

# NATIONAL RADIO NEWS

*A Merry Christmas.*



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Dec.-Jan.  
1949-1950

VOL. 13  
No. 12



All of us here at NRI extend to each and every one of our students and graduates our sincere wishes for a jolly Christmas and a joyous New Year.

J. E. Smith  
President



# BEHIND THE SCENES IN NRI'S LABORATORIES

**T**HREE laboratories form an important part of NRI's Instruction Department. They might be called the "proving ground" for many of the facts that are contained in NRI lessons. The NRI practical experiment kits and accompanying instruction manuals are developed largely by our laboratory personnel. Much of the designing and engineering work on NRI Professional Test Equipment is also done here.

Laboratories usually hold a certain fascination. Visitors here at NRI seem interested in seeing the "labs," and in hearing what goes on within them. We feel that readers of NR NEWS will be interested, too. We want you to meet some of our laboratory personnel, who work behind the scenes, so that you may feel better acquainted with them and with your school.

## THE TELEVISION LABORATORY

In order that NRI instructors might be in closer touch with practical television problems, NRI established the "TV Laboratory." Here, experimental television receivers have been constructed using both commercial and NRI developed circuits so NRI consultants and technicians might be more intimately familiar with modern television circuits and their practical operation. In addition, experiments are conducted on commercial television receivers and new, more effective servicing techniques developed.

By keeping in close contact with TV development and service problems, NRI instructors are better able to serve students and graduates. New techniques and professional service methods, as rapidly as they are perfected, are incorporated into the lesson material in revised texts and passed on to graduates in NEWS articles. Eight television receivers have been built by NRI instructors, four using commercial circuits and four using NRI developed circuits. One of the NRI developed receivers is shown in Fig. 1.

This is a 21-tube television receiver using a 7-inch electrostatic tube, an r.f. type high voltage power supply, and an inter-modulation sound system. In another of the illustrations (Fig. 4), an NRI consultant is shown working on another NRI developed receiver. This is a small set using a 3-inch electrostatic tube.

Not only are television receivers built in the NRI TV laboratory, but experiments are also performed on commercial receivers. Among the TV receivers regularly assigned to the laboratory are an RCA 630TS, a Stromberg-Carlson Model TV-12, and a Hallicrafters Model 505. Other receivers, such as National, DeWald, etc., are brought into the lab from time to time so

that NRI instructors might be familiar with the newer sets as they are placed on the market.

The lay-out of the television laboratory may be of interest to NRI students and graduates planning their own TV service business. The lay-out is illustrated in Fig. 2.

A workbench runs along the length of one wall. Two bench stools are provided for the men nor-

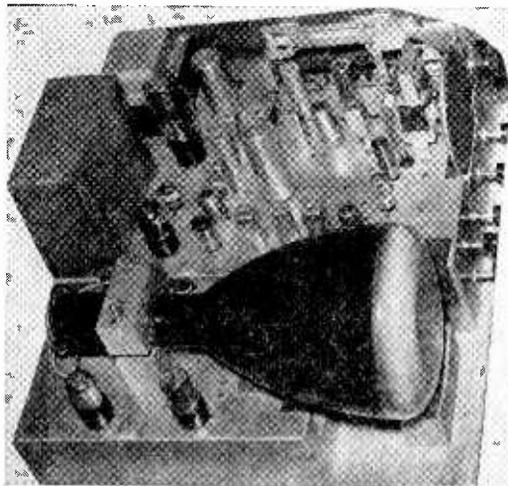


Fig. 1. This is a direct-view television receiver employing a 7-inch electrostatic tube. The set was built at NRI, using a circuit developed here. (This set was built for experimental purposes only—please do not request a diagram or other information concerning this receiver.)

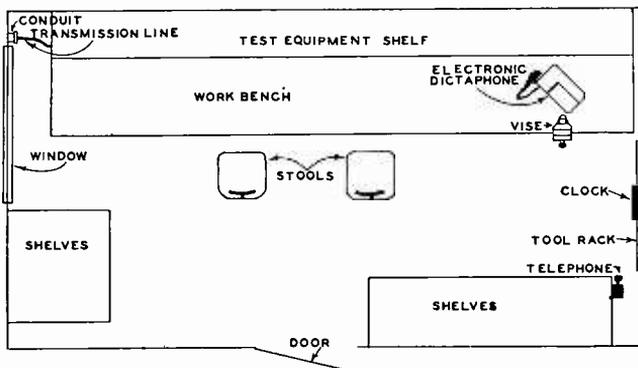


Fig. 2. This is a plan view showing the arrangement of the TV laboratory.

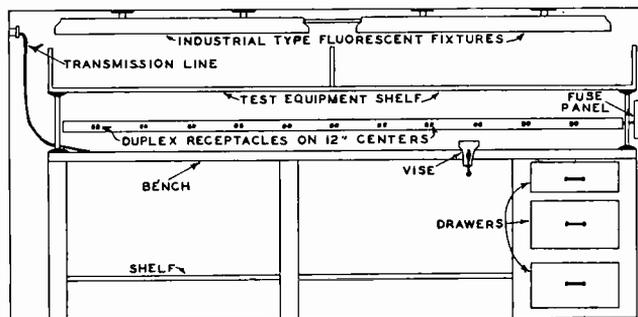


Fig. 3. This is an elevation view showing the television laboratory workbench. Also shown are the test equipment shelf, power facilities, and lighting facilities provided.

mally assigned to the television laboratory. Ample shelf and cabinet space is available. One set of shelves are 18 inches apart, the wide space providing ample room for two metal parts cabinets in which resistors and condensers are stored, also for test equipment and cathode ray tube storage. The other set of shelves are spaced 12 inches apart. Here are stored bottles containing small hardware, tubes, and replacement and servicing parts. Also, a rack is mounted in one shelf which supports several spools of colored hook-up wire.

At one end of the laboratory, a wall-mounted tool rack is provided in which are placed the small hand tools (screwdrivers, pliers, wire strippers, etc.) used frequently. Part of this tool rack is visible in Fig. 4.

A wall clock is also available in the TV laboratory. This is an important piece of equipment where work is conducted on television sets—primarily because television stations are only

on the air during certain times of the day and it is important to check, when working on a set, whether a specific station is on the air at that time. In addition certain stations make a practice of removing the sound transmission for five or ten minutes, either on the hour or half hour (and sometimes both). Here, again, it is important to know the exact time so that effort will not be expended trying to find trouble in a set in good condition. If no sound is received, for example, one must check and see whether the station is actually transmitting sound at the time the receiver is tested.

In order to allow the instructors working in the laboratory to easily make notes and observations while working on equipment, an electronic dictaphone is provided as a normal part of the TV laboratory equipment. A telephone is also located in a position convenient for the technicians' ready use.

The workbench is of a special interest and is shown in elevation in Fig. 3. The workbench is approximately 11 feet long. The bench top is 39½ inches above the floor and is covered with heavy linoleum. The bench is 30 inches deep.

Underneath the bench top, and 6 inches narrower than the bench is another shelf. This is only 9 inches above the floor. A metal strip is provided on the outside edge of this shelf for a foot-rest. This shelf is used to store large equipment, cabinets, and experimental receivers not in use.

A test equipment shelf is provided above the workbench. This shelf is 12 inches wide, runs the entire length of the workbench, and is mounted 18 inches above the bench. This height was selected because it allows clearance of any standard table-model television receiver except those using the largest picture tubes. Also, equipment placed on this shelf is at the right height for easy viewing and operation when seated at the workbench. Equipment mounted on this shelf can be easily seen in Fig. 5.

A continuous electrical wiring strip is mounted at the back of the workbench along the wall. This outlet strip is 6 inches above the bench and double outlets are mounted on 12 inch centers along its length, with a total of 20 outlets available.

In order to avoid too many wires and cables

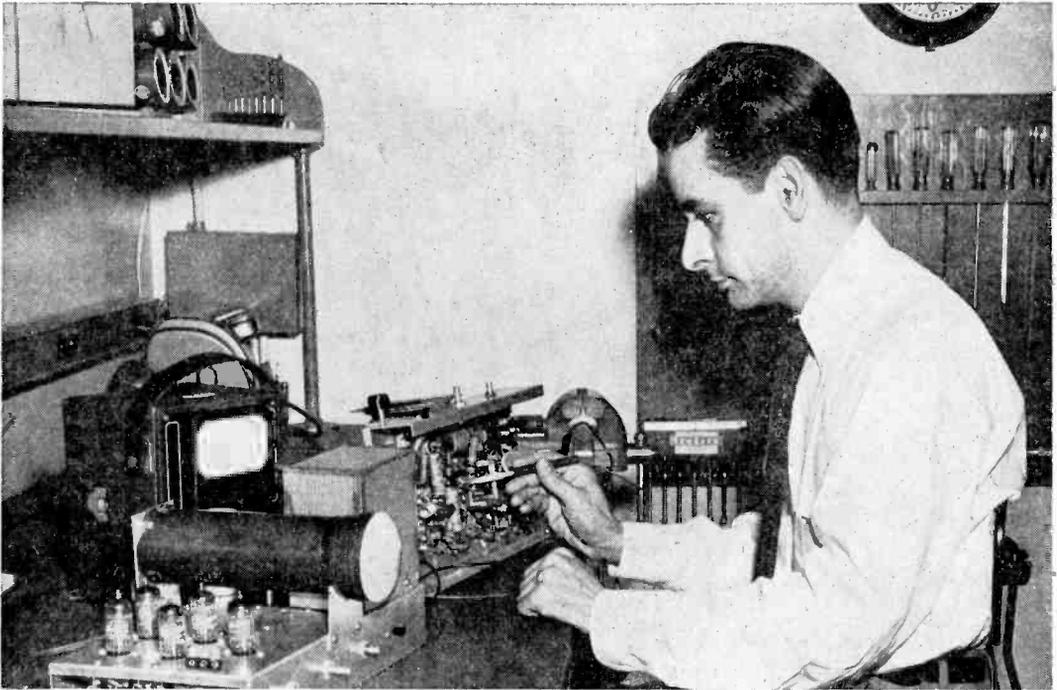


Fig. 4. Mr. Mariano Orege is shown experimenting on a small television receiver. Mr. Orege acquired his basic electrical theory at a technical school and later he studied Radio Engineering at the University of Puerto Rico. His experience prior to NRI includes work in South America and Caribbean countries as a Junior Engineer; Supervisor of Radio Ionosphere Measurements on a National Defense Project sponsored by the National Bureau of Standards; and Electronics Engineer with the Army Security Agency in Washington, D. C.

along the front of the shelf, holes are provided in the back of the test equipment shelf and the power cords brought directly through the holes and down to the outlet strip.

Three large drawers are provided along one side of the workbench. Here are stored smaller hand tools such as alignment tools, reference books, and similar material. A small bench vise is also provided on the workbench.

Ample lighting is assured by two industrial type 2-lamp fluorescent fixtures. With both of these fixtures turned on, approximately 40 to 50 foot candles of illumination is obtained.

The TV antenna for the laboratory is mounted on top of a high metal mast on the roof of the NRI main building. Conduit is mounted along the side of the building in which the transmission line to the antenna is run. The transmission line comes into the TV lab through a feed-through mounted in the upper corner of the window opening. Shielded 300-ohm, twin-conductor transmis-

sion line is used between the antenna and the TV laboratory. The TV antenna, at the top of the mast, is approximately 85 feet above ground level.

Two NRI instructors are normally assigned to the television laboratory.

Mariano Orege, one of the instructors, is shown in Fig. 4. Here, Orege is using an NRI Professional Model 45 Volt-Ohm-Milliammeter to check voltages in a small TV receiver shown on the bench.

In the background can be seen the electronic dictaphone, the bench vise and the tool rack.

In Fig. 5, Lou Garner is shown working with the Stromberg-Carlson Model TV-12 receiver. He is using a laboratory type oscilloscope (Tektronix Model 511AD) to check wave-forms in this set.

The oscilloscope is of particular interest since it is mounted on a movable "dolly." This allows

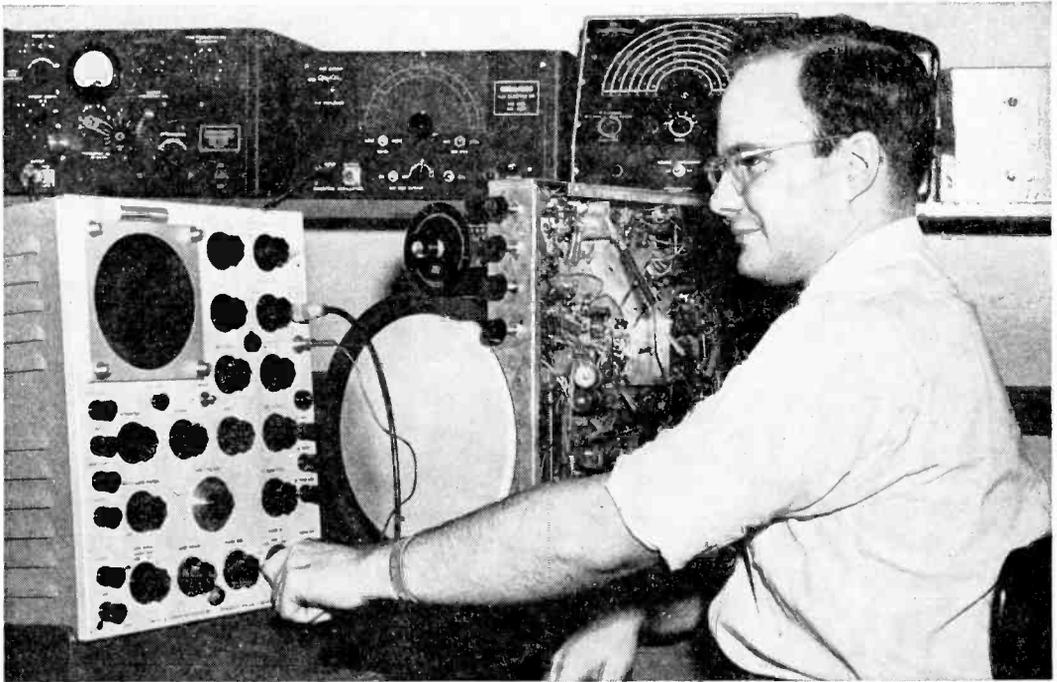


Fig. 5. Mr. Garner is shown using a laboratory oscilloscope to check wave-forms in a Stromberg-Carlson Model TV-12 Television Receiver.

Garner's education includes work at Columbia Technical Institute, George Washington University, and the University of Maryland, in Radio Engineering, Mathematics, and Communications. He holds a first-class radiotelephone operator's license. Experience prior to NRI as a Draftsman and Engineer includes work in Radar Section, Bureau of Ships; Army-Navy Electronics Production Agency; and several private engineering firms. Mr. Garner is the author of several technical articles published recently in various magazines.

the heavy oscilloscope to be moved easily around the TV laboratory or, if need be, moved to other laboratories at NRI.

In the background, along the test equipment shelf, can be seen a Mega-sweep laboratory sweep signal generator, a Megaligner marker generator, a Model 88 NRI Professional Signal Generator, and a Model 45 NRI Professional Volt-Ohm-Milliammeter (the Model 45 is behind Garner's head and not completely visible in the photograph).

Other equipment normally assigned to the television laboratory includes a Barber Model VM-27 Vacuum Tube Voltmeter, a Vision Research Tele-sweep Sweep Generator, a Vision Research Marker, an Isolation Transformer, a Resistance-Condenser Substitution Box, and another Sweep Generator.

One of the more interesting items is a stainless steel mirror mounted on a tripod. This is used

so that a technician can watch the test pattern on a TV set while adjusting controls at the back of the receiver.

You will see the results of work performed in the NRI TV laboratory from time to time in the form of News articles on new and more efficient servicing techniques as well as general articles on television. In addition, however, as an NRI student or graduate, you will benefit indirectly in many ways from the work performed in this laboratory, in the form of better consultation service, and up-to-date lesson texts.

— n r i —

He who wishes to exert a useful influence must be careful to insult nothing. Let him not be troubled by what seems absurd, but consecrate his energies to the creation of what is good. He must not demolish, but build. He must raise temples where mankind may come and partake of the purest pleasures.—Goethe.

## THE COMMUNICATIONS LABORATORY

The Communications Laboratory is located on the first floor of the Main Building and occupies a floor space approximately 10 feet by 30 feet.

This space is partitioned off so that two rooms are formed. The smaller of these rooms is approximately 10 feet square while the larger room takes up the remainder of the space.

The smaller room serves as an "office" for the two Consultants regularly engaged in Communications work. It contains two desks with shelf space above each desk for complete NRI Courses as well as various handbooks, tube manuals and reference texts.

The larger room contains two large workbenches, file cabinets and a fairly large cupboard that is used to store items not regularly needed in the main work room.

One workbench is used for developing experimental equipment, and certain other types of special equipment, as well as servicing the regular Radio and Television Communications Course.

When tests are to be made on any of the kits—

the equipment is set up on this bench and operated according to the instructions in the manuals. Besides the regular NRI Electronic Multi-tester used in this Course we have a Model 45 Volt-Ohm-Milliameter, a Model 112 R-C bridge, General Radio Frequency Meter, Dumont 5" oscilloscope and a Hallicrafters Model SX-42 receiver which are used in making comparison checks. A Lecher wire system is also available for VHF experimental work.

In Figure 6, James Conley, one of our Lesson Graders, is shown tuning up the NRI Experimental Transmitter used in our new Radio and Television Communications Course to prove theory and to give practice in actual transmitter operation. At the left of the transmitter is one corner of the SX-42 receiver while the Dumont 'scope may be seen at the right.

The transmitter power supply is on the lower "deck" while the r.f. section occupies the top "deck." The complete r.f. section contains a crystal oscillator, buffer-doubler stage, pentode driver-amplifier and a push-pull neutralized power amplifier. This transmitter is designed to show commercial transmitter practice by using

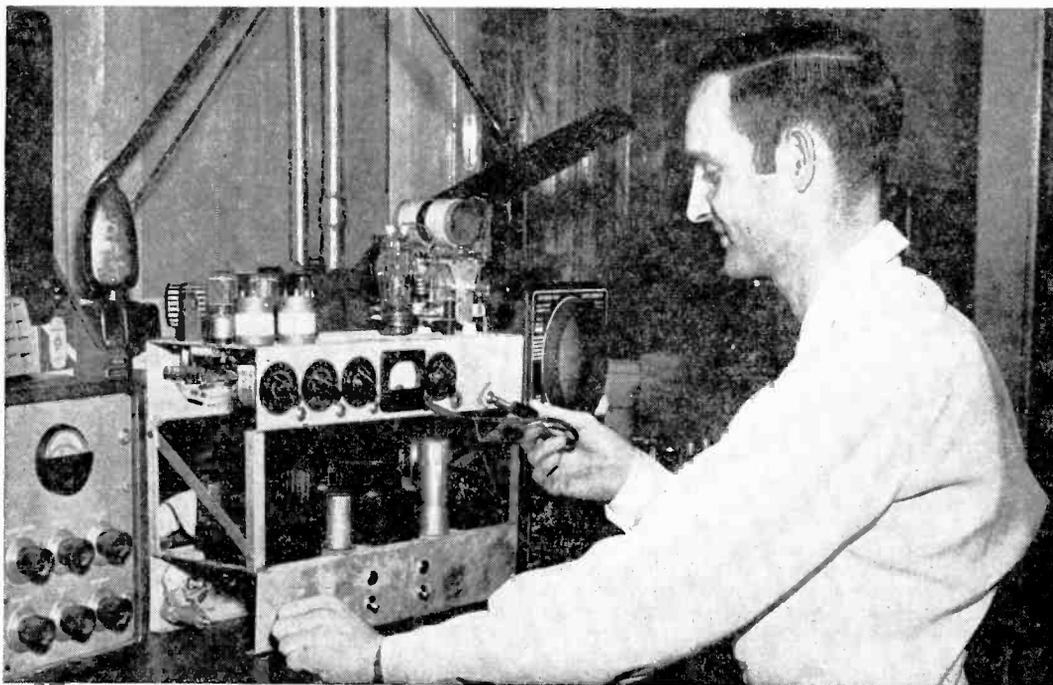


Fig. 6. James Conley tuning the NRI Experimental Transmitter.



Fig. 7. (Left) Max Tall, (Right) Leo M. Conner.

receiving type tubes.

A non-inductive resistor is used as a dummy antenna so that radiation is kept to a minimum. The measured power output across the dummy antenna is 20.6 watts when the transmitter is properly tuned. The efficiency of the final amplifier is 78 per cent.

With this transmitter and the other units, such as the wavemeter, the audio bridge and amplifier and microphone the student can and does duplicate any job that he might be called upon to perform as a Communications technician.

The other bench in this room contains a drill press, heavy bench vise and a South Bend lathe. The small storage room is used for storing the lathe accessories, a small metal "brake" for bending chassis from sheet metal and hand tools as well as supplies.

With this equipment it is possible to make special chassis, turn out special insulators, neutralizing condensers and other items that may be needed. These parts are then used in actual experiments in order to make sure that they are correct for the purpose. Then samples of these

parts are sent to manufacturers for duplication in quantity. After the parts are received from the manufacturer they are tested in actual use before being accepted.

All of the special parts used in the first laboratory model transmitter were manufactured with the equipment listed above.

Fig. 7 shows the two men responsible for the handling of the requests for technical information. On the left is Max Tall who recently came to the Institute after graduation from College of the City of New York with a Bachelors degree in Electrical Engineering. Prior to his university work he was a member of the armed services serving with the paratroops in the European theatre of operation.

He will answer your questions relating to mathematics as well as take care of the writing of new Communications texts.

On the right is Leo M. Conner who is in charge of the Communications Laboratory. He will answer your questions on the kits and on special problems. He holds a Radiotelephone second class and class A (W3GUP) amateur license. In addition he holds an Experimental station license (W3XGW) for use in Citizens Band experiments. He has been with NRI since 1942. During this time he has done the work on the transmitter, experiments and accessory equipment.

In this Course we have the finest material of its type that is available. We intend to keep it modern and practical. To this end you will find experiments that have seldom before been attempted outside of College and Advanced School laboratories. Here is the opportunity of a lifetime for the man who cannot take time off to attend regular classes in order to learn Communications.

We are ready to give you every possible assistance. The facilities of the Communications Laboratory are at your service. The rest is up to you.

## THE SERVICING LABORATORY

This laboratory which is located on the third floor of the main building here at NRI is devoted to general radio service and RK Kit experimental and development work. It is here that our Technicians, Instructors, and Consultants develop and try out new servicing techniques and equipment, find the answers to unusual problems encountered by our students as they carry out their RK experiments, and develop new experiments and equipment. Here also we inspect and test

the NRI Professional Servicing Instruments to make sure they meet the standards that have placed them among the leaders in their fields.

Although the "RK Laboratory" as we call it here at NRI (because the Radio Kits for our Practical Demonstration Course were developed here) is not large, it is arranged so that a maximum amount of work can be accomplished. Against one wall we have a test bench with a 3" RCA

oscilloscope, General Radio standard signal generator, an RCA-Rider Chanalyst, Triplett tube tester, two Weston multimeters, condenser bridge, audio signal generator, and a General Electric radio receiver, permanently mounted at convenient levels above the work space. Most of these instruments are visible in Fig. 9. The General Radio standard signal generator is placed at the center of the test panel so as to be convenient to either of the two technicians the bench was designed to accommodate, and the Weston multimeters, one a model 772 and the other (visible in the photo) a model 785, are positioned directly ahead of the two working positions at an average eye level. The less frequently used Rider Chanalyst and the condenser bridge are located at the extreme ends of the test panel. Directly above the big signal generator you can see the RCA Oscilloscope. This instrument is tilted slightly downward for ease in making adjustments and viewing.

A unique feature of the test bench is that each instrument is mounted on a separate shelf and protected by an individual panel held in place by four friction catches. This allows the panel to be readily removed to permit easy access to one instrument at a time and at the same time makes it possible to replace any instrument with a newer model of a different size, or to install new equipment without disturbing the others. All that is necessary is to cut a new front panel for that section.

Underneath and at each end of the bench, storage cabinets with smooth operating drawers are provided for additional test equipment of the portable type, tools, and spare parts. To the right of the test bench we have a storage battery and a Stancor 6-volt d.c. power supply to keep the battery fully charged at all times. The units are wired so that power cannot be drawn from the battery unless the charger is turned on. Adequate lighting is provided by two 48" fluorescent lamps mounted in a white enameled reflector suspended over the bench and a total of seven 110-volt, 60-cycle a.c., and one 6-volt d.c. power outlets are provided. All a.c.-operated instruments in the test panel get their power from separate outlets permanently wired into each instrument compartment.

Running the full length of the wall opposite the test bench we have a plain work bench. Along the back of this is a shelf to hold test instruments and underneath is a shelf for equipment storage purposes. To the left of this bench is a small parts storage cabinet and bench grinder. A total of eight 110-volt, 60-cycle a.c. power outlets are permanently wired into this bench. Fluorescent

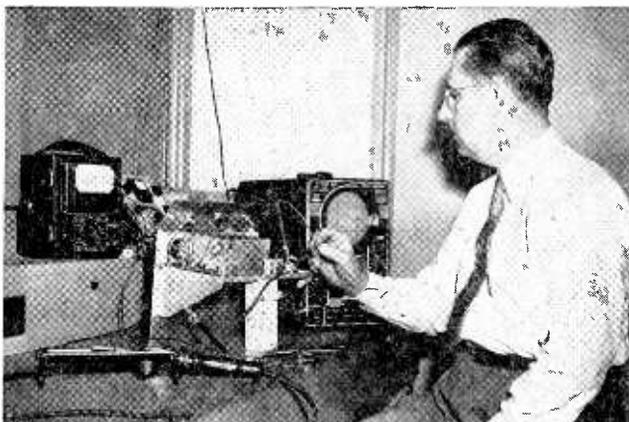


Fig. 8. George Rohrich inspecting a Signal Generator.

lighting is provided for this bench also.

The RK Laboratory also contains a desk at which reports and specifications are prepared, and in which technical data, reference material, and emergency first aid supplies, are stored. Full telephone service is provided and the ceiling of the laboratory is insulated with acoustic Celotex to absorb sound.

Figs. 8 and 9 accompanying this article will give you an idea of the work regularly performed in this laboratory. In Fig. 8, Mr. George Rohrich is shown inspecting one of our model 88, NRI Professional Signal Generators. To make sure that all specifications are fully complied with, he is measuring d.c. voltage distribution using one of our Model 45 Volt-Ohm-Mil-Ammeters, and the r.f. output voltage with a special vacuum tube voltmeter. In the background you see the 5" Dumont model 274 Cathode-Ray Oscilloscope used to check the wave form of the audio output provided by these signal generators. We are constantly on the alert for any variation from the specifications and work constantly with the manufacturer to improve our instruments. No effort is spared to offer accurate and reliable test equipment of the most modern design.

Incidentally, "George" as we all call him, is one of NRI's first instructors, having helped Mr. Smith wire up his first code instruction table in 1914. After serving with the Signal Corps in World War I, George joined the Institute on a full time basis in 1923 and has been with us since that date. During World War II, he again served with the Signal Corps and now holds the rank of Major in the Reserves. George is always ready to answer questions pertaining to the operation of our NRI Professional servicing equipment.

In Fig. 9 you see the men responsible for keeping

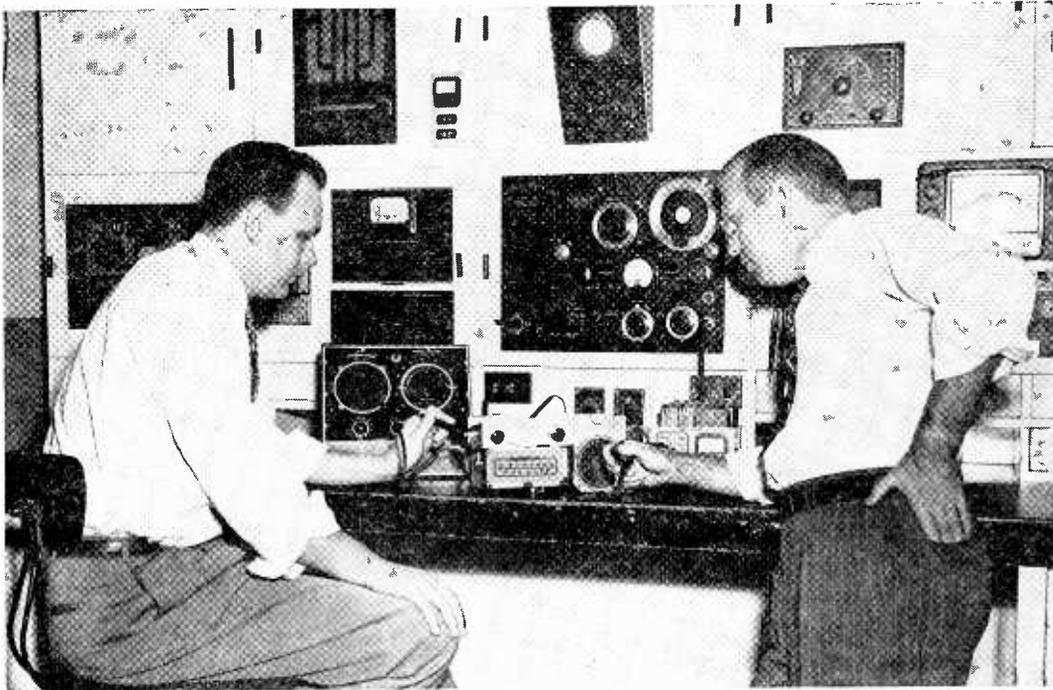


Fig. 9. (Left) Ernest B. Mullings and (Right) Ray Schaaf checking receiver gain.

our Practical Demonstration Course of experiments in basic radio fundamentals up to date and for handling student correspondence regarding the experiments. At the left is E. B. (Ernie) Mullings, who answers most of the requests we get for help with the experiments of our Practical Demonstration Course. "Ernie" served as an instructor in the Radio-Mechanics School of the AAF at Truax Field, Madison, Wisconsin, and joined the NRI staff in March, 1946. He is a native Washingtonian, attended Tampa University (Florida) and the George Washington University (D.C.), and holds a Class A amateur radio operator's license with the station call W4MKZ.

At the right in Fig. 9, is R. H. (Ray) Schaaf, who is in charge of the Servicing laboratory, and is responsible for keeping the experimental course up to date. When this involves new experiments, he develops them, writes the specifications for the parts used, and prepares the instruction manuals. He also supervises the experimental work done in the Servicing laboratory, and acts as a Consultant on special problems pertaining to our experimental course.

Ray is a graduate of NRI (1933) who owned and operated his own radio service shop, worked in the inspection and special engineering sections

of the Magnavox Co., and supervised a radio workshop prior to coming with NRI in 1941. He also attended the George Washington University and holds a Class A amateur radio operator's license with the station call W4JDF.

In Fig. 9, Consultants Mullings and Schaaf are checking the gain of each stage of an experimental model of a receiver. The big signal generator is feeding an r.f. signal of known strength into the input of the set and the output of each stage is being checked with one of our model 33 NRI Professional Signal Tracers. Such other important characteristics as selectivity, tone quality, ease of assembly, etc. are also checked. Unsatisfactory performance will require further development.

Students who have questions on the experiments of their Practical Demonstration Course are urged to use only the pink RK Kit Consultation blanks supplied for this purpose by NRI, and to give full information. The color of the RK Consultation blank makes it possible for those who handle the incoming mail to route these letters direct to the proper technical correspondent, thereby greatly speeding up our service to you. Your questions receive careful attention. All correspondence of a technical nature should be addressed to Mr. J. A. Dowie, Chief Instructor.

# TWO NRI GRADS EMPLOYED AT TV STATION WNBW

Washington, D. C.

Graduates  
Meline and Deem  
Both Members of  
TV Engineering Staff



Photo courtesy NBC  
NRI Graduates James F. Meline (left) and Warren D. Deem (right) working at an RCA Model TT5A TV Transmitter, Station WNBW, NBC's TV outlet in Washington, D. C.

*Dear Mr. Smith:*

"I am employed at the National Broadcasting Co. in the Engineering Dept. of WNBW, Washington's TV outlet. Before taking my course at NRI, I knew nothing of the technicalities of radio. But after finishing the course I was offered a job at NBC. That was seven years ago, and since that time I have received many promotions and was transferred to TV last December. I want you to know that without your training I would still be struggling along at \$200 per mo. I have enrolled for your new course in Radio and Television Communications. Thank you again."

**James F. Meline**  
Friendship Heights, Maryland

*Dear Mr. Smith:*

"I am a video engineer employed by NBC here in Washington, D. C. and wish to express my appreciation for your new course in Radio and Television Communications. I graduated from your servicing course in 1943 while I was in the Navy and am finding your new course just as clear and as informative. I have seen some of the advanced lessons on TV equipment in your new course and was surprised at the modern equipment described. It is the same gear that I am working with at present. I would recommend this course to those just beginning in radio and TV as well as those in advanced positions."

**Warren D. Deem**  
Arlington, Virginia

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# THE RCA 45 R.P.M. RECORD CHANGER

By H. L. EMERSON  
Graduate Service Department



AS a rule, servicing automatic record changers can usually be divided into four rather general steps: (1) Question the customer carefully concerning the nature of the complaint, then verify the complaint for yourself; (2) remove the record changer from its case and set up changer so that you can observe its mechanical operation, watch operation of the changer mechanism until it is understood and the trouble diagnosed; (3) make any necessary repairs or adjustments; and (4) give the record changer a trial of sufficient length to be sure the operation is now satisfactory.

Because Step No. 2 above, is obviously the most difficult, a discussion of how the 45 r.p.m. changer works should prove helpful in making adjustments or repairs. Brief descriptions of the most important adjustments are also given.

Tools suggested for servicing the new 45 r.p.m. RCA changer will include a quarter-inch open-end wrench and a quarter-inch spin-tight type wrench for loosening and tightening certain screws; a fine stone for smoothing rough lever edges; a scale for checking tone arm pressure (5 grams is correct pressure); a good magnifying glass for checking the sapphire stylus for a chipped surface; a .010 inch feeler gauge for adjusting the vertical play, or clearance, in the tone arm vertical pivot shaft; a No. 10 Allen set-screw is ideal for use as a wrench for loosening and tightening the nut which holds the sapphire stylus in the crystal; and a No. 6 Bristo wrench is needed on some models for the set-screws holding the star wheel in place. RCA type S5261 oil is recommended for slow speed bearings; RCA type S5262 grease for the cam track; and sewing machine oil for the motor. Cement is helpful in keeping springs in place. Speed checks call for a 45 r.p.m. stroboscope.

## Care of the Stylus

The sapphire tip radius is only .0009 inch and requires reasonable precautions in use. The RCA color coding system, found on the wire bridge of the stylus, uses white to identify the 45 r.p.m.

stylus. Placing more than the proper number of records on the turntable may cause the sapphire needle to strike the edge of the top record with enough force to cause the stylus to crack or chip, or the needle may scrape across the top record on the change cycle with possible damage to both the record and the sapphire. Do not place the tone arm on the record by hand. When picking up the tone arm, raise the arm above the record first by a gentle pressure on the extreme back of the arm, just beyond the pivot. The tone arm should be returned securely to the pickup rest when not in use.

## Adjusting Tone Arm Pivot

The procedure used is illustrated in Fig. 2. The pivot screw should be adjusted to allow slight play between it and the vertical shaft. Excess play will cause failure to trip, intermittent tripping, or erratic landing. If too tight, binding occurs with distortion resulting from incorrect tracking in the record grooves.

When adjusting the pivot screw, the pickup end of the tone arm should be moved back and forth from side to side with play movement under 1/32 inches. Recheck by trial following adjustment, for the pivot screw may move slightly when the locking screw is tightened.

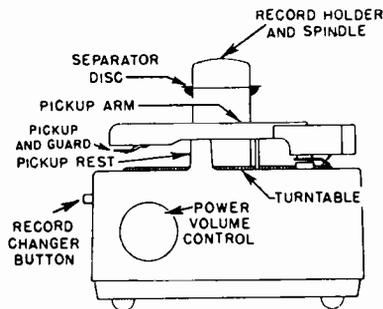


Fig. 1.

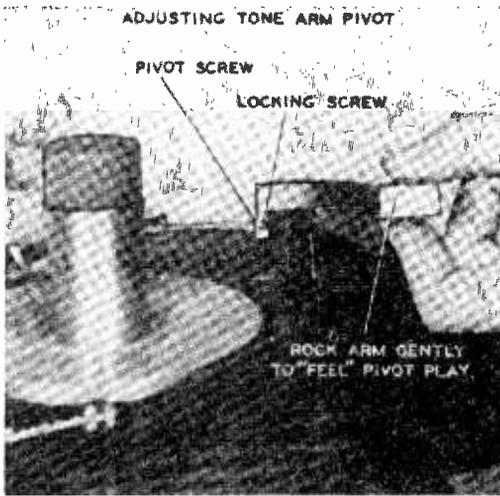


Fig. 2.

#### Starwheel Timing

Changer mechanism operating power is taken directly from the drive gear shaft by a starwheel fastened to the shaft, as shown in Fig. 3. Since any brake effect exerted on the starwheel puts the record separator parts into play for a change action, it must be properly adjusted for timing.

With the turntable mechanism assembled on the motor board, rotate the drive gear shaft by hand. With the fingers, hold the separator shelves, located at the top of the record spindle. When the separator blade nose starts to emerge from its slot (left in Fig. 3), turn the shaft in the opposite direction, until the blade heel is coming out (center illustration, Fig. 3). Determine the shaft position mid-way between the above two positions. With the shaft in this mid-way position, place the starwheel with one tooth directly under a cam screw, as shown at the right in Fig. 3. Recheck after tightening set-screw on starwheel.

#### Changer Mechanism Operation

Fig. 4 shows an exposed view of the self-contained phonograph model, with built-in amplifier and loudspeaker. The changer unit illustrated is identical with all other models.

When the instrument is turned on, the motor drives the turntable through the idler wheel at a speed of 45 r.p.m. The trip pawl is actuated by the inward motion of the trip lever which is attached to the tone arm. At the tripping point, a lug on the turntable engages the trip pawl and automatically cams the mechanism into its rapid cycle.

The reject button, which actuates the reject level, is for manual operation to produce this same action, and is used to drop the first record to the turntable. The main lever actuates the entire cycling operation and is controlled by a cam under the turntable. When the trip pawl trips the changer into cycle, the tone arm lift and return levers guide the tone arm up and away from the turntable to permit passage of the dropping record. The tone arm latch, which is engaged by the tone arm latch pin, holds the tone arm in place for a precision landing on the new record.

#### Record Separation Action

The drawing in Fig. 1 shows the location of the separator disc (also called separator blades) on the center spindle. The record shelves are directly below the separator blades. The records are designed with a center shoulder, providing an air space between the playing surfaces and also between the record surface around the inner circumference of the record's center hole.

During the record-dropping action, the two shelves retract within the spindle, and simultaneously the two changer blades (see separator disc in Fig. 1) move out of slots in the spindle, just above the shelves, and into the air space (provided by the design of the records) between the two bottom records in the stack. The separator blades thus provide temporary support for all the records stacked above the bottom one. As the bottom record drops to the turntable, the separator blades recede into the spindle and the retractable shelves simultaneously emerge to resume their function as supports for the entire stack of remaining records.

Fig. 5 illustrates the above operation in detail. In the top of the illustration, two records are

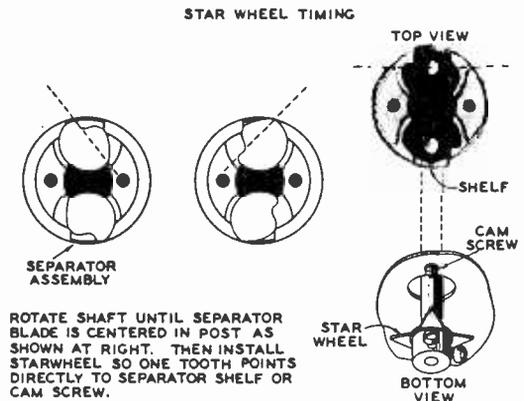


Fig. 3.

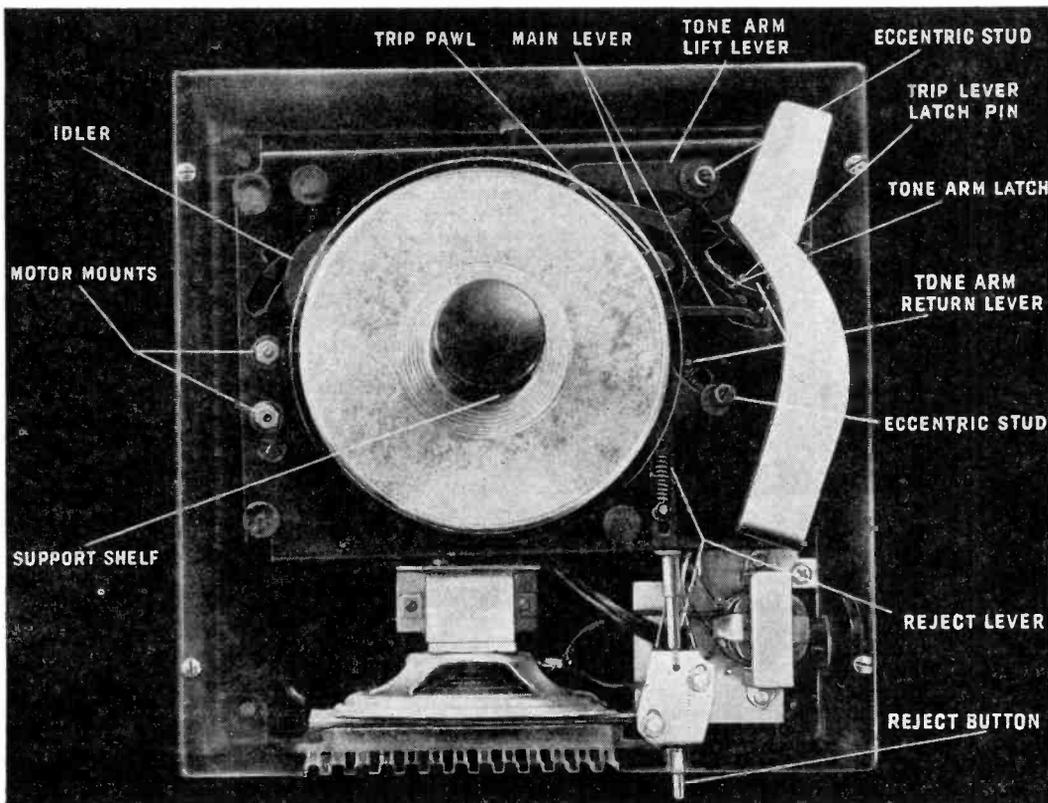


Fig. 4.

resting on the support shelf. The center view shows the blade entering the air space between the records as the change operation advances. The bottom view shows the support shelf retracted and the bottom record dropped in place as the top record is held up by the separator blade. Simultaneously the separator blade retracts and the support shelf returns to hold the remaining records until the next change.

Servicing the new RCA changer system should present no great problems for the keen observer with adequate mechanical and electrical experience.

— n r i —

The man who succeeds above his fellows is the one who, early in life, clearly discerns his object, and towards that object habitually directs his powers. Even genius itself is but fine observation strengthened by fixity of purpose. Every man who observes vigilantly and resolves steadfastly grows unconsciously into a genius.

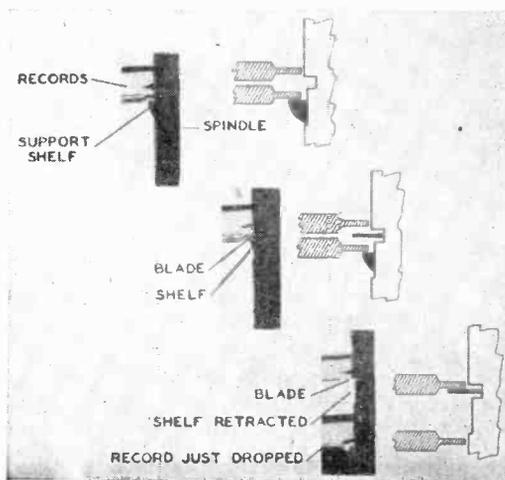


Fig. 5.

# How to Get Along With Others

DR. JAMES F. BENDER, DIRECTOR

The National Institute for Human Relations

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Is there anyone of us who doesn't have a personal problem from time to time? Happy people probably have as many problems to solve as unhappy people. But the former do something about their problems whereas the latter invest more time in fretting and fuming.

Charles F. Kettering recently described how research workers solve a scientific problem. They jot down ten or more steps to be followed in order to solve the problem. Then they take one step at a time. A personal problem can often be resolved in the same way. What are the barriers? Once we name them and take one step at a time, we can unravel the knottiest problem.

Another good way is to share our problem with someone who can keep a secret. Isn't it true that when we share a joy, the joy increases? And when we share a sorrow, the sorrow diminishes? Sometimes a friend will do. Sometimes we need professional guidance, and turn to a clergyman, physician or psychologist. The point is we need to talk out the problem with a sympathetic listener. For words have a magic way of drawing vague worries into the sunlight.

Many of our problems are preventable. Do you also discover that when you follow a regular schedule, allowing enough time for sleep, exercise, and play, that your mood is more cheerful and your problems don't grow so big?

When we take systematic care of ourselves we get more pleasure out of work, save more money, and develop deeper peace of mind. The old maxim, *An ounce of prevention is worth a pound of cure*, holds for personal problems.

In these days of a topsy-turvy world, most of us feel the need of more strength than is found within us. And so we call upon the divine power to help us solve our problems. By silently asking for help and direction throughout the day, we build understanding of our most irksome personal problems. Our renewed strength gives us courage to face the future and to deal decently with those about us.

For he who finds the way to solve his daily problems gets more from life and serves as an inspiration to those about him.



## What's the greatest standing offer ever made?

The greatest standing offer ever made has been in effect since the days of the colonists.

It is this—reward for *extra* effort.

It is a basic fact of human nature that people will work amazingly hard if they get something extra for doing it.

Through the years it has stimulated Americans to invent new and better machines—to invest in new enterprises . . . to create the world's greatest industrial plant . . . to compete in free markets.

By increased use of machine power on our mass production lines, we have been able to lower costs—to produce more for every hour we work than any people on earth.

Our productive efficiency has resulted in con-

stantly higher wages and shorter hours. Our labor has the right to choose jobs, to organize and to bargain collectively.

No wonder that the United States, with only 7 per cent of the world's population, produces as much material wealth as all other nations combined. No wonder so many other countries are looking to us today for help and guidance.

Our American system has its faults. We all know that. We still have sharp ups and downs of prices and jobs. We'll have to change that—and we *will*.

Meanwhile, we're being challenged to make the American system *work* as it never worked before. Let's create new industries and expand old ones—make more new jobs for more people.

Here's a big reward for extra effort—one we *all* can share. Let's show the world what Americans can do when they really *try!*

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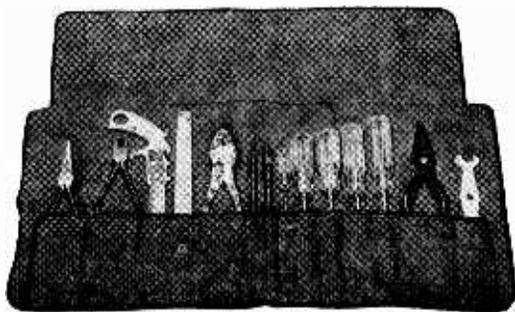
The Better We Produce The Better We Live

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# PLACE CHRISTMAS ORDERS EARLY

LAST year at this time we received many letters from students and graduates, members of their families and even friends inquiring about the NRI Professional Testing Instruments, and other NRI services, with a view of purchasing them for Christmas presents. Anticipating this same interest this year we give, in the following several pages, condensed information about these items.



## NRI Professional Tool Kit

INCLUDES ROLL-UP CARRYING CASE

A kit of fourteen carefully selected, good quality tools, complete with roll-up carrying case. Any man will be proud of this fine kit of tools. They are just what NRI recommends for doing your experiments. Will last well into your professional Radio Servicing career.

This is a real money-saving value. If bought at dealer's net prices, it would cost at least \$9.50. Yet NRI's price is only \$7.95, including the strong canvas carrying case. The items included in the kit are as follows:

1. Long nose pliers. Professional grade, precision made, of tool steel. Length 6½ inches.
2. Diagonal cutters. Precision made from tool steel. Professional quality.
3. Metal cutting saw. Removable, four position blade. Light, but very sturdy.
4. Eight inch file. An indispensable item.
5. Slip joint pliers. For general utility.
6. Double blade neutralizing tool. Designed for new miniature i.f. transformers.
7. Four-in-one bone fibre neutralizing tool. Necessary for aligning receivers.
8. Small screwdriver. Slender four-inch blade.
9. Nut driver. For five-sixteenths inch hex nuts. Good quality, plastic handle.
10. Nut driver. Same as above, for one-fourth inch hex nuts.
11. Phillips screwdriver. For special Phillips screws widely used in Radios. Plastic handle.
12. General utility screw driver. Good quality.
13. Plastic long nose pliers. Shock proof. Used to move "hot" wires.
14. Volume control wrench. Correct size for tightening volume controls and toggle switches.

Only \$7.95

Tool kit shipped, complete with carrying case, by parcel post, prepaid. Individual tools or carrying case not sold separately. Cannot be shipped to Canada because of Canadian import regulations. Please use order blank on page 20.

We urge our readers, who are prepared to send orders for these items at this season, to do so very promptly. For those who must wait until nearer Christmas, we promise to try to make shipments within one day of receiving order. That means Monday's orders, for example, are shipped Tuesday. Tuesday's orders are shipped Wednesday, etc., but Friday's orders are shipped Monday. The Institute is closed on Saturdays.

You must remember that mail moves slower at this season than it does ordinarily. A letter may take a day or two longer to reach us. Likewise, shipments move slower, too. More time must be allowed for delivery. We will do everything we can to rush shipments but please help us avoid impossible situations. Every year we receive orders within a few days of Christmas marked "Christmas present, please rush" or "Must get here before Christmas," with not enough time for the shipment to get there. That leads to disappointments, and awkward explanations.

One more important point. A father, mother, wife, sweetheart or friend may purchase these items for a student or graduate but we must have the student's name and student number as part of our record. Remember, we do not sell to those who are not students and graduates except when the item is bought for a student or graduate. Failure to give the student's name and address or his student number will delay the shipment.

To keep the present secret from the student, the shipment may be sent to any relative or friend, just so we have the name and address or student number of the student. So, mail your orders early. We'll extend every possible cooperation to help make the lucky recipient of the shipment have a Merry Christmas.



## Radio Replacement Parts Kit INCLUDES STURDY STEEL TOOL BOX

Commonly needed Radio replacement parts ideal for the man who wants to get an inexpensive start. Also just the thing for a man already doing Radio and TV service work. If this kit were bought from a Radio parts distributor, it would cost approximately \$35. We offer it for only \$19.75. The parts are standard, fresh, first-quality—they are not surplus. Made by well-known manufacturers' cartons. Here is what the kit includes:

1. Sturdy steel tool box, 16 inches by 7 inches by 7 inches, with pop-up tray.
2. Two 456 kc. i.f. transformers, one standard size, and one miniature size.
3. A matched set of 2 r.f. replacement coils for t.r.f. receivers.
4. Two 25 ft. rolls of flexible indoor antenna wire, wound on antenna hanks.
5. One antenna coil and one oscillator coil (matched) for either a.c.-d.c. or a.c. sets.
6. Box containing 10 assorted pilot lamps.
7. Dial cord and belt replacement kit, including springs, fasteners, and other hardware.
8. Paper tubular condensers—twenty-five most popular sizes, rated at 600 volts.
9. Fixed resistors—one hundred popular sizes and wattage ratings.
10. Electrolytic condensers—eight widely used types for a.c. and a.c.-d.c. receivers.
11. Two high-grade plastic line cords.
12. One universal output transformer for either single-ended or push-pull output.
13. One A.C.-D.C. output transformer.
14. Scratch filler, for hiding cabinet scratches.
15. One tube of speaker cement and one bottle of solvent.
16. Volume control kit—six popular volume controls, four switches, eight assorted shafts.
17. Two popular types of selenium rectifiers.
18. Two jars full of standard radio hardware.

**Only \$19.75.**

Shipping weight is 15 pounds. All Replacement Parts Kits are shipped express, collect. Cannot be sent outside of the United States. Please use order form on page 20.

**Page Eighteen**



## NRI Professional Tube Tester

The new model 68 NRI Professional Tube Tester has been engineered and priced exclusively for NRI men. This is truly a professional test instrument. It will give customers confidence in your work. This instrument is easy to use—beginners will find it ideal.

The use of an approved RMA emission circuit helps greatly to reduce obsolescence to a very minimum. It is easy to adapt this tester to new tubes as they are developed. Comes complete with instruction manual and tube test data. Instructions included for making your own chart listings on new tubes. Specifications are as follows:

1. Has 10 tube test sockets, including socket for new 9-pin miniature tubes used in FM and Television.
2. 19 filament voltage taps — for all receiving tubes.
3. Manual line voltage adjustment.
4. Separate tests for multi-function tubes.
5. Beautiful maroon crackle finish, including removable cover. Size 10" x 10" x 6½".
6. Power—50 to 60 cycle, 110-120 volts a.c. only. (cannot be used on d.c. power.)

**Price \$47.50**

Actual weight 11½ pounds, shipping weight 15 lbs. All shipments are made by express, collect. Cannot be shipped outside the United States. Order blank on page 20.



## Announcing the New NRI Service Manual, Volume 2

NOW—TWO BIG NRI SERVICE MANUALS

NRI service manuals contain radio circuit diagrams and information which is most frequently requested from NRI. This is our answer to your radio diagram problem. More than 9000 NRI students and graduates have already purchased Volume I, and additional orders for this manual are being received daily. Volume II now follows Volume I to bring this diagram service up to date.

**Volume I contains most frequently needed diagrams of receivers built before 1946.**

**Volume II contains most frequently needed diagrams of receivers built during 1946-1949.**

These are big, sturdy manuals. Circuit diagrams are in detail, with parts values, and many illustrations. I.F. values and alignment data are included. A complete, cumulative index is also included with each manual.

**\$14.50 Each**

Please use Order Blank on page 20.



## NRI Professional Signal Generator

FUNDAMENTALS: 170 KCS. TO 60 MCS.

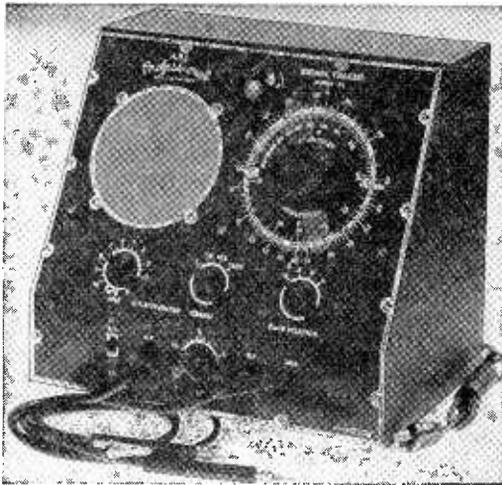
Designed specifically for rapid, easy alignment of radio receivers. Extremely accurate and easy to operate. Frequency coverage ideal for all AM servicing, as well as i.f. used in FM and Television. Strong harmonics and accurate calibration make the instrument useful up to 120 mc.

Invaluable in isolating the defective stage in a "dead" receiver, or in checking an audio amplifier. A stable Hartley electron-coupled oscillator circuit is used, with a cathode follower output stage. Single output jack with detachable coaxial lead. Coarse and fine r.f. attenuators. R.F. modulated, R.F. unmodulated, and 800 cycle audio output. Specifications:

1. Frequency coverage: 170 kc. to 60 mc. In six carefully selected bands.
2. Tubes included: 1-6BE6; 1-6SN7; 1-5Y3.
3. Sturdy maroon crackle finish case with handsomely etched aluminum panel. Size 12 inches by 8¼ inches by 10¼ inches.
4. Actual weight 14 pounds. Shipping weight 17 pounds. Shipped complete with detailed instruction manual.

**Only \$39.85**

Shipped by railway express, collect. We cannot ship these instruments to Canada or other points outside of the United States. Please use the order blank on page 20.



## NRI Professional Signal Tracer

TUNED CIRCUITS—GIVE HIGH PERFORMANCE

Signals can be traced from antenna to loudspeaker. Trouble is quickly localized in dead receivers. Greatly assists beginner or experienced serviceman in finding stubborn cases of hum, noise, or distortion. Sources of oscillation in r.f. or i.f. stages can be quickly isolated. Two separate inputs make the instrument ideal for tracing down intermittent trouble.

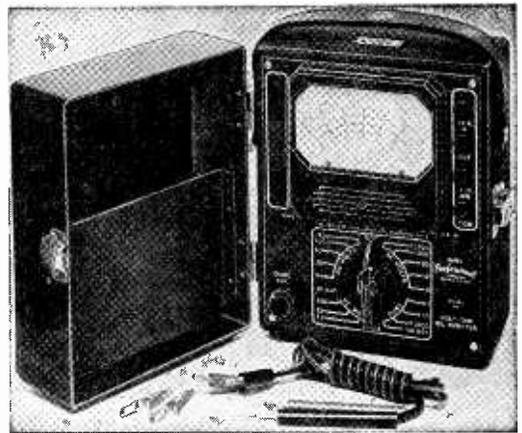
One special use for this instrument is in measuring the "gain-per-stage." Also, because this instrument uses two stages of tuned radio frequency amplification, it can readily be used for alignment purposes. A Signal Generator is not essential. The actual broadcast station signal is used instead. The instrument is practically fool proof—anyone can safely use it. Detailed instruction manual is included. Specifications:

1. Power requirements—50 to 60 cycle, 110-120 volts a.c., only.
2. Sturdy maroon crackle finish case—12" x 8¼" x 10¼".
3. Tubes included: 2—6BA6; 1—6SQ7; 1—6K6-G; 1—6E5; and 1—5Y3-G.
4. Frequency coverage is 170 kc. to 11.3 mc., in four bands.
5. Five inch dynamic loudspeaker provides audio output. Also has visual output indicator.

**Price \$52.50**

Actual Weight—15 lbs. Shipping weight—20 lbs. Cannot be shipped outside of the United States. Shipped by express, collect. Please use order blank on page 20.

Page Twenty



## NRI Professional Volt-Ohm-Mil-Ammeter

20,000 OHMS PER VOLT

We are proud to offer such a fine instrument at an unusually reasonable price. A Volt-Ohm-Mil-Ammeter is a fundamental instrument which every radio technician needs. Actually, seven basic instruments are built into one unit, and each section of the instrument is instantly available merely by turning the center selector switch. Specifications:

1. Five d.c. voltmeter ranges, at 20,000 ohms per volt. Maximum d.c. range 1200 volts.
2. Five a.c. voltmeter ranges available, sensitivity 5000 ohms per volt. Maximum range 1200 volts.
3. Micro-amperes 0-60.
4. Milliamperes, d.c.—0-1.2; 0-12; and 0-120.
5. Amperes: 0-12.
6. Four well divided ohmmeter ranges, with maximum range of 100 megohms. Zero adjust control on front panel.
7. Attractive maroon crackle finish — nickel plated hardware—6¾ inches wide, 7¾ inches high, 4¾ inches deep.
8. Shipped complete with operating instructions, test leads, alligator clips, and detachable cover.

**Price only \$39.95**

This is an ideal instrument for portable use as well as bench work. The actual weight is only 5 pounds. Shipping weight, 11 pounds. All instruments are shipped by express, collect. Please use order blank on page 20.

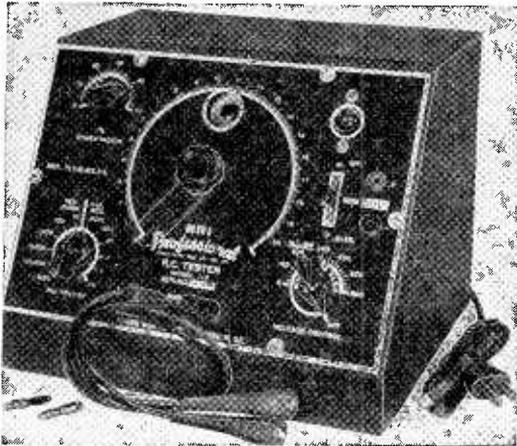
## Use Order Blank Below For Ordering NRI Equipment

As mentioned in connection with the description of our instruments, all test equipment is shipped by Railway Express, Collect. This gives fast service, in practically all cases. The NRI Parts Kit is also shipped by Express, Collect.

Tool kits and diagram manuals are shipped by Parcel Post, Prepaid.

Please indicate on your order blank the amount of your remittance. Check those items requested. Give full information as to name, student number, address, and Express Office, so that we can give best service possible. Please make remittances in the form of certified check, money-order, or bank draft.

We are very sorry, but none of the items mentioned on the previous pages can be sent to Canada at this time. This is because of Canadian Import Regulations.



### NRI Professional R-C Tester

No Radio service shop is complete without a reliable resistor-condensor tester. Such an instrument speeds up your service work, enabling you to increase your profits and your customer goodwill.

Here's what you can do with this instrument: (1) Measure power factor of electrolytic condensers. (2) Measure capacity of all types of condensers. (3) Check all types of condensers for leakage or break-down by applying actual d.c. working voltage. (4) Accurately measure resistor values in ohms and megohms.

#### Specifications:

1. Capacity Ranges: .0001 microfarad to 200 microfarad, in six ranges.
2. Resistance Ranges: 10 ohms to 20 megohms, in six ranges.
3. Bridge Type Circuit, linear calibrated main scale.
4. D.C. voltage up to 600 volts for leakage test.
5. Complete with four tubes: 1-V, 6Y6G, 6SL7, and 6E5.
6. Power requirements: 110 to 120 volts, 50-60 cycle a.c. only.
7. Maroon colored, crackle finish cabinet. Measures 10 inches by 8 inches by 7½ inches.
8. Actual weight 11 pounds. Shipping weight, 13 pounds.
9. Complete with instruction manual, rubber covered test leads, and special test plugs.

**Only \$34.25**

Shipped by express, collect. No shipments outside the United States. Please use the order blank at right.

## ORDER BLANK

National Radio Institute,  
Supply Division,  
16th and U Streets, N.W.,  
Washington 9, D. C.

I enclose \_\_\_\_\_ (certified check, money-order or bank draft). Please send me the following material, as checked.

- NRI Professional Tool Kit, parcel post prepaid. Price \$7.95.
- NRI Replacement Parts Kit, Express Collect. Price \$19.75.
- Model 68 NRI Professional Tube Tester, Express Collect. Price \$47.50.
- Model 88 NRI Professional Signal Generator, Express Collect. Price \$39.85.
- Model 33 NRI Professional Signal Tracer, Express Collect. Price \$52.50.
- Model 45 NRI Professional Volt-Ohm-Mil-Ammeter, Express Collect. Price \$39.95.
- Model 112 NRI Professional Resistor-Condenser Tester, Express Collect. Price \$34.25.
- Volume 1 NRI Service Manual, Parcel Post, Prepaid. Price \$14.50.
- Volume 2 NRI Service Manual, Parcel Post, Prepaid. Price \$14.50.

Name ..... Student No. ....

Address .....

City ..... Zone .... State .....

Express Office .....

If you live in Washington, D. C., add 2% for D. C. Sales Tax.

# FCC Regulations for The Citizens Band

By LEO M. CONNER

NRI Consultant

THE Federal Communications Commission recently released the rules and regulations governing the Citizens Radio Service which became effective June 1, 1949. Since interest in this band is quite high, a summary of these rules and regulations together with other information will be given in this article.

Throughout the rules and regulations are certain terms and phrases which apply to these services and the FCC definitions for these terms will be given first.

The FCC defines the Citizens Radio Service as "a fixed and mobile service intended for use for private or personal radio communication, radio signaling, control of objects or devices by radio, and other purposes not specifically prohibited in the rules and regulations. Any citizen in the United States eighteen years of age or over is eligible for a station license in this service. The term "Citizens Radio Station" means a station in the Citizens Radio Service.

The term "Class A Station" means a Citizen's Radio Service station which employs equipment meeting the specifications for Class A stations as described later.

A "Class B Station" means a Citizen's Radio Service station which employs equipment meeting the technical specifications for Class B stations which will be given later on.

The term "remote control" when applied to the use or operation of a citizen's radio station means the control of the transmitting equipment of that station from any place other than the location of the transmitting equipment, except that direct or electrical mechanical control of transmitting equipment located on board a craft or vehicle from some other point on the same craft or vehicle shall not be considered to be remote control. In other words, if the equipment is in the trunk of an automobile and is controlled from

the driver's seat it is *not* remotely controlled.

The term "air-navigation-hazard antenna" means the antenna and antenna supporting structure of any citizen's radio station when (1) the overall height of such antenna and antenna supporting structure above ground level is greater than 150 feet regardless of location, or when (2) the antenna is located within 3 miles of a Civil Aeronautics Administration landing area and the overall height of the antenna and supporting structure exceeds 5 feet from ground level for each 500 feet of distance, or fraction thereof, from the nearest boundary of the landing area.

The term "person" includes an individual, partnership, association, trust, or corporation.

The following is information on applications and licenses.

Station authorization from the FCC is required. No station may be operated in the Citizens Radio Service except under and in accordance with an authorization granted by the Federal Communications Commission.

Any person eighteen years of age and a citizen of the United States is eligible to apply for a Citizens Radio Station license if qualified in accordance with the provisions of the law: provided, that not more than one person shall be eligible as licensee of the same apparatus. In other words, husband and wife could not hold license for the same apparatus although both may operate the equipment.

The first step to take in obtaining a station license in a Citizens Radio Service is the filing of an application for construction permit. After the construction is completed and the station tested, application for license should be filed. Where the equipment proposed to be installed is available as a complete unit and is of such a nature that no construction other than installation (connec-

tion to a power supply and antenna) is necessary, no tests are required and the application for station license and construction permit may be submitted simultaneously.

Application for an authorization for a station in a Citizens Radio Service using type-approved equipment should be submitted on FCC form 505 to any Commission Field Engineering office or to Washington, D. C. This form is a combination of application for construction and station license. (Forms can be obtained by writing to the Federal Communications Commission, Washington 25, D. C.

Where non-type approved equipment is to be used, the application should be submitted on FCC form 505 to the Federal Communications Commission, Washington 25, D. C. These applications must be accompanied by complete information which will be listed later.

When it is proposed to erect an air-navigation-hazard antenna as defined above, form 505 shall be accompanied by FCC form 401A in quadruplicate. There shall be attached to each copy of FCC form 401A a sketch showing the antenna and supporting structure as well as a map showing the location of the antenna, landing areas in the vicinity thereof and all tall structures that may affect the marking of the antenna or supporting structure.

Application for station license for equipment that is not type approved shall be filed on FCC form 403 upon completion of the construction or installation in accordance with the terms and conditions set forth in the construction permit and submitted to the Federal Communications Commission, Washington 25, D. C.

Unless otherwise stated in the authorization, licenses for all stations in Citizens Radio Service will be issued for a term of 5 years from the date of issuance.

Unless otherwise directed by the Commission, each application for renewal of station license in Citizens Radio Service shall be filed no less than 60 and no more than 120 days prior to the expiration date of the license sought to be renewed.

It is necessary to file an application for modification of a station license in the Citizens Radio Service whenever it is proposed to: (a) Move, change the height of, or erect an air-navigation-hazard antenna as defined above. (b) Change the permanent address of the station licenses. (c) Make changes of any nature which may affect the operational characteristics of the transmitting antenna. (d) Substitute equipment not identical to that previously authorized in the station license. (e) Increase the number of transmitters for operation under existing license. (f) Add remote control or change control points.

No station license can be transferred without written approval of the Federal Communications Commission.

The application for an authorization shall be signed under oath or affirmation by the applicant if the applicant be an individual, or by any one of the partners if an applicant be a partnership, by an officer if the applicant be a corporation, or by a member who is an officer if the applicant be an unincorporated association; provided, how-



ever, that applications may be signed by the attorney for an applicant (a) in the case of physical disability of the applicant, or (b) is absent from the Continental United States. If it be made by a person other than the applicant, he will set forth in the verification the grounds of his belief as to all matters not stated upon his knowledge and the reason why it is not made by the applicant.

#### Technical Specifications and Type of Equipment

The following frequency bands, within the band 460-470 megacycles will be assigned to the classes of stations indicated, on a non-exclusive basis subject to such interference as may be received from other stations in this service.

- 460-462 megacycles—Class A stations at fixed locations only.
- 462-468 megacycles—Class A and Class B stations.
- 468-470 megacycles—Class A stations.

The input power to the plate circuit of the elec-

tron tube or tubes which supply energy to the radiating system of a station in the Citizens Radio Service shall not exceed the value shown below, when used or operated in the frequency bands indicated: 460-462 megacycles—50 watts; 462-468 megacycles—10 watts; 468-470 megacycles—50 watts.

The carrier frequency of a class A station must be maintained within + or — .02% of the frequency on which the transmitter is adjusted for operation. The frequency tolerance of a class B station for all operation including tolerance in communication band shall be confined to within + or — .4% of 465 megacycles.

The communication band for class A station shall not exceed 200 kilocycles. All operation including frequency tolerance in communication band shall be confined to the frequency band 460-470 megacycles. Stations operating in the Citizens Radio Service may use only amplitude, phase or frequency modulation for continuous or interrupted carrier telephony, radiotelegraphy, radio printer or facsimile.

When the station is amplitude modulated the modulation shall not exceed 100% on negative peaks.

Wherever it appears that a station in the Citizens Radio Service is not being operated in accordance with the technical standards, the Commission may require the licensee to provide for such tests that may be necessary to determine whether the equipment is capable of meeting these standards.

Anyone who manufactures equipment designed to be used or operated in the Citizens Radio Service and within the frequency bands specified may submit units of such equipment to the Commission for type approval, upon grant of request therefore in writing by the manufacturer to the Secretary of the Commission. However, the Commission will not normally grant such requests unless the manufacturer plans to make at least one hundred units of the model which is submitted. Then, when advised by the Commission, the applicant must send a typical production model or prototype of the particular equipment, complete with tubes and power supply, to the Commission's Laboratory at Laurel, Maryland, for test. All instructions which will be supplied to the purchaser of the equipment must be included and the transportation of the equipment and all associated material to and from the laboratory must be at no cost to the Government.

The equipment which is submitted for type approval must be capable of meeting the technical specifications outlined for either Class A or Class B stations in a Citizens Radio Service and in addition to this must comply with the following:

(a) Any basic instructions concerning the proper adjustment, use or operation of the equipment that may be necessary, shall be attached to the equipment in a suitable manner and in such position as to be easily read by the operator.

(b) A durable nameplate must be mounted on each transmitter showing the name of the manufacturer, the type or model designation, and provide suitable space for permanently displaying the serial number, FCC type approval number, and whether approved for Class A, Class B, or Class A and B stations.

(c) The transmitter must be designed, constructed and adjusted by the manufacturer to operate on a frequency or frequencies within the band 460-470 megacycles. In designing the equipment every reasonable precaution must be taken to protect the user from high voltage shock and radio frequency burns. Connection to batteries (if used) shall be made in such a manner as to permit replacement by the user without causing improper operation of the transmitter. Generally accepted modern engineering principles shall be utilized in the generation of radio frequency current so as to guard against unnecessary interference to other services. In cases of serious interference arising from the design, construction or operation of the equipment, the Commission may require appropriate technical changes in equipment to eliminate interference.

(d) Controls which may affect changes in the carrier frequency of the transmitter must not be accessible from the outside of the unit unless the FCC specifically approves them.

When the FCC conducts the type approval test to determine whether radio equipment meets the technical specifications the tests will be made under the following conditions:

(a) Gradual ambient temperature variations from 0° to 125° Fahrenheit.

(b) Relative ambient humidity from 20% to 95%. This test is normally made by subjecting the equipment for 3 consecutive periods of 24 hours each, to a relative ambient humidity of 20%, 60% and 95% respectively, at a temperature of approximately 80° Fahrenheit.

(c) Movement of the transmitter or object in the immediate vicinity thereof.

(d) Power supply voltage variations normally to be encountered under normal operating conditions.

(e) Additional tests as may be prescribed, if considered necessary or desirable.

An additional item not mentioned above is that the manufacturer must satisfy the Federal Communications Commission that he has the facilities for manufacturing at least 100 units. The manufactured units must be exact duplicates of the approved unit and in order to insure this the FCC disassembles the unit which is submitted

and photographs the various sections so that photographic evidence will be at hand in case of question.

The above requirements do not mean that it is impossible to obtain a license for composite transmitting equipment or equipment constructed by a manufacturer in lots of less than 100 units. In the usual case transmitters falling into this classification will not be tested by the Commission for the purpose of granting type approval. Anyone desiring a Citizens Radio Station license and proposing to use or operate composite equipment which has not been type approved must supply complete information on the equipment showing that it fully complies with either Class A or Class B station requirements, on appropriate supplementary forms which must accompany the application. In addition, the Commission may, at its discretion, require that the equipment or a prototype be made available to the laboratory for test in accordance with the procedure outlined for equipment manufactured in lots of more than 100 units. In addition, field tests as deemed necessary or desirable may be carried out by authorized government personnel to determine the reliability of equipment under operating conditions comparable to those encountered in actual service.

From these rules and regulations it is apparent the Citizens Band or the Citizens Radio Service is definitely not for radio experimenters.

Instead, it is a fixed and mobile service intended for private and personal radio communication, radio signaling, radio control of model planes or other devices and therefore, unsuited for experimental procedures. This statement is further borne out by the fact that special permission of the Commission is required before a circuit which has been licensed can be changed. This is entirely different from the amateur regulations where the Commission does not require information on the original transmitter and changes may be made at will without Communications Commission consent. The only regulations as far as the amateur is concerned are that his operation be within specified bands and of the type approved for that particular band.

However, this does not mean that the Commission will not approve suitable equipment.

If you have the technical skill and the necessary test equipment to prove that your equipment is operating in the prescribed manner, then this data may be submitted to the Federal Communications Commission and in all likelihood they will approve its operation and issue licenses.

Current magazines carry advertisements listing the type BC-645-A Transceiver as suitable for operation in the Citizens Band. In fact, the current issue of one magazine of national circulation contains at least four ads making these statements.



The truth is that the FCC will not issue licenses for this equipment. A recent FCC release states, "For example, war-surplus equipment such as the BC-645 transmitter-receiver, designed for airborne use, does not possess in its original form sufficiently stable circuits to permit licensing in the Citizens Radio Service. Extensive modification, in some cases amounting to almost complete redesign of the original equipment, appears to be necessary to meet the standards of the Citizens Radio Service rules and will be required before the Commission will consider authorizing the use of the majority of war-surplus apparatus in the Citizens Radio Service."

In this connection, the Commission tested these sets and found that the frequency of the transmitter varied as much as 4.5 megacycles when objects were moved in the vicinity of the transmitter. This is typical of modulated oscillator type equipment and the frequency change is caused by the change in loading on the oscillator when the objects are moved in the vicinity of the antenna. The frequency stability of modulated oscillators is not great enough to permit their operation in these bands. An additional factor is that an oscillator cannot be modulated more than about 30% and still retain reasonable stability.

The confusion over the type BC-645 equipment probably arose from the fact that the FCC approved some of these units for experimental operation under experimental licenses. However, all experimental license for this service expired November 1, 1949 and the Commission has served notice that it will not renew these licenses unless proof has been submitted that the transmitter has been re-designed to meet these specifications.

However, these units are quite reasonable in price and contain, in addition to the transmitter, a complete superheterodyne receiver. For anyone who is interested in this service the units would be a good buy for the receivers alone since receivers for these frequencies are difficult to build. Some modification of the audio system is required. However, the transmitter is no good and a completely new transmitter of the crystal controlled type should be purchased or built. In any event the transmitter must meet the FCC specifications.

It is also well to keep in mind that at least two units are needed for each set up. However, the Commission will license more than two units provided the equipment is satisfactory. So far as the Commission is concerned the receiver that is used makes no difference and they do not test receivers. They only test transmitting equipment.

Recently considerable publicity was given to a "camera type" unit which was designed for use in the Citizens Band. However, no units of this type ever appeared on the market and the company which originally planned to make these units recently sold their assets to another company which plans modification of the equipment. This means that the new type approval will have to be obtained before it can be offered for sale.

Incidentally, the proposed price of the camera type unit was approximately \$75 per unit and the range was quite limited.

In some sections of the middle west, equipment of this type was being used and is not available to the general public. Holders of experimental station licenses have been using these frequencies and considerable data has been compiled. The present indications are that considerable work with antennas must be done before reliable ranges can be expected.

If you have the necessary technical ability, equipment and time and will concentrate on real frequency stability, you should have no difficulty in securing a license for Citizens Band equipment. Please remember to write directly to the Federal Communications Commission, Washington 25, D. C., for all application forms. Application forms are not available from the National Radio Institute.

— n r i —

Be friends with everybody. When you have friends you will know there is somebody who will stand by you. You know the old saying, that if you have a single enemy you will find him everywhere. It doesn't pay to make enemies. Lead the life that will make you kindly and friendly to every one about you, and you will be surprised what a happy life you will live.

## Our Cover Photo

This year, as last year, we use a copyrighted photo by Harold M. Lambert of Philadelphia. The work of this photographer is outstanding. We believe you will like this appropriate Christmas setting, which we have selected for this issue.



## Third Edition of Reference Data for Radio Engineers Now Available Through Publisher

NRI Students, well advanced in the course, and graduates who want to design their own circuits will find much valuable information in the *Reference Data for Radio Engineers*, A Radio handbook, including formulas for the practical design of radio equipment. This handbook should be of particular interest to NRI men interested in Communications circuits. The third edition has grown to twice the size of the preceding edition and is three times as large as the first edition. The only way to get this book is to send \$3.75 direct to the Federal Telephone and Radio Corporation, Publication Department, 67 Broad Street, New York 4, New York.



It seems that a girl and a boy were madly in love. So great was their love that when fate separated them and sent the boy to a distant city, he telegraphed messages of his devotion and affection each morning. Every day for three years the same Western Union messenger boy knocked on the girl's door, bearing the messages of undying love. At the end of three years they were married—the girl and the Western Union boy.



TELEVISION BOX SCORE	
Stations Operating	84
Construction Permits Granted	29
Applications Pending	349
(As of Oct. 13, 1949)	

## RCA Official Predicts Non-Broadcast TV Services May Eventually Surpass Broadcast Video in Size

New roles which television will play in industry, traffic safety, the guarding of asylum and prison corridors, retailing, teaching, graphic communication, and the theatre were outlined by W. W. Watts, Vice President in Charge of the RCA Engineering Products Department.

"Measured in terms of the equipment it will require, non-broadcast television may well become a service even larger than broadcast television," Mr. Watts said. At the same time, he paid tribute to the broadcast television engineers "through whose work these unlimited possibilities for television are now unfolding."

He described some of the applications of television to industry which are now being explored, including the use of fixed focus cameras in laboratories and at critical points in production lines to facilitate inspection of materials and observation of processes and gauges in locations where explosive materials, dangerous gases, extreme temperatures, or difficult access make it impracticable to station a human observer.

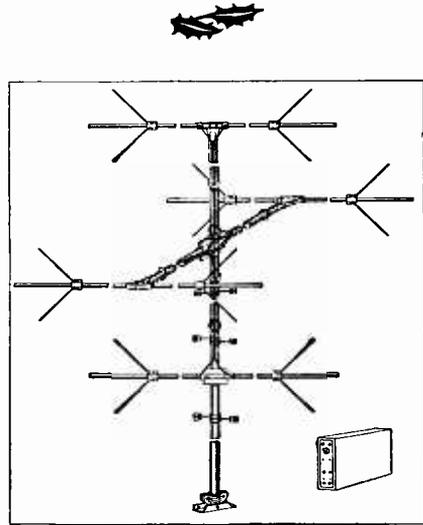
A highly significant future application, he said, is represented by the proposed program for air navigation and traffic control, which calls for television radar screens, showing all aircraft in the vicinity of airports, and sending the images of these screens, with transparent maps of the region and other navigation information superimposed, to television receivers in planes.

"It is in the field of education that television has proved to be a particularly brilliant and useful servant of society," Mr. Watts said. He told of the numerous applications of television to medical and surgical teaching which have been found, and of the explorations which have been conducted in the use of television in the school by cooperation between stations, schools and manufacturers. He explained how television can look down the eye-piece of microscopes and throw the images on large screens before classrooms, how manufacturing methods in fields ranging from heavy engineering to watchmaking can be taught to large groups quickly, and how the best of facilities and faculties can be made available to all students in an area simultaneously by broadcast or direct-wire television service.

The speaker predicted that one of the first of television's new directions to be translated into reality will be theatre television, with some exhibitors presenting television images 15 x 20 feet or larger on theatre screens, possibly before the end of this year.

New applications of television, Mr. Watts said,

"an inviting frontier for creative engineering, and a source of prestige, fortunes, and opportunities to render to the world services greater than those encompassed by the widest sweeps of the science-fiction writers' imaginations."

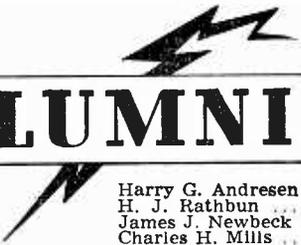


### New TV Antenna Solves Co-Channel Interference Problem

A new antenna design for the elimination of co-channel interference is announced by Technical Appliance Corporation, Sheburne, N. Y.

Type 900 Taco television antenna features four driven elements, two in the vertical plane and two in the horizontal plane, in place of parasitic elements, thus giving far greater control of the field pattern, and also permitting lobe-switching. With this new antenna it is now possible by means of a diplexer network to eliminate entirely the co-channel interference present in many locations where two stations are on the same channel or adjacent channels and located about 180° apart at the installation. It also makes possible the reception from either direction without the necessity of turning the antenna itself. Front-to-back ratio is extremely high, ranging up to 20:1.

This new antenna is supplied with a diplexer housed in an attractive case located at the receiver. The diplexer serves as a matching transformer between transmission line and receiver, eliminating any standing waves due to a mismatch. It also serves as a reversing switch for switching directivity lobes. As reversing is done entirely electrically, nothing is lost in signal strength according to the manufacturer.



# N.R.I. ALUMNI NEWS

Harry G. Andresen .....	President
H. J. Rathbun .....	Vice Pres.
James J. Newbeck .....	Vice Pres.
Charles H. Mills .....	Vice Pres.
Harvey W. Morris .....	Vice Pres.
Louis L. Menne .....	Executive Secretary

## Harvey Morris of Philadelphia is President-elect Of NRI Alumni Association for 1950

Earl Oliver of Detroit, Alex Remer of New York, Oliver B. Hill of Burbank, Calif., and Claude Longstreet of Westfield, N. J., are successful candidates for Vice Presidents

In a friendly contest for President of the NRI Alumni Association for the year 1950, Harvey W. Morris of Philadelphia was elected over H. J. Rathbun of Baltimore. Both candidates were well supported. Rathbun, splendid fellow that he is, was the first to extend congratulations to Morris. Mr. Rathbun will have his day, too. We will hear from him again in the next few years.

Harvey Morris has been a leader in Phila-Camden Chapter for many years. He has served as Chairman for a number of terms and has also been a Vice President of our Alumni Association for several years. He is a natural leader and an outstanding Radio and Television man. Harvey is employed as head of the Television department of a leading distributor in Philadelphia. Our congratulations to him.

The race for Vice Presidents, too, was very interesting. F. Earl Oliver of Detroit, again elected a V. P., is known to most of our members. He has been in some office, from President down, almost every year for the last ten years.

Alex Remer of New York is a new-comer. He is very popular in New York Chapter where he is one of the leaders.

Oliver B. Hill of Burbank, Calif. served one term as Vice President, several years ago. This year he bounced back, being well supported by our members in the west.

Claude Longstreet of Westfield, N. J. is a surprise winner. Like Oliver B. Hill, he has no chapter connections and therefore had none of that support. We think it is a healthy condition to have good balance in our official family and we are pleased to have Mr. Hill and Mr. Longstreet, who have no chapter affiliations, join Mr. Oliver and Mr. Remer, who do have chapter connections, as the four Vice Presidents to serve during 1950.

Our respects to all candidates and our congratulations to the successful ones, who will assume office on January 1, 1950.

## Chapter Chatter

Let's start with *Baltimore Chapter* where something new is being tried. Arrangements have been made to hold four meetings a month instead of the usual two. These will be held on Tuesdays. The first and third meetings of the month will be devoted to practical Radio and Television Servicing. The meetings on the second and fourth Tuesdays will be business meetings with a liberal amount of time given to social affairs and getting better acquainted . . . the success of this plan will depend upon attendance . . . it sounds good and is worth a try . . .

Mr. Clifford Whitt gave us several good talks on Television . . . Mr. J. B. Straughn came over with Mr. L. L. Menne from headquarters . . . Straughn gave us a fine talk on Television. In fact it was so good we had him come back two weeks later when we were visited by a number of members of Philadelphia-Camden Chapter. This was quite an affair with refreshments aplenty for all.

Harvey Morris, who has, since this visit, been elected president of the NRI Alumni Association to serve during 1950, was one of the visitors from Philadelphia. Charlie Fehn, Norman Kraft, Clifford N. Hill, were among others from Philadelphia who made short talks . . . Clarence Stokes, former member of Philadelphia-Camden Chapter and an ex-President of the NRI Alumni Association, now a member of Baltimore Chapter, was present and warmly greeted. E. W. Gosnell, another former President also made a short talk.

Quite a few new members. They are B. A. Gigliotti, Frank J. Orban, George H. Bauhaus, Frank J. Fricki, Thomas H. Hughes, Joseph S. Pluchino, Harry Fitez, A. J. Oleszczuk, R. J. DeLong, J. R. Mattingly, John C. N. Newton, Charles F. Wilhelm, Walter O'Leary, Fred Trediger, Roland T. Burns, Joseph N. Nardi and Grant W. Shinkle.

All NRI students and graduates in this vicinity are welcome to visit us. We meet at 745 West Baltimore Street, in Redman's Hall. It is easy to reach by streetcar or auto.

Things are moving along nicely in *Detroit Chapter*, as always. Lloyd Buehrer showed some very interesting films on diode tubes . . . Explained the principles of diodes and their operation . . . Afterwards, refreshments. Showed several other good films through courtesy of the Anaconda Wire and Cable Company . . . At another meeting Harold Chase, an old timer in Detroit Chapter and the owner of a successful service business, gave an interesting talk on the business end of running a service shop for profit. He gave the members much fine information on what to charge as a fair price for their work . . . He emphasized that to be successful one must have

the ability to sell himself as well as his merchandise . . . Meet at 21 Henry Street, at Woodward, on the second and fourth Fridays of each month.

*New York Chapter* is all pepped up because Alex Remer has been elected a Vice-President . . . just reward for a fellow who has always worked hard for others . . . Bert Wappler, the chairman, feeling much better and back on the job . . .

Ralph H. Baer, who has had a very wide experience and who is back with us after many months, has lectured to us on "Fundamentals of Frequency-Modulated Signals" and "Elementary FM Transmitters and Receivers." On November 17 he will lecture on "Special FM Receiver Circuits; their Operation and Function," on December 1st he will talk on "Servicing FM Sets" and for December 15 he has chosen for his subject "Test Equipment for FM Servicing" . . . This is just the beginning of a series of fine talks which have been arranged by the executive committee . . . Other very capable speakers will follow Mr. Baer.

Meetings are held at 12 St. Marks Place, at 8:30 P. M. sharp. This is in the St. Marks Community Center which is between 2nd and 3rd Avenues in New York City.



Meeting of Phila.-Camden Chapter.

Some swell meetings in *Chicago Chapter*, too . . . Jack L. Cappells of Tele-Service Company, gave us a nice talk on Television Servicemen's problems . . . Larry McGee of Precision Electronics Company spoke on the value of the Signal Tracer to the service man . . . Fred Korn, always ready to do his bit, taking candid camera shots.

Mr. George Kelly and Mr. C. Hammack of Chicago were guests speakers at another meeting . . . They spoke on the "Techniques of TV Servicing" and "This Amazing World of Television Electronics" . . . Both excellent talks described in detail by blackboard sketches.

Chicago chapter meets only once a month, on the second Wednesday, in Room 1745, Merchandise Mart, 666 North Lake Shore Drive. Enter through West door . . . Visitors are cordially invited.

And a jolly Christmas to you all from us all.



Meeting of Chicago Chapter in their inviting new quarters in room 1745, Merchandise Mart, 666 North Lake Shore Drive. That's chairman Andresen standing on extreme right.

Pardon me, fellows,  
for squeezing in like  
this but "Merry  
Christmas to You  
All."

L. L. Menne



### Philip Space says:—

I went into a hotel the other day and the clerk showed me to a little room and said, "This room costs \$15 a day. Washington slept here." And I said, "Sure, on his salary he could afford it!"

I told my son that if he studied hard he might get to be President and he said, "I don't want to be President—I want to be on his advisory Board who tells him what to do!"

Did you hear about the bee who had a baby? He was a son of a bee.

I wish to have a man-to-man talk with you—and I'm giving you the benefit of the doubt!

I told her I could go for a girl like her—so she told me where to go to!

"Pardon me, young lady," said the boss, "but in the matter of dress, don't you think you could show a little more discretion?"

"My gosh," said the secretary, "some of you guys are never satisfied."

"We were happy for over a year, Your Honor, and then the baby came."

"Boy or girl?"

"Girl—she was a blonde and moved in next door."

"I see where a Hillbilly got a divorce because when he got married he didn't know the gun was empty."

"When success turns a man's head it's a pain in the neck."



F. Earl Oliver, newly elected Vice President, makes a talk at Detroit Chapter, using the RCA Dynamic Demonstrator.

# Here And There Among Alumni Members

Alumnus James M. Carty, of Roebing, New Jersey, has opened a radio sales and service business since his graduation from NRI. He tells us that he is doing very well, and he expects to go into television sales and service soon.

— n r i —

George Kelly, of Vancouver, British Columbia, Canada, now has a ham station, call letters VE-7AAO. He also operates a small radio repair business which is steadily increasing. Kelly is a great booster for NRI.

— n r i —

We were delighted with the visit of Warrant Officer W. L. Hallenk, U. S. Navy. Graduate Hallenk has been stationed in Honolulu, Hawaii, for the past several years, and expects to return there for another tour of duty.

— n r i —

We are extremely proud of the record of Graduate J. F. Leezer, now attending the Navy Electronics School at Treasure Island, San Francisco. He tells us that his NRI training is very helpful in his present studies. Leezer has consistently made the highest grades in his class, and now has an average of 95. Good work!

— n r i —

Fathometer repairing is one of the specialties of NRI Graduate Robert L. O'Neal, of Cape May, New Jersey. Small commercial fishing boats in his area use Fathometers.

— n r i —

Congratulations to Graduate Philip J. Harvey, of Seattle, Wash. He has passed the Civil Service examination for Trolley Coach mechanic in his city with a salary of over twice that of his previous work. Harvey says that the review he received on Ohm's Law and basic electrical theory in his NRI training was very helpful in aiding him to pass this exam.

— n r i —

Alumnus Donald T. Davis, Kansas City, Missouri, is with Trans-World Airlines as a radio technician, working on Aircraft Radio equipment.

— n r i —

William J. McEwen, of Elverson, Penna., recently attended an Army radio school in connection with his National Guard work. He is now employed as a full time radio serviceman.

— n r i —

When Melvin H. Sarson, of Camden, New Jersey, went to work for the Krickhefer Container Co., he saw that this firm had no one to make electronic repairs and installations. He immediately took up NRI training, and is now an industrial electrician with his firm, with plenty of electronic work to take care of.

Harold C. Hemond, a teacher in the High School in South Hadley, Mass., writes that his radio and television training with NRI has more than met its objective. Hemond desired this training so that he might be more conversant with electronics, and be better equipped to direct the work of his science people interested in Radio. He particularly praises the NRI experimental kits. We appreciate these comments from a professional teacher.

— n r i —

Another NRI Graduate, Mr. Carl Saglimben, Gowanda, New York, joins the ranks of NRI radio amateurs, with call letter W2ZPV. Hopes to try for his commercial license soon.

— n r i —

Graduate Charles L. Tyo, Columbus, Ohio, is extremely interested in industrial electronics. He has been employed as a laboratory assistant in research work for the past six years, and has done the major portion of construction work on several successful electronic devices.

— n r i —

Alumnus Daniel I. Esslinger writes that he has been employed for the past three years with the S. N. C. Manufacturing Company, of Oshkosh,



Wisconsin, as head of the coil department. His department makes transformers and coils for all types of electronic applications.

— n r i —

Lawrence J. Hammond specializes in Public Address work. He is employed by the United Sound Service, Clarksburg, West Virginia.

— n r i —

Graduate Glen Sund, Shyenenne, N. D., reports that he is in business full time, for himself. In addition to his radio sales and service shop, he has a cream buying station on the side.

— n r i —

Full time television servicing occupies Graduate Paul W. Zehner, Philadelphia, Penna. Previously Graduate Zehner was employed as a sound operator in a TV station.

— n r i —

Anthony D. Bonetti, a research chemist in Brooklyn, New York, reports that he uses electronics as an aid in his work. Graduate Bonetti also has a "ham" license.

— n r i —

Thomas B. McTeen, Earlybranch, S. C., reports spare time earnings of about \$100 per month.

— n r i —

Graduate Michael C. Glorioso, of New Castle, Pa., operates an auto service station and radio shop combined. He specializes in auto radio.



# NATIONAL RADIO NEWS

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FROM N.R.I. TRAINING HEADQUARTERS

Vol. 13 December, 1949-January, 1950 No. 12

Published every other month in the interest of the students and Alumni Association of the

NATIONAL RADIO INSTITUTE  
Washington 9, D. C.

The Official Organ of the N. R. I. Alumni Association.  
Editorial and Business Office, 16th & You Sts., N. W.,  
Washington 9, D. C.

L. L. MENNE, EDITOR  
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Printed in U.S.A.