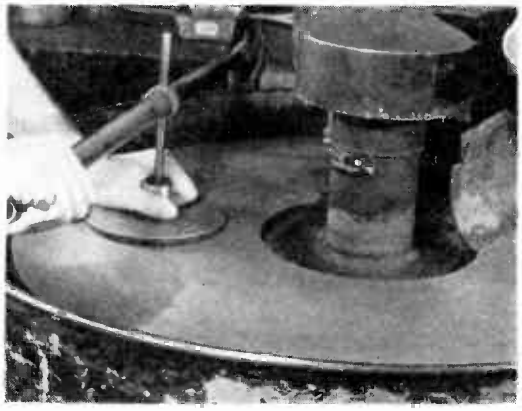
After the quartz has passed muster it moves on to the cutting room. Here it receives a shower of water, carborundum dust and castile soap—while a large steel disk whirling through this mucky mixture cuts the lump into sections. Usually from one to four sections can be cut from the raw quartz according to its size. Each section is now inspected for twinning and given a second axis examination.

One little fraction of a degree off axis and the oscillator just won't pass muster. But the man bent so intently over these jagged specimens knows his axes and there is little danger that the finished crystal will fail to perform properly. This it MUST do when it takes over the big job of maintaining a fixed frequency for the particular transmitter it will eventually control.

Two more cutting operations follow which slice the sections to slabs, then blanks. Each time the quartz is mounted in the cutting machine with the utmost accuracy to make sure that the axes of the natural crystal are in the correct positions. Once more it is inspected for twinning and the rough burrs on the edges ground off on a large flat disk smeared with carborundum paste. Guided by a fine measuring rule the operator now draws with pencil the pattern of the crystal, square or rectangular as the case may be, on the rough blank. You notice how careful he is not to include any of those defective portions in the area of the drawn crystal. Next the pencilled figure is trimmed from the blank on a special diamond saw. The rough crystals are now cemented to a metal holder and placed under the x-ray machine for further tests of axes.

Determination of the axes of the crystal at this stage is one of the most important steps in its entire manufacture, because upon it hinges the success of the finished product. The Laboratories determine the axes to within six minutes, or one-tenth of a degree. Such accuracy can be attained only through the use of the x-ray. All commercial crystals produced by the Laboratories are cut with this accuracy which permits a performance guarantee that no crystal will deviate more than two cycles per degree centigrade per megacycle. Actually more than fifty per cent of them are within one cycle. Once this axis reference point is established, not even the slightest deviation from this point is permitted while the face of the crystal is brought in the axis plane. The other side of the crystal is then brought into a parallel plane.

Up to this stage the crystals have been of uniform thickness. Now they begin to take on individual form according to the frequency of the transmitter they are being groomed to control. Frequency control, you discover, depends on the thickness and dimensions of the blank—the thinner the crystal the higher the frequency at which it oscillates. When completed the blanks will range all the way from 18 millimeters square and 0.2 millimeters in thickness to 55 millimeters square and 7.60 millimeters thickness. Rectangular crystals vary similarly in size. If you are not up on your millimeters,



Grinding second face of plate parallel to first. Rate of lapping is determined by pressure exerted by experienced operator.

picture an ordinary three-cent postage stamp cut in four equal parts and you have your smallest crystal blank. The larger crystals are just about the area and thickness of a small graham cracker. The 18 millimeter sliver may oscillate at an ultra-high frequency of 14,000,000 cycles while its big brother maintains frequencies as low as 250,000 cycles.

Crystals come out of the Laboratories in an

(Page 18, please)

Changing Raw Quartz into Small Crystal Oscillators (Continued from page 17)

endless variety of shapes and sizes, each one designed to do a particular type of work. You see one crystal having a frequency of 550 kc. and the approximate shape of a soda cracker, another with exactly the same frequency, yet whose size is about one-fourth of an inch square.

The first thinning process, known as a "rough grind," takes place on a large flat disk with the aid of the familiar carborundum abrasive. Edges are also ground to the approximate dimensions required for the finished crystal. Again the hard worked blanks are on the move. This time to the lapping room where they are mounted clockwise fashion in circular metal nests (from eight to twelve in one nest). Lapping or grinding down the faces of the crystals in these nests is still a machine job and is designated as "rough lapping."

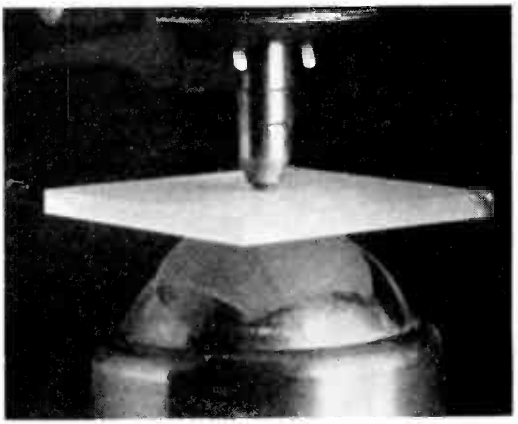
From the nests they go to a precision lapping machine and, held flat to within plus or minus 20 millionths of an inch, they again dwindle in thickness. During lapping operations the crystals make frequent trips to the x-ray room to be checked for proper angle. Groups of crystals of the same dimensions are "finished edged" to the correct size within .01 millimeter of the desired surface area, or to an accuracy equal to about the thickness of a human hair. These intricate operations of cutting, lapping, x-raying and edging are only half the story of crystal oscillators in the making, you learn, as you finish your tour of the quartz shop and enter the calibrating room. Here the climax of the tale is reached, for calibrating is THE most delicate and precise operation in the whole romantic history of quartz crystals.

To the non-engineering-minded visitor the calibrating laboratory seems a confusing labyrinth of black transmitter cabinets, power generators, oscillograph circuits, switches and more switches, ice boxes, ovens, polishing plates and again the mucky carborundum paste. Voltage cables and coupling cables zigzag across the ceiling and signs reading "Caution—High Voltage" hold up a warning finger. The whole outfit seems so mammoth compared to the diminutive bits of quartz awaiting final tests. Men are talking of hops and wiggles, frequencies and output stability, cycles and kilocycles, temperature coefficient and heat-runs. "Hey, Bill—is that 23A in circuit?" "Better check this 10B for hops." "How's the 19A coming?"

Suddenly a shrill sound like a fire siren shatters the quiet of the room and sends a jittery feeling down your spine. It rises to a crescendo and quickly dies. That, the supervisor explains, is the beat note of a crystal oscillator in a testing circuit.

On leaving the lapping room the crystals have been placed in small cardboard boxes. The printed figures on the cover of the box show the cut of the crystal, its dimensions, the frequency it must maintain and the type number of the transmitter it will control.

Two methods for testing the blanks are used—audible and visual. The audible method, you learn, matches the frequency beat note of the crystal against a standard beat note. This test is performed in a standard transmitter. When the crystal is oscillating correctly there is no sound. To accomplish this the crystal is gradually ground down by hand until zero beat is reached. For the visual method the cathode ray oscillograph is used.



Optimeter tells thickness to within 5 millionths of an inch. Clamped between steel hemisphere and plunger with sapphire tip to resist abrasion.

The operator who assumes guardianship of the blank when it leaves the lapping room hops back and forth from the calibrating circuits and the oscillograph to the lapping plates nearby. This is a finger-tip operation and an extremely delicate one as the crystals are nearing the desired thickness and only the smallest fraction of the surfaces or edges must be polished off at a time. Grinding the surfaces brings the frequency up to the specified frequency. Gently the operator presses the tiny crystal square round and round over the plate for by now it has been reduced to such fragile proportions that it can easily be crushed to a thousand splinters. Yet, they tell you, nothing can shatter it in a Western Electric transmitter except too high a voltage. Toward the end the polish-

(Page 21, please)

Changing Raw Quartz into Small Crystal Oscillators (Continued from page 18)

ing process becomes so precise that fine emery powder is used in place of carborundum.

The word "precise" is actually meaningless in describing this hand lapping process. There is no mechanical means of measuring such small increments, since the thickness of quartz lapped off at this stage is of the magnitude of a wavelength of light. To attain such accuracies electrical methods of measurements are resorted to which permit a direct measurement of the quantity which is to be controlled and at an accuracy of about one part in a million.

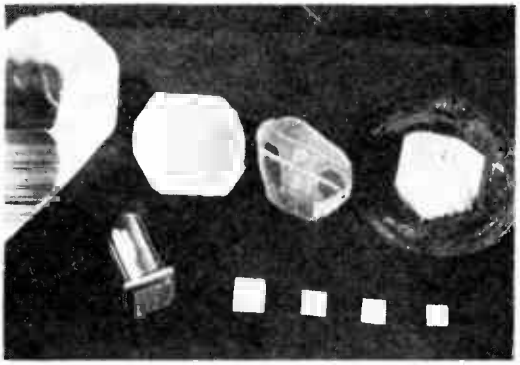
When crystals are being calibrated, they must be tested in circuits which are exact duplicates of the transmitters in which they are to be used, otherwise they may not have the frequency characteristic required. At the Laboratories the actual transmitter is used in checking the new crystal being made for it, or an exact duplicate oscillator circuit is set up. This is done in the manufacture of every crystal turned out by the Laboratories.

When the frequency, tested in a standard transmitter, and the stability and output, measured in the oscillograph, check correctly the crystal is put through a heat-run. This, you observe, means placing the blank in an icebox, then an oven where it runs the gamut of temperatures from minus 10 to plus 60 degrees centrigrade. Crystals must be immune to the temperature fluctuations they are likely to encounter on their future travels. After the heat-run the crystal is rechecked for frequency and output.

Now the last stage of the long journey through the Laboratories has been reached and the crystals are ready for shipment to all parts of the globe. Some will spend the coming years in broadcasting stations. Others will lead a more adventurous existence flying the airways, spanning oceans and speeding through city streets and along highways in Radio police motor patrol cars.

Perhaps the most impressive part of the whole business of crystal making at Bell Telephone Laboratories is the precision, the skilled workmanship, the rigid tests and the detailed histories kept of these minute bits of quartz. A complete record of each crystal is filed away for future reference after it has emerged as a full-fledged oscillator. These show how the crystal performed in the final tests—the curves charted in the standard circuits—the temperature coefficient—who made the tests and just how much time was spent in the calibrating.

Before the crystal leaves the shop it is given a serial number and assigned to a particular type of transmitter. Rarely is one returned for misbehaving. Occasionally crystals which are used in the ultra-high frequency bands find their way back to the shop for a check-up. According to the records about one-half of one per cent of the mobile oscillators return. This is considered a remarkably low percentage when it is realized that over 7,000 of these Western Electric crystals are continually on the job in all parts of the world and that approximately 50 leave the quartz shop every week.



Steps in manufacture of BT low temperature coefficient quartz plates for use in mobile Radio equipment.

Such a record is understandable, for Bell Telephone Laboratories' engineers are pioneers in the art of crystal making for Radio telephone purposes. It was back in the early twenties that the utility of quartz crystal oscillators for Radio transmission was definitely established. The first one sold for commercial broadcasting went into a Western Electric transmitter at Station WLW, Cincinnati. With broadcasting stations springing up like magic in all sections of the country, with aviation, police and marine Radio booming ahead, the demand for this new type of frequency control became urgent. By this time the United States government had taken over the responsibility of regulating the air channels and the Laboratories had settled down to an intensive study of the methods for making and applying quartz crystals. As time went on they were able to overcome many of the difficulties found in the early types and consequently could manufacture them in greater quantities.

Today in the research department the Laboratories' engineers are still delving into the mysteries of quartz and are continuing to improve upon these bits of crystal which have become the midget masters of broadcasting channels.

Novel Radio Items

—BY L.J. MARKUS—

Mike and Ike Don't Look Alike!

A microphone has long been known as a "Mike" among Radiotricians, and now Teletricians are calling the iconoscope tube an "Ike." Thus "Mike" and "Ike" are actually working side by side in Television studios today, different though they be in appearance.

n r i

Fight is Broadcast in Spanish!

Station XEW of Mexico City had its own crew at the ringside for the Louis-Braddock fight. A direct telephone wire connection between the transmitter in Mexico City and the announcers in Chicago made it possible for Mexican boxing fans to hear the event in their own language.

n r i

N.R.I. Men Can See Television in 1939!

If you attend the 1939 New York World's Fair, you will see a public demonstration of modern 441 line Television. The Television exhibit, sponsored by RCA and NBC, will be the feature of a complete Radio display.

n r i

Stockings Are Spun to Radio Music!

Loudspeakers which bring Radio music to every worker in a Belmont, N. C. hosiery mill are credited with several extra stockings per day per worker. The louder the factory noise, the more volume is turned on.

New Auto Radios Are Irresistible!

When you buy a new car this year, you'll very likely find an auto Radio in it. About three cars out of every ten are today being made with built-in Radios. Shrewd auto dealers leave the Radios in the cars even when customers assert they don't mix music with driving; statistics show that 95 out of every 100 will purchase the Radios after listening to them free of charge for a few weeks.

n r i

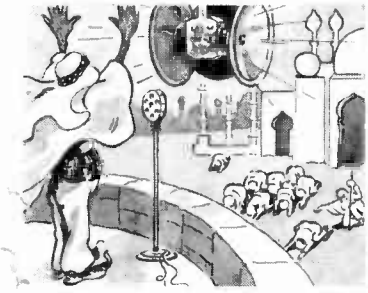
Radio Replaces Dinner Bell on Farm!

Farm Radio receivers can now be obtained with an extra loudspeaker for the barn and a special switch which converts the regular loudspeaker into a microphone for two-way conversations between house and barn or for calls to dinner.

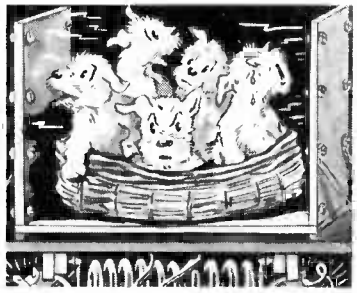
n r i

Wind Machine Chirps Mysteriously!

Shrill squeaks accompanied the eerie moan of a wind-imitating machine used at station WGAR for rehearsals of a Radio drama. Oiling of the bearings had no effect upon the chirps, but finally, on the very night of the show, the interfering noise was located. A large cricket had selected the inside of the rotating sand-filled drum machine as its home!



LOUDSPEAKERS CALL MOHAMMEDANS TO PRAYER! Holy men in certain Mohammedan areas in the Far East have installed public address systems in the towers of their temples, and now giant loudspeakers blare out the calls to prayer each day. 'Tis but another step to hook up these P.A. systems to transmitters which will broadcast the calls to all followers regardless of where they be.



RADIO WAVES CURE AILING PUPS! Shortwave diathermy treatments are proving surprisingly successful in the treatment of distemper in puppies. Two special transmitting tubes (connected to a 1000-volt power supply) are said to deliver more than enough power to cure small dogs placed between the flat metal electrodes, while higher power is required for larger dogs.

OVERHEARD IN MEXICO! Two peons were discussing the merits of their respective ten-year old, tumbledown Radio receivers. "My Radio is *too* selective to bother with any inferior signals; it brings in only the one best station," asserted the first. "My receiver is so good that all of the signals come through at the same time, regardless of how I tune it," retaliated the other!

Nominations for 1938

Another year has passed since we asked for nominations for officers in the N.R.I. Alumni Association. To some the year just passed seemed unbelievably brief, while to others it dragged through seemingly endless months. It is interest that makes the difference—interest in our daily work—interest in what is new in the world. Now another year approaches and we must get ready to move on to greater accomplishments.

The Constitution of the Alumni Association provides that the officers of this Association shall be a President, four Vice-Presidents, Secretary and an Executive Secretary. The terms of all elected officers shall be for one year, starting January 1 of each year.

The officers prescribed in the Constitution of the Alumni Association of N.R.I. shall be elected in the following manner: Two months prior to January 1 of each ensuing year, nominations for the office of President, the four offices of Vice-President, and the offices of Secretary and Executive Secretary shall be called for from the membership, by the Secretary of the Association, through the columns of the NATIONAL RADIO NEWS.

The President and Vice-Presidents shall be nominated at large, but the Secretary and Executive Secretary shall be in or near Washington, D. C., for the purpose of remaining in active touch with the Institute headquarters. It is the duty of each member to submit one nomination for each office to the Secretary.

The following are serving your Association during 1937 and are eligible for re-election:

President, P. J. Dunn, Baltimore, Md.
Vice-President, Earl Bennett, Evanston, Ill.
Vice-President, Clarence Stokes, Philadelphia, Penna.
Vice-President, R. H. Rood, Los Angeles, Calif.
Vice-President, F. E. Oliver, Detroit, Mich.
Secretary, Earl Merryman, Washington, D. C.
Executive Secretary, Louis L. Menne, Washington, D. C.

You may nominate any or all of the present officers for re-election, or you may submit the names of one or all new candidates for office—just as you like.

Don't be backward or hesitant about submitting your choice. Your vote counts as much as any other. The Alumni Association values and respects your opinion. Naturally you will want to choose the men you feel are best qualified for the office, either by previous good work, or because of information you may have which convinces you a man not now holding office will make a good leader. This is your Association. Exercise your right and privilege by casting your ballot for the nomination of your choice of candidates.

On page 30 of this issue of NATIONAL RADIO NEWS is a Nomination Ballot Form. It is especially arranged so it may easily be removed without injuring the magazine. Simply cut it out along the dotted line.

Send your ballot promptly. Fill in the form and mail it to the N.R.I. Alumni Association, 16th and You Sts., N. W., Washington, D. C. The two men having the highest number of votes for each office will be declared nominated and in the next issue of the NEWS their names will be submitted to the membership for final selection of officers to serve during 1938.

Do not fail to do your duty. Submit your ballot promptly. It is a big job for headquarters to sort, count and tabulate all the votes. Your prompt response therefore will be appreciated.

Vote for anyone you please. Vote for yourself if you wish. You may express your choice freely and frankly. Mr. B. Lavins, N.R.I. Controller, and Mr. C. Alexander, Bookkeeper, will count all ballots.

Here and There Among Alumni Members

Some of us who lack determination could take a lesson from Chester E. C. Short of Altoona, Florida, who signs himself, "Yours for service with a smile," and says, "Just a line to say hello to all of you who, with the cooperation of the State Vocational Rehabilitation Education Department of Florida, did through a little hard study on my part, make it possible for a handicapped man to earn a good living. I do most of my service work from a wheel chair." Good boy, Short, and we are back of you all the way.

n r i

O. A. Grendahl of Duluth, Minn., says he is more active in the service field at sixty-six than ever and sends kind greetings to all Alumni members.

The store of Graduate Lloyd V. Stenberg of Willmar, Minn. who specializes in P. A. work.

Another fellow who wants to send greetings to Alumni members is Edw. H. Page of Sedro Woolley, Washington. That's fine, but how about some news?

n r i

If you should be tuning in at night in the vicinity of St. Clairsville, Ohio, try to pick up WAKL, a 100 watt station, frequency 2430 k.c., Lat. 40 04 59.90 N., Long. 80 54 04.27 W. The chief operator and engineer is Graduate Ralph S. Harrison, who is employed by the Belmont County Municipal Police Emergency Radio Station.

n r i

A recent visitor at headquarters was Sigfrid Palm of Worcester, Mass., who came to Washington to see the sights.

Not content with a successful shop at Lawn, Texas. J. T. Wilkinson is equipping another shop at Tuscola, Texas, and has hired an N.R.I. graduate to operate it.

n r i

Graduate A. Arnhym of Highland Park, Ill., recently gained much publicity through an interesting article in Modern Mechanix relating to a fog device Mr. Arnhym patented. He is an inventor of far reaching reputation and a real booster for N.R.I., too.

n r i

Word comes from John H. Henninger of Philadelphia that he is now Technical Supervisor of Radio Station WIBG, Glenside, Pa.

n r i

Graduate Rex A. Floyd of Pt. Barrow is an Eskimo who travels by dog team. Much of his work at the present time is erecting antennas.

n r i

Graduate Frank A. Seitz, former Vice-President of WFAS, White Plains, N. Y., was recently elected President.

n r i

E. H. Leftwich of Nashville, Tenn., was highly commended by the Engineers' Division, War Department, U. S. A., for heroic work in helping establish communications between flooded cities last spring.

n r i

Graduate Edmun Lemon and his charming wife visited headquarters recently. Mr. Lemon is operator at station WLVA, Lynchburg, Va. Both Mr. and Mrs. Lemon are licensed amateurs.

n r i

Edwin W. Holscher of Spencer, Iowa, has moved into new and larger quarters. Now also manufactures a corking invisible auto aerial. If you are interested in a good agent's proposition, write to Holscher.

n r i

What is new with you? Send it in.

The Service Forum

Conducted by

J. B. Straughn, N. R. I. Service Consultant

PHILCO MODEL FT-9 — **WEAK AND DISTORTED**

Try a new 600 ohm cathode resistor on the 75 type tube. The present resistor which by the way resembles some of the small mica condensers may change in value. A half-watt replacement resistor will prove to be satisfactory.

W. M. FRIEND,
Maryland.

n r i

CLARION MODELS A.C. 51 AND 52 — **OSCILLATION**

If oscillation occurs, look for an open screen grid by-pass condenser, an open plate by-pass condenser, an open grid bias resistor, poor contact between the variable condenser canopy and chassis, poor contact between variable condenser frame and rotors through the tension spring clips or by open circuiting of the ground strap between condenser frame and chassis. Chassis base plate loosely attached to chassis; poor ground connection, a high resistance connection in series with a by-pass condenser, tube shields not secure and high line voltage are also possible sources.

n r i

CHEVROLET MODEL 600249 — **WEAK AND DISTORTED**

Carefully check the primary of the input push-pull transformer. An ohmmeter should be used for this purpose and if any variation is noted you must install a new transformer.

n r i

CLARION MODEL 40 — **POPS WHEN WARMING UP**

Replace the 1 megohm resistor in the control grid circuit of the 47 type tube with a 500,000 ohm resistor.

n r i

STEWART WARNER MODEL R-116 — **IMPROPERLY CALIBRATED AND WEAK ON LOW FREQUENCY END**

Go over the trimmers on the condenser gang with a hot soldering iron and realign the receiver.

STEWART WARNER MODEL R-116 — **HUM**

Try reversing the green and white speaker field leads.

n r i

STEWART WARNER MODEL R-143 — **DEAD AND NO VOLTAGES**

If voltage readings are obtained across the plate to cathode circuits of the rectifier tube but not across the plates this is probably due to a shorted .01 microfarad 1500 volt condenser connected across the transformer secondary. This condenser is located on top the transformer, and to get at it remove the transformer can which is held in place by four nuts. The condenser can then be replaced without disconnecting any other leads.

n r i

STEWART WARNER MODEL 1172 — **INTERMITTENT MOTORBOATING AND DEAD**

This is due to insufficient by-passing at the I.F. tube and may be remedied by connecting a .1 microfarad 600 volt condenser to the red wire coming from the second I.F. transformer. The other end of the condenser should be connected to the chassis.

n r i

STEWART WARNER MODELS 111 AND 115 — **VOLTAGE MEASUREMENTS**

In these universal receivers the chassis is not a part of the voltage circuit and when making point to point voltage measurements the condenser gang should be used as the common negative point of measurement.

n r i

GENERAL ELECTRIC MODELS J-100, J-105 AND J-107 — **OSCILLATION**

Frequently caused by an open in the 10 microfarad condenser which connects by means of a yellow lead to a lug on the volume control. When trying a substitute be careful of its polarity as the positive lead is grounded, the negative lead going to the volume control.

(Page 27, please)

Chicago Chapter

The N.R.I. Alumni Association is a clearing house for information for graduates. Through it we keep in touch with new developments in Radio, but equally important, we learn how to put our knowledge to profitable use. After we have built a house, by going over the plans, construction details and the layout of the rooms, various ideas and new solutions present themselves. So it is with Radio. We have acquired a fundamental knowledge of Radio, and by association and interexchange of ideas and problems we become more efficient and can render better service.

We here in Chicago have adopted the following business program:

1. Reading of the minutes
2. Applications for new members
3. Unfinished business
4. Communications
5. New business
6. Report of special committees
7. Report of standing committees
8. Recess for dues
9. Financial report
10. Good will and welfare
11. Adjournment

Under good will and welfare we have our speakers introduced, or the discussion of the evening is brought up. For this fall we are planning to continue our discussion of the faults, aches and pains of Radio receivers. It took us four meetings to take care of a five tube T.R.F. Midget. Now, that may seem to be a lot of time, but not if we stop and give a little thought to the various defects that are possible in a five tube T.R.F. receiver from antenna to A.C. cord. This fall we are starting on simple supers and gradually taking in all the latest embellishments added to Radio receivers.

A. H. KETELHUT, Chairman.

n r i

Detroit Chapter

Chairman Oliver wishes it to be known to all members of the Detroit Chapter and all students and graduates in the Detroit area that regular meetings are being held again after a short suspension during the summer. The time is the second and fourth Friday evenings in every month, the place is at 11305 Woodward Ave.

The boys are building a test bench which will soon be completed. This will be a great help to members on "shop nights." Just the thing for practical demonstrations.

A point now being considered is the advisability of publishing a bulletin for the benefit of Detroit Chapter members. Chicago leads the way with a real snappy Local bulletin, well prepared, and Detroit is getting envious. All plans point to a busy fall and winter at Chapter meetings in Detroit.

n r i

Directory of Chapters

Baltimore—I. A. Willett, Secretary, 2411 Arunah Ave., Baltimore, Md.

Philadelphia-Camden—Clarence Stokes, Treasurer, 3347 N. Front St., Philadelphia, Pa.

New York—L. J. Kunert, Secretary, 66-11 74th St., Middle Village, L. I., N. Y.

Buffalo—T. J. Telaak, Chairman, 657 Broadway, Buffalo, N. Y.

Toronto—Ed. Witherstone, Secretary, 363 Nairn Ave., Toronto, Ont., Canada.

Chicago—L. Lewandowski, Secretary, 3130 So. 55th Court, Cicero, Ill.

Pittsburgh—Albert Maas, Secretary, 9 S. Howard Ave., Bellevue, Pa.

Detroit—C. H. Mills, Secretary, 5458 15th St., Detroit, Mich.

Directory of Officers

(To Serve Until January, 1938)

President—P. J. Dunn, Baltimore, Md.

Vice-Presidents—Earl Bennett, Evanston, Ill.
R. H. Rood, Los Angeles, Calif.
F. E. Oliver, Detroit, Mich.
Clarence Stokes, Phila., Pa.

Secretary—Earl Merryman, Washington, D. C.

Executive Secretary — L. L. Menne, National Headquarters, Washington, D. C.

n r i

I want to express my appreciation for the wonderful help which has been added to my completed course by our Alumni Association.

WM. F. BROUN,
P. O. Box 78,
Forest, Ont., Canada.

The Service Forum (Continued from page 25)

RCA MODELS R-74 AND R-76 — **OSCILLATION**

See note on General Electric Model J-100.

n r i

GRUNOW MODEL 750 — **NOISY OR DEAD ON BAND A**

Remove and sandpaper the spring type wiper arms of the tuning condenser rotors. A high resistance contact at this point will give the above complaint.

n r i

GENERAL ELECTRIC MODELS J-100, J-105 AND J-107 — **TROUBLE WITH 82**

Frequent burning out of the 82 rectifier and interference due to its use may, when the receiver checks O. K., best be remedied by changing to a 5Z3 type rectifier. Connect the 2.5 volt rectifier filament leads in series with the filament winding of the A.V.C. tube to obtain 5 volts. If necessary reverse the connections to one winding to obtain this voltage. The new 5 volt leads are connected to the filament socket terminals of the rectifier. Then the filament socket terminals of the A.V.C. tube are connected to the filament power supply of the other 2.5 volt tubes, taking care to remove the jumper wire between the cathode and heater terminal of the A.V.C. tube socket. If erratic operation is noted there is probably some heater to cathode leakage in the A.V.C. tube and a new one should be tried.

n r i

RCA MODELS R-74 AND R-76 — **TROUBLE WITH 82**

See note on General Electric Model J-100.

n r i

RCA MODEL M-34 — **VIBRATOR NOISE**

If this trouble develops after the installation of a new vibrator, unsolder and twist the primary leads together, then resolder. The noise may also be due to breaking of the solder bond between the power transformer partition shield and the chassis. The remedy is to resolder the bond.

n r i

RCA VICTOR MODEL R-8 — **MOTORBOATING**

Try a new 4 microfarad electrolytic condenser from the screen of the R.F. tube to the chassis. The condenser lead coming from the condenser block is maroon.

n r i

RCA MODEL R-8 — **INTERMITTENT**

Replace the 2 megohm resistor in the control grid return of the A.V.C. tube. This resistor is near the 80 rectifier tube socket. Replace the two 500,000 ohm resistors in the same lead and located under the resistor terminal load. The .05 microfarad condenser in the control grid return of the R.F. tube should be replaced. This condenser is inside the condenser block and is identified by its leads colored black with yellow tracer and black. The black lead need not be disconnected. Just disconnect the black with yellow tracer lead and connect a .05 microfarad condenser from the point of disconnection of the old lead to the chassis.

n r i

RCA MODEL RAE 59 — **INTERMITTENT**

Try a new .1 microfarad condenser in the A.V.C. circuit control grid return. The original condenser which is usually in a leaky condition is in the condenser block located in the power amplifier and is identified by its blue and black leads. When replacing only remove the blue lead as the block is common to several other condensers.

n r i

RCA MODEL 60 — **WEAK OR DEAD**

When this condition accompanied by low plate voltages is experienced check the value of the 20,000 ohm black resistor in the power pack. This resistor frequently decreases in value lowering the D.C. operating voltages in the receiver. Remove and use a 20,000 ohm 10 watt replacement.

n r i

WELLS-GARDNER SERIES 6J-6C1, A1-A2-A3 — **VOLUME CONTROLS**

In a few of the volume controls used on the early 1937 radios of the series mentioned above, the manufacturer used a plating which under certain conditions can develop a "whisker." This "whisker," which can be seen only under a microscope, may short circuit the element. When this occurs in auto sets, it usually manifests itself by a reduction in volume. The resistance of the control element when measured will be found to be much less than the rated value—sometimes as low as 1000 ohms. This condition is easily remedied by connecting a 45 volt battery from the movable arm to ground. The movable arm may be at any point between the high potential (high volume) end of the control and the center position. Do not move it below the center position to avoid damaging the control. Any "whisker" touching the element will be burned away. In the case of the Series 6J auto set, the movable arm connection may be made at the control grid of the 6B7 tube. This same condition is much less likely to happen in house sets because of greater spacing in the volume control. However, if it does occur, it will usually manifest itself in low volume, the set cutting out entirely, or noise when the control is turned. The remedy is the same as mentioned above.

Baltimore Chapter

Baltimore Chapter is another which has resumed regular meetings after the customary hot weather interruption. Chairman Jensen has been hard at work getting things lined up for a social as well as business season of activity. That big dance idea is still being given consideration, and may materialize.

Chairman Jensen plans to write every student and graduate in the Baltimore area to extend a personal invitation to come to Chapter meetings. Look for some big news from Baltimore.

n r i

New York, Philadelphia-Camden

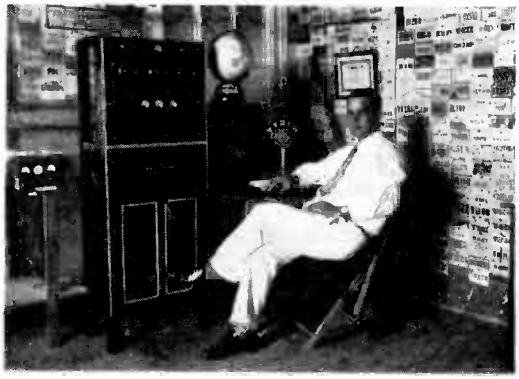
New York and Philadelphia-Camden Chapters have returned to regular meetings after summer suspension. All members, students and graduates are cordially invited to attend. For special information regarding forthcoming events get in contact with L. J. Kunert, Secretary, 66-11 74th St., Middle Village, L. I., N. Y., and James F. Hornbrook, Secretary, 555 E. Van Kirk St., Philadelphia, Penna.

n r i

Ladies of Chicago Chapter, Thanks

Headquarters joins Chicago Chapter in extending a great big vote of thanks to several of the members' wives who gave so much of their time and enthusiasm toward making the last party a complete success. Mrs. Rose Lewandoski, Mrs. Alice Bennett, Mrs. Sam Juricek, Mrs. Letha Morehead and Miss Faye Morehead made many personal sacrifices to see that the food was properly prepared and served. Thank you very much, ladies.

A view of the shop of O. Ferguson, Johannesburg, S. Africa in which he is doing a fine spare time business.



Clement E. DeSilvia, VP2CD, St. Johns, Antigua, B. W. I. built his own receiver and has made over 1000 contacts with 50 countries in five continents.

n r i

Compact Round-Can Oil-Filled Capacitors

Handy high-voltage oil-filled capacitors in compact round cans, arranged for inverted mounting in limited space, are now offered by Aerovox Corporation, 70 Washington St., Brooklyn, N. Y. These units are similar in general appearance and size to the usual electrolytic condensers. The section of selected linen paper and foil, oil impregnated and bathed in oil, is hermetically sealed in the aluminum can. There is an insulated center terminal and grounded can. Fittings supplied with each unit permit insulating the can from the chassis and providing a second insulated terminal. Units are available in 600, 1000 and 1500 volts D. C. working, and in capacities of from 0.5 to 4 mfd.

n r i

Arcturus Develops New 5W4G Tube

Arcturus Radio Tube Company, Newark, New Jersey, announces a new 5W4G rectifier for use in A.C. receivers. The electrical characteristics of this new Arcturus 5W4G remain unchanged, but the mechanical construction has been altered after considerable investigation and collaboration with several leading set manufacturers.

This change enables a set manufacturer to utilize any chassis arrangement with respect to the rectifier tube and r. f. coils. Exhaustive tests in the laboratories of set manufacturers disclosed a general tendency of 5W4G's, when placed next to an r. f. coil, to cause noise in the receiver when the tube was vibrated ever so slightly. The new Arcturus construction eliminates this noise regardless of vibration or the position of the r. f. coil and results in quiet set operation.

Wholesale Radio Service Company, Inc., Now In Boston

Wholesale Radio Service Company, Inc., of 100 Sixth Avenue, New York City, added another link to their growing chain of modern establishments with the opening of their beautifully fitted display and salesroom at 110 Federal Street, Boston, Mass. The opening of this unit marks another forward step in the progress of this organization. Mr. Michael Scott, well known Radio merchandiser, is in charge of the new branch.

In the comparatively short period of 16 years, Wholesale Radio Service Company, Inc., has climbed from a small Radio sales office to an enterprise supplying every corner of the globe, and owning impressive salesrooms and mail order warehouses in New York City, Bronx, N. Y., Chicago, Ill., Atlanta, Ga., Newark, N. J., Jamaica, L. I.—and now, Boston, Mass. The new store will serve as headquarters for Radio servicemen, P. A. engineers, amateurs, experimenters and short-wave fans living in the Boston area.

———*n r i*———

General Electric Builds New Transmitter

General Electric's short wave stations W2XAD and W2XAF will become the strongest in America and probably in the world, upon completion of a new 100-kilowatt transmitter, permission for the erection of which has just been granted by the Federal Communications Commission.

The new equipment will involve a cost of more than $100,000 and will increase the signal to more than twice its present strength, affording much stronger and clearer reception throughout the world.

The new transmitter will be a linear, Radio frequency amplifier and may be used by either of the two short wave stations. "The previous strength of 18 to 25 kilowatts for W2XAD and W2XAF, respectively, has rivaled the world's strongest short wave stations, and the greater signal strength should permit world-wide reception throughout the year," according to B. W. Bullock, assistant manager of broadcasting of the General Electric Company.

The application was granted for the increase in power by the Federal Communications Commission as a result of General Electric's experience of more than 20 years in conducting and actively pursuing many Radio developmental investigations.

W2XAD now broadcasts approximately 220 hours a month, and W2XAF 290 hours. It is anticipated that this will be increased as the result of the greater range of the new transmitter, which is expected to be completed by the early part of next year.

Nomination Ballot

All Alumni Association Members are requested to fill in this Ballot and return it promptly to National Headquarters. This is your opportunity to select the men who you want to run your Association. Turn this page over—the entire other side is devoted to your selection.

After the ballots are returned to National Headquarters they will be checked carefully and *the two men having the highest number of votes* for each office will be considered as candidates for the 1938 election. This election will be conducted in the next issue of NATIONAL RADIO NEWS.

You may vote for the officers who served last year or select entirely new ones. It's up to you—select any men you wish as long as they are MEMBERS IN GOOD STANDING OF THE N. R. I. ALUMNI ASSOCIATION. Be sure to give the city and state of your selections to prevent any misunderstanding. A list of the 1937 officers are to be found on page 23 of this issue.

Tear carefully along this line

Detach this slip carefully from your NATIONAL RADIO NEWS so as not to damage the book. Tear off the slip at the dotted line, fill it out carefully, and return it immediately to L. L. Menne, Executive Secretary, N. R. I. Alumni Association, 16th and U Sts., N. W., Washington, D. C.

Your signature .....

City ..... *State* .....

(Over)

The 1938 nomination is a very important one. Choose carefully the men you desire to handle the reins of the Alumni Association for the coming year. Let's all do our part to help the staff handling the elections, by submitting ballots on or before October 15, 1937.

Nomination Ballot

L. L. MENNE, *Executive Secretary,*
N. R. I. Alumni Association,
16th and You Sts., N. W.
Washington, D. C.

I am submitting this Nomination Ballot for my choice of candidates for the coming election. The men below are those whom I would like to see elected as officers for the year 1938.

MY CHOICE FOR PRESIDENT IS

.....

City..... State.....

MY CHOICE FOR FOUR VICE-PRESIDENTS IS

1. .....

City..... State.....

2. .....

City..... State.....

3. .....

City..... State.....

4. .....

City..... State.....

MY CHOICE FOR SECRETARY IS

.....

City..... State.....

MY CHOICE FOR EXECUTIVE SECRETARY IS

.....

City..... State.....

Tear carefully along this line

Shielded Loop for Aviation Radio Equipment

A new and simple type of shielded loop which can be rotated for direction finding service is being introduced in the aviation field by the Western Electric Company. Because of its shielded construction, it is instrumental in reducing the disturbances in Radio reception caused by rain, snow and sleet static.

The new loop equipment is compact, light and sturdy in construction, can be installed with ease in any desired location aboard the ship, and, while designed primarily for use with the Western Electric 14 and 20 type receivers, it is also applicable to other types. The slight modifications required in a receiver to employ this new device in no way affect the reliability or interchangeability of the receiver, which is of particular importance to airlines operating large fleets.

The aural null direction finder enables the taking of Radio bearings by rotating the loop. Rotation is accomplished by a compact control unit equipped with a 264 to 1 gear ratio and connected to the loop through a flexible shaft. The position of the loop is indicated at the control unit by a needle on a scale, permitting extremely accurate loop adjustment.

The contribution of this new development to the field of transport and private flying increases the utility of much existing aviation Radio equipment and adds materially to the safety of aerial navigation.

n r i

Arcturus Issues New Metal Sign for Outdoor Use

Made available to dealers and servicemen by the Arcturus Radio Tube Company, Newark, New Jersey, is a new metal sign for attaching to the exterior of store fronts. The sign establishes the store as Radio service and tube headquarters.

The color combination of blue and white makes this an attractive, yet dignified sign that will harmonize with any type of store front and has remarkable visibility from all directions. The signs are available through Arcturus distributors.

n r i

Chief Dowie Celebrates 22 Years of Service

Chief Instructor J. A. Dowie recently completed his twenty-second year of continuous service with the National Radio Institute. Mr. Dowie received warm congratulations from the officers and staff members of N.R.I., and to commemorate this occasion the Chief was presented with a handsome wrist-watch.

Enjoys Every Page of News

I certainly enjoy reading every page of NATIONAL RADIO NEWS and especially the Service Forum. I like the new arrangement of the Service notes very much.

HENRY L. SMITH,
So. Portland, Me.

n r i

Wants Section for Hams

I wish to take this opportunity to congratulate you on the fine magazine you are editing. You and your associates are certainly giving us readers some worthwhile material.

I read every department in your magazine, but I wish you would put in a "ham" section where you could publish a few transmitting helps and kinks and also allow the "hams" to send in contributions. I am not an amateur yet but I soon expect to be one.

EARL C. MCNEIL,
Brockway, Pa.

n r i

The New Cover Gets a Bouquet

The Service Helps have been invaluable many times in setting me right when problems arose.

Since George Dunkirk, of Los Angeles, wants comments on the new cover—here's mine. "Swell" is no name for it. It's immense.

FRANCIS R. DETWEILER,
Philadelphia, Pa.

n r i

Finds Novel Page Interesting

I want to tell you how much I enjoy your page of Novel Radio Items. I think they are both interesting and educational, and your picture descriptions are very amusing. Here's hoping you keep up your good work as I always look forward to your future novelties.

FRANK BRAUN.
Chicago, Ill.

Likes Television Articles

I am forced to compliment you on your June-July issue of NATIONAL RADIO NEWS. It was swell—especially the article Mr. Kaufman and Mr. Thomsen wrote about television. So on bended knees please give us more. Hoping NATIONAL RADIO NEWS the best of luck.

JAMES SMITH,
Auberry, Calif.

n r i

Service Tips Are Helpful

You may tell this to the editor of the NATIONAL RADIO NEWS magazine, it is getting better all the time. I enjoy reading every issue and I especially like the service tips, as I am filing them for future reference.

LLOYD EVELAND,
Tonkawa, Okla.

n r i

Thank You, Mr. Griggs

The Sightseeing articles have been excellent. Let's have more of them. Since I have not outgrown my boyhood curiosity, there are many things that I still wonder about in the manufacture of the things I handle every day in my work. These articles have answered some of them. The NEWS is a grand magazine.

LEO C. GRIGGS,
Miles City, Montana.

n r i

Another Article Scores a Hit

Your article regarding "Overseas Telephone Service" was just the thing I have been looking for. I have enjoyed the article very much and am looking forward to more of the same or of a similar nature. In the Mailbag page, Mr. Geo. H. Emond's suggestion is a capital one. NATIONAL RADIO NEWS is getting better each issue.

A. O. L. AUSTIN,
Dharmavaram, British India.

New Loud-Speaker Phone System

A new intercommunication system, known as the "Handy-Phone," has been developed by the General Electric radio division in Bridgeport, Conn., it has been announced by H. A. Crossland, manager of the technical sales and service section. Essentially a loud-speaker phone system, the new apparatus is designed for use in offices, hospitals, stores, homes, or any similar place where speedy voice communication is desired.

The system consists of one master station and from one to four remote speaker-phone stations. The latter may be located at any point within 2000 feet of the master unit, or at greater distance with special arrangements.

An individual at the master station of the Handy-Phone may have two-way conversations with any of the remote stations, or may speak to all of them at one time. He merely turns the five-point selector switch to the desired position, presses down the "talk-listen" control lever, and speaks. When he is ready for his answer, he releases the lever and it automatically returns to the "listen" position.

Remote stations may talk back to the master station without the operator using hands, switches, or keys.

The new system was designed to afford a greater than usual convenience and efficiency in operation, as neither speaker nor listener must bend over the station cabinet to carry on a conversation. Tests indicate that the best results are obtained by speaking in a normal fashion, two or three feet from the station. By increasing the volume control setting at the master station, speech is made intelligible for as much as 50 feet from the remote station.

Operating cost of the Handy-Phone is approximately a quarter of a cent per hour. The speakers are five inches in diameter and the maximum power output one watt.

The stations are housed in walnut veneer cabinets. The system operates on either alternating or direct current, 115-125 volts; 25, 50 or 60 cycles. Only the master station requires connection for power, as the remote stations are energized and controlled from it.

Additions to N. R. I. Ham List

R. L. Westerman—W5GPH—Hernando, Miss.
Charles W. Hopkins—W3GWK—Washington, D. C.
John Thornton—W5GMP—Hot Springs, Ark.
Edmun B. Lemon—W3EMX—Lynchburg, Va.
L. J. Davis—W4EVU—Pelzer, S. C.
Leroy Shepherd — W9YWM — Council Bluffs, Iowa.
Collins Snow—W5GPN—Hardy, Ark.
Griffith Sechler—W3HAT—Allentown, Penna.
Russell E. James—W6LFJ—Ash Fork, Ariz.

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