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LET THESE WORDS BE WRITTEN IN GRANITE WHERE ALL MAY SEE—"A GOOD NAME ENDURETH FOREVER."

Romance of Radio 1914 to 1949

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W. Franklin Cook

1914 These were the "good old days"—when Radio was referred to as "wireless" most of the time—when only the stout-hearted dared walk into the room of a Radio fan and risk jarring the "cat's-whisker" off the long-sought-for sensitive spot on the galena crystal—when tubes were so microphonic that a heavy footstep anywhere in a house sounded like thunder in the phones—when practically all broadcasts were in code, and many a tense midnight listener mistook static for voices from the moon or Mars. "Bloopers," those unforgettable regenerative receivers developed by De Forest in 1912 and Armstrong in 1914, were just becoming known among experimenters; these sets acted like miniature transmitters during the tuning process, causing howls in neighboring receivers for blocks around. Loudspeakers existed only in the dreams of inventors; listening was done with headphones, and crushed and aching ears were the reward for perseverance.

The two-element rectifier tube had been invented by Fleming in 1906, and De Forest had added a grid to this tube in 1909. Pickard had perfected the crystal detector in 1907, and it was for many years the most popular of all detectors. Of course, Marconi had in 1901 amazed the world by broadcasting the letter "S" from Poldhu, England, to Saint Johns, Newfoundland. Our own NAA in Arlington, Virginia, went on the air in 1913 with a 100 kw. spark transmitter operating on 6,000 meters. About this same time Nauen, Germany, began broadcasting on 16,900 meters or about 18,000 cycles (just above the audio band), and station FL atop the Eiffel Tower in Paris began broadcasting on 10,000 meters. Many an old-timer still remembers tuning in these stations with a crystal set having huge tuning coils and an aerial hundreds of feet long. The Titanic had crashed into an iceberg in 1912, with Radio summoning assistance and bringing news of the disaster to a young wireless operator named David Sarnoff (now President of RCA) who was listening in a New York City skyscraper.

It was in 1914 that Hiram Percy Maxim founded the American Radio Relay League. War broke out in Europe this year, and amateur licenses were suspended in practically all foreign countries. American amateurs listened with suspicion to German Radio stations in this country and found at least one to be sending code reports on allied shipping to German submarines; recordings of the messages, turned over to the Secret Service, resulted in confiscation of this Telefunken station.

Broadcasting of entertainment—even of grand opera with Caruso singing—was now several years old, with the De Forest Radio Telephone Company starting things off with phonograph records in 1907. Only a handful of experimenters heard these first "canned" programs, and these were more interested in DX (distant) code reception than in the highly distorted and almost unrecognizable music. Few people even dreamed of the vast entertainment possibilities of Radio during these days, and James E. Smith founded the National Radio Institute in this year primarily to train men for careers as wireless operators on land and sea.

1915 Human voices leaped across the Atlantic for the first time in history; this radiotelephone conversation between radio operators at Arlington, Virginia, and the Eiffel Tower in Paris was also heard by listeners in Honolulu.

More and more ships were being equipped with wireless, creating a demand for trained wireless operators. The ability of Radio to save lives at sea in time of disaster was demonstrated forcibly again and again.

1916 America was doing its best to keep out of the great conflict in Europe despite the sinking of the Lusitania by a German submarine in 1915. Wireless was adopted by the New York Police Department as a means of combatting crime. Across the seas, wireless telegraphy was made compulsory this year on all British vessels over 3,000 tons. Naval vessels of all countries were rapidly being equipped with wireless transmitters and receivers.

1917 America entered the World War. All amateur Radio enthusiasts pulled down their antennas and packed away their Radio apparatus in observance of a Government order. Many answered the Navy's call for volunteer wireless operators, and by the end of the war, over 3,500 American Radio Relay League members were in service as operators and Radio technicians. All activity in Radio during the war was concentrated in the various divisions of the Government and among Radio manufacturers who were making equipment for the Government.

1918 Radio played an important part in the activities of the U. S. Signal Corps in France, as well as in maneuvers of the U. S. Navy. Radio principles were applied to submarine-detecting apparatus for the first time. Radio technicians became an established unit of U. S. armed forces, doing all repair work on Radio apparatus. Tube manufacturers were making special hard (high-vacuum) tubes for the Navy, and somehow these tubes got out to the public shortly after the end of the war. Their superior performance doomed the former gaseous or "soft" tubes as amplifiers, although the soft detector was to reign supreme for some years to come.

1919 The war was over! All bans on Radio were removed and amateur Radio was re-established as a hobby. Spark transmitters were being junked in favor of vacuum tube oscillators, and more and more hams gave up C. W. for phone operation. Scores of commercial wireless stations were built in this country; most of them used the famous Alexanderson alternator, which was simply a huge A.C. generator capable of producing A.C. powers up to 300 kw. at frequencies over 100 kc. These alternators fed power directly to the transmitting antenna.

It was during this year also that Dr. Frank Conrad of Westinghouse broadcast phonograph records over a home-made transmitter in his garage in Pittsburgh, getting an avalanche of

From this small beginning in 1920 grew the 50,000 watt broadcasting station of KDKA.

fan mail and requests for favorite recordings. Westinghouse officials were amazed at this interest in Radio.

1920 Westinghouse built its first transmitter in a little shack atop its nine-story factory in Pittsburgh. This station, eventually assigned the famous call letters KDKA, amazed the world with a broadcast of presidential election returns on November 2, 1920, followed by a report of Harding's election. Some two thousand newspapers began printing KDKA programs regularly; Radio was being acclaimed everywhere as the newest form of entertainment for the home, and receiver sales skyrocketed upward. Navy multi-range receivers left over from the World War were being sold to the public at this time, as also were receivers using honeycomb coils. "C" batteries made their appearance, pleasing the public because they cut down plate current and made "B" batteries last longer. Receiving tubes were hard to get, and cost anywhere from $6 up. Radio experimenters spent about $2,000,000 this year, not for complete sets but rather for parts with which to build their own crystal sets, small vacuum tube receivers, and transmitters. The first Armstrong superheterodyne circuit was announced, and amateurs immediately began experimenting with its circuit.

1921 Station WJZ at Newark went on the air and soon was broadcasting regular bedtime stories. The Dempsey-Carpentier prize fight broadcast made a hit; Radio had a sudden flurry of activity, with hardware, stationery, drug and even millinery stores selling commercial receivers or merchandising the handiwork of a mechanically-minded son or kid brother. Horns with places for attaching headphones were offered at $10 and up; glass and wooden bowls were also widely used to boost the sound output of headphones and permit groups of persons to listen to programs. Attachments for holding phone units against the tone arms of phonographs were being sold this year.

Broadcasting stations were springing up like toadstools; while there were only 5 in December of the previous year, 532 more had gone on the air by September, 1922. More than 20,000 dealers rushed madly into this entrancing new field, and thousands more started manufacturing Radio apparatus. The majority of these received badly burned fingers toward the close of this year, when intense competition knocked the bottom out of prices. In New York, Chicago and elsewhere, cut-price Radio centers started up, offering the stocks of financially embarrassed and bankrupt Radio manufacturers at mere fractions of the original prices.

1922 WGY and WEAF went on the air, with WEAF making history by offering its facilities to advertisers. Major Armstrong announced his super-regenerative loop receiver, a 3-tube circuit which amplified signals over 100,000 times with "nary a bloop or squeal." Magnavox came out with a deluxe electrodynamic horn type loudspeaker. The Hartley regenerative receiver circuit was popular with experimenters. Practically every high school student of the time had a crystal receiver and spent hours jiggling the little coil of wire called a "cat's-whisker," in order to get maximum power into the headphones. What a thrill it was in those days to clamp on the headphones, tune the receiver and scratch up the crystal for half an hour, then have the thrill of hearing a station 25 miles away!

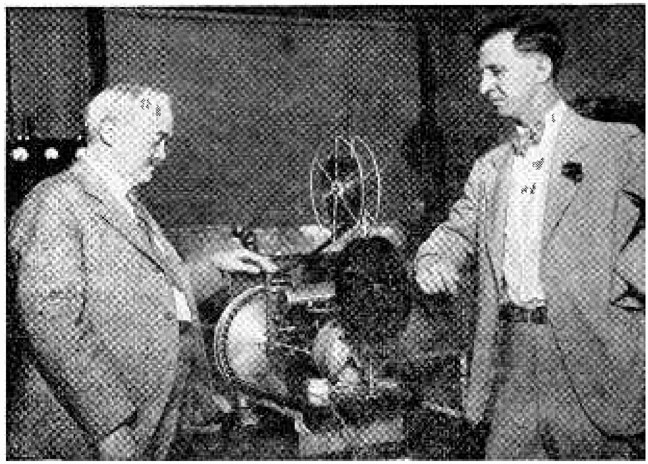
1923 Neutrodynes took the country by storm, and soon you were a social outcast if you didn't have one. These sets didn't squeal, and you could actually get a station twice in succession at the same dial setting—sometimes! President Harding had one of these receivers installed in the White House. Other popular receiver circuits included regeneratives and ultradynes; popular tubes were the 201A's, the 171A's and the UV199 "peanut" tubes. Vacuum tube receivers had replaced crystal sets, except possibly among the high school experimenters. Loudspeakers had come to stay. Set manufacturers prided themselves on the assortment of knobs and gadgets which decorated receiver panels, but already the public was calling for a single-knob control. Women resented the unsightly batteries, and inventors worked day and night to find some means of operating receivers from ordinary light socket power. Radio receivers became obsolete in from three to six months during these days, with even the larger companies selling surplus stocks at half-price and lower to clear the shelves for new models.

1924 President Coolidge's cat, presumably wandering in search of some errant love, was sought for and found by Radio, with newspapers making much of the story. Over 1,400 broadcasting stations were now pumping programs into the American ether; each station took any frequency it pleased in the band between 200 and 550 meters, since licenses did not specify any definite operating frequency. High-power transmitting tubes were not available, and the power radiated hy each of these early stations was even less than that consumed by the average one-slice electric toaster. Daily broadcasts of Major League baseball games began this year, making a hit with fans.

The receivers being turned out by manufacturers were becoming more and more complex. By the thousands, an eager public snapped up superheterodynes, reflex sets, T.R.F. receivers and neutrodynes, and immediately there arose a need for skilled men to service these complex creations. Earlier receivers had been so simple that they seldom required servicing, and the real technical équipment in transmitters was being installed and maintained by trained factory experts, many of whom were NRI men. To meet the public demand for repairs on ailing receivers, Radio dealers began hiring men especially for servicing work—and thus a new profession was born. Early servicemen sweated over burned-out A.F. transformers in the famous De Forest Model D-7 self-contained loop receiver, which with four tubes and a crystal detector in a reflex arrangement gave seven stages of amplification. In the equally famous RCA "portable" superheterodyne, the catacomb coils and the extremely fragile type 199 tubes were going had and creating profitable service calls. Western Electric came out this year with a magnetic horn loudspeaker, and this was soon supplanted in popularity by magnetic cone loudspeakers, some more than three feet in diameter.

1925 Radio coils reached a peak in unique design; set builders had to choose from standard solenoid coils, pancake coils, spider-web coils wound on forms like the spokes of a wheel, honeycomb coils, toroidal or doughnut-shaped coils, binocular coils, bank-wound coils, random-wound coils and even figure-of-eight coils. Coil forms were often removed after the windings were cemented together with a coating of coil "dope," on the theory that this would reduce losses. The Raytheon cold-cathode gaseous type BH rectifier tube was perfected this year. Overproduction of receivers was a chronic complaint in the Radio industry, with hundreds of manufacturers plunging foolhardily into production schedules which inevitably resulted in bargain sales, receiverships and bankruptcies. Radio was now well established as a form of entertainment, and so intriguing was this entertainment to the public that each new improvement was received with open arms by all who could dig up the necessary money.

1926 The first all-electric sets timidly made their appearance, mostly with T.R.F. circuits and separate power packs. The "tinker" type of serviceman, seeing the array of chokes, filter condensers and voltage dividers in the power pack, silently dropped out of the picture. "B" eliminators became popular, with the type 80 tube sharing honors with the Raytheon BH tube as the rectifier in these units. The famous Browning-Drake receiver circuit revived a dying interest in set-building. The purchaser of a complete new Radio installation still had to choose five separate items in most cases: *1.* A Radio receiver in a table model cabinet; *2.* A loudspeaker; *3.* A set of tubes; *4.* An "A," "B," and "C" battery eliminator pack; *5.* A suitable table or cabinet for the various units.



J. E. Smith assists the late Dr. C. Francis Jenkins, in early Television experiments. This photo was taken about 25 years ago.

A U. S. Court decided that the Secretary of Commerce had no power to regulate broadcasting—only the power to issue licenses. This decision made Radio broadcasting even more chaotic than before; new stations merrily started up and increased power in tremendous jumps in order to drown out rival broadcasts. Whistles and heterodyne squeals were heard on almost every program. This year also marked the start of the National Broadcasting Company, the first network of stations.

In England the British Broadcasting Company was granted a Royal Charter. Its license to broadcast contained only one important restriction, namely, that no money could be accepted from outside interests; in other words, there was to be no commercial sponsorship of Radio programs. Broadcasting in England was to be paid for by the manufacturers of Radio equipment, by the Government, and by means of license fees collected from owners of receivers.

1927 Television was the big topic of discussion this year. Television receivers were being sold in kit form and as complete sets by Jenkins, Baird, Freed-Eisemann and several others. These sets used elaborate scanning discs and neon crater lamps, with the same scanning discs and photoelectric cells at the transmitters. Mechanical television systems reached the peak of their popularity this year, and even telephone television was tested out (with this set up, two persons could see as well as talk to each other even though separated by many miles, but the quality of the image was very poor).

A super-abundance of stations forced manufacturers to sacrifice tone quality and fidelity to sharp tuning in order that interfering stations could be tuned out. Sales of Radio receivers reached a new low; the public sat back, waiting, aware that perfected A.C. sets were just around the corner. The Federal Radio Commission was established by the Government to clear up the chaos among transmitters. The first act of this Commission was to revoke all broadcasting licenses; it then assigned channels and powers so that interference between stations was a minimum, and reduced the number of stations as well. The Columbia Broadcasting System was started. Single dial receivers became a reality, with the Kolster Six as one of the early leaders. The McCullough A.C. tube was announced.

1928 Attempts were made to bridge the Atlantic Ocean using mechanical television, but image quality was still poor and unsatisfactory either for commercial use or for entertainment. RCA put out the famous Radiola 17, an A.C.-operated receiver. Diode detectors began to receive consideration among set designers. Types 226 and 227 tubes with A.C. heaters were released by tube manufacturers and immediately snapped up by set manufacturers. The typical A.C. T.R.F. receiver of this day used type 226 tubes in the R.F. and A.F. voltage amplifier stages, a 227 tube as detector, a 71A tube in the output stage and an 80 in the power pack. A.C. screen grid tubes were announced the latter part of this year, with the 224 leading the list. Next came variable mu tubes and power pentodes.

1929 The Majestic receiver line, with several styles of console cabinets from which to choose, was the hit of the year. Majestic sets, with their characteristic deep bass response, met with instant popularity, and a few are still in use today. An estimated 110,000 people were employed in the Radio industry this year.

The Radio manufacturing industry underwent an inevitable upheaval this year. Important Radio patents had been scattered among many holders; patent rights were being openly violated and infringement suits were common. The Radio Corporation of America, organized shortly after the war in order to keep control of the Alexanderson alternator in this country, secured control of the important Radio patents, and granted licenses for these to other manufacturers, who could then build receivers without fear of litigation.

1930 The T.R.F. circuit still reigned supreme for this year and that to follow, even though many supers were being made. Interest rose in short-wave reception among the listening public; to meet this, manufacturers began putting out short-wave converters which changed an ordinary T.R.F. receiver to a short-wave superheterodyne. Plug-in coils for changing bands were replaced with band-changing switches about this time, but the average Radio set purchaser was content with broadcast band reception and scorned the complicated all-wave receivers. The National Carbon Company this year brought out a 2-volt air cell battery for farm Radios; this battery required no recharging and had a life of about one year as a filament supply for receivers using the new 2-volt tubes. Experimental television broadcasts with mechanical systems were begun by the British Broadcasting Company this year.

1931 RCA brought out the Radiola 80, one of the most famous of all Radio receivers; it was a 9-tube A.C. superheterodyne, and did more than anything else to start the super on its sudden climb to the throne as king of receiver circuits. The first midget receiver to attract widespread attention, the Jackson Bell set, came out this year; it heralded a flood of midget receivers which still continues today. This year just about marked the end of the set-building boom which had started back in 1922; receivers built at home from kits gave way to manufactured sets.

1932 Automatic volume control was introduced, to make single dial receiver control more nearly possible and make reception more enjoyable by compensating for fading. Manufacturers, seeking ways and means of overcoming the summer slump in the Radio business, began giving considerable attention to auto Radios. The auto sets sold this year required separate "B" batteries or a dynamotor, as well as a separate loudspeaker. Remote tuning controls were provided right from the start, however.

1933 Police Radio installations became an important factor in the war on crime, creating new jobs for Radio operators. Remote control tuning, with cables running from the control unit to the receiver, was featured by some manufacturers. Another feature of the year was the Philco inclined sounding board.

1934 All-wave receivers which actually brought in foreign short-wave stations were the hit of the year. Among broadcasters the big news was WLW's boost in power to half a million watts under an experimental license. It was this year, too, that Admiral Byrd isolated himself for several months in a cabin 123 miles south of Little America, with Radio as his only means of contact with his associates and the rest of the world.

1935 Interest in television was reborn with the announcement of the Zworykin iconoscope and the Farnsworth image dissector tube for cathode ray television. Sensation of the year was the introduction of metal tubes. Radio broadcasting stations alone had a payroll of $21,491,000 this year, and Radio technicians installed 1,100,000 auto Radios. All-wave antennas were developed for the new foreign-station receivers. All-wave signal generators and cathode ray oscilloscopes were also brought out by manufacturers, to assist servicemen in repairing the new sets.

1936 Automatic tuning was the big new feature in the receivers announced during the fall of this year; most of the early sets also had automatic frequency control. Approximately 8,000,000 receiving sets were sold this year. Philco made a few cathode ray television receivers for experimental purposes, and other laboratories worked feverishly on cathode ray television development. An estimated 3,000,000 automobiles were equipped with auto Radios at the beginning of this year, and three out of four families in this country had home Radios.

1937 Floods in the Ohio River Valley disrupted communications and made thousands homeless. Radio jumped into service; broadcast stations and amateurs joining together to re-establish communication with isolated communities. Portable and police radios were installed in boats, which were directed by radio in their rescue efforts. Hundreds of lives were saved by the unceasing day and night efforts of radio operators and announcers.

Events of the Presidential Inauguration were broadcast to the world over one of the largest radio hook ups in history, with a number of NRI men at the controls in Washington. Features of the new radios were cathode-ray tuning eyes, slide-rule tuning dials and sleekly veneered cabinets for consoles. A trend toward higher fidelity and more classical music resulted in the formation of the NBC Symphony Orchestra. RCA conducted extensive experiments with cathode ray television.

1938 Push-button tuning was now considered almost essential. High fidelity receivers made their appearance. Standards for television systems were approved by the Radio Manufacturers' Association, paving the way for the introduction of commercial television. Howard Hughes set a new record in flying around the world; contact with America by radio was maintained for the major portion of the flight, with Hughes broadcasting over a nation-wide hook-up while flying over Germany. Huge water-cooled 250,000-watt transmitter tubes, taller than a man, made news this year, along with midget or finger-size tubes for hearing aids.

1939 Electronic Television emerged from the laboratories. Important demonstrations at the New York World's Fair and the start of regular high-fidelity television broadcasts served to arouse the public's interest. Several manufacturers made a limited number of high-definition 441-line commercial television receivers. Time tuning and remote wireless controls were the two outstanding features of the year's new radio models. Radio cabinet designers matched accepted classic furniture styles with many console units. Automatic frequency controls were no longer required to correct for errors in push-button tuning systems, for the development of adjustable iron core coils and zero-temperature coefficient condensers made electrical tuning systems satisfactory. Improved mechanical push-button tuning systems were used in many midget sets. High fidelity cabinet arrangements such as the acoustic labyrinth became more prevalent among higher priced receivers. Wind chargers were available for farming communities and built-in loop aerials were brought back as a noise-reducing feature. Considerable interest was shown in facsimile broadcasting, and the frequency modulation system of Major Armstrong was announced. The start of the European war revived the public's interest in short-wave receivers with which to hear foreign broadcasts. It soon became evident that radio was to play an important part in this war as a means of communication between military units.

1940 To keep the public buying standard sets, many appeared with "television jacks" intended for the sound portion of television programs. Frequency modulation began to compete seriously for public interest as a high fidelity, noise-free means of transmission; commercial FM stations were permitted for the first time. Real portable receivers and extra small table models were widely sold. Tubes with 117-volt filaments made their appearance. A radio operated from a gas flame was demonstrated at the World's Fair. (The flame heated a thermocouple which produced sufficient power to operate the radio.) The war brought about a curtailment of amateur activities as communication with foreign countries was forbidden. Defense measures began to be taken, and many manufacturers began to convert to the manufacture of military equipment. The Selective Service Bill was signed and the draft started.

1941 So far the biggest year in radio history; 13,000,000 radio sets and 130,000,000 tubes were made this year. Radio models were frozen by agreement among the radio manufacturers, so as to release engineers for development of military equipment. Television in color was demonstrated and over $8,000,000 spent on television equipment and research. Commercial operation of television stations was permitted, with the acceptance of new standards. Frequency modulation began to spread rapidly with 30 commercial stations on the air. Hundreds of broadcast stations had their frequencies shifted and servicemen enjoyed a boom resetting push buttons. Interest in high-fidelity record-player combinations reached a high level.

Then, in December, came Pearl Harbor and the United States was again at war. All amateur operating activities stopped.

1942 The manufacture of all broadcast receivers was stopped and all receiver manufacturers changed over to defense activities. The manufacturers of war materials called for industrial control equipment and electronic engineers were in great demand. The better trained radio engineers and operators were snapped up in defense jobs or drafted, leaving a shortage of operators for broadcast and commercial stations. The Federal Communications Commission relaxed requirements for operating license classes for operating these stations. The manufacture of radio tubes was limited and many types were dropped altogether. The development of television was halted, but existing television facilities were used in training air raid and civilian defense personnel—the first example of mass education by television. Amateurs were permitted to join in civilian defense, forming communications networks for emergency purposes.

1943 Radio servicemen began to feel the pinch of the parts shortage. The draft was now taking large numbers of radio men, resulting in a business boom for those remaining. Remodeling receivers to get around shortages became fashionable. Electronic equipment of amazing types and quantities was made for the military forces. Equally amazing strides were made in electronic factory control equipment, designed to speed up production and deliver improved materials.

1944 Servicemen obtained some relief from the parts shortage as manufacturers were allowed to make some replacement parts. The emphasis was still on war needs, with no new radio receivers being manufactured. Even so, the United States had about 30,000,000 homes equipped with 57,000,000 radio sets.

1945 With the signing of the Japanese truce in September, 1945, the radio industry turned to the problem of supplying increasing public demands caused by acute deterioration of radio receivers during the lean war years. Production of long-needed a.m. receivers, even in the latter four months of the year after the lifting of War Production Board limitations, was quite slow because we still hadn't the necessary components for high rates of production. Industry was looking forward to frequency modulation and the Federal Communications Commission made definite frequency allocations in the 88 to 108 megacycle range, clearing, more or less, the stumbling block to the introduction of f.m. In general, with the war drawing to an end in 1945, it became a year for contemplative talk of what was going to be done to revolutionize public life through the great war-time inventions. Radar was to be a great motivating activity, so much so that it was jokingly said that even vacuum cleaners might be equipped with radar to stop the damaging of furniture legs.

1946 This was the year of great radio production. Roughly speaking, over fifteen million radio receivers were made and close to ten million of them were table models. About two million were battery receivers, a million and a half portable receivers, and about two million radio phonograph combinations. The demand was high, and since the price was also high, table model sales were in the front. At first, any make of receiver was accepted, but as the supply caught up with the demand, only the well known brands sold. A start was made in the frequency modulation receivers. Of the grand total of fifteen million only half a million frequency-modulated sets were made during this year. Of particular importance was the emerging of the universal a.c.-d.c. receiver using new miniature tubes that would lend compactness to the receiver. Selenium rectifiers, a war-time development, gradually came into some use as a replacement for the vacuum-tube rectifier in the small receiver.

In the broadcasting field there was a gradual increase in the number of a.m. broadcasting transmitters going on the air. F.M. stations were increasing in number. There were also a few television transmitters on the air and a number of T.V. construction permits. War-time developments began to appear in the transmitters but the so-called "miracle developments" did not appear in the radio receivers.

1947 During this year the number of radio receivers produced was again close to fifteen million, of which eight hundred thousand were f.m. receivers. Again the table model receiver was the best seller. Compactness was realized by using minature tubes and resistors, selenium rectifiers and miniature i.f. transformers. The printed circuit used in combination resistor-capacitor units was introduced. Again there was an increase in the number of broadcasting stations. The real value of the war-time research became evident in communications. There were improvements in aircraft radio. Airborne and shipborne radar in commercial navigation came into use and also new electronic circuits in industry. Electronic computers, radio frequency heating, photo-electric controls, and other electronic mechanisms were prominent improvements. The pulse techniques and other unique methods of modulating radio radiations began to appear. There was great progress in the frequency-modulated and television antennas along with the development of slot antennas for vhf and uhf. However, radar did not achieve the predicted position of importance which some optimists had predicted for it.

1948 Production of broadcast receivers continued heavily in the first part of 1948. People were insisting on well-known "name" products and gradually the supply caught up and passed the demand. The chief reason for this was that Television was coming into its own. The RMA standard for television transmissions had previously been accepted, and in 1948 it became clear that its framework resulted in good techniques of transmission and reception. In the larger areas of New York, Washington, Baltimore, Boston, Chicago, etc., Television was the main topic of discussion. The telecasting of Republican and Democratic conventions from Philadelphia made newspaper headlines throughout the nation. People bought television receivers as they became available. The RCA 630 and the Dumont were the basic receiver circuits and were licensed to the other manufacturers. The radio industry took on the production of TV receivers in earnest. During 1948 a 7-inch tube receiver made its appearance in the low-price market. The most popular, however, was the 10-inch receiver. A 12-inch set remained high priced and a 15-inch set was definitely a luxury.

A number of projection receivers also appeared on the market. Television was here. Its acceptance was no longer doubted. The communications field increased in activity and vhf, uhf and micro-wave came into their own for civilian use. Mobile communications services expanded, including taxicabs, railroads and other common carriers. In the phonograph field, the so-called LP phonograph record was introduced, making it possible to accommodate the average symphony or concerto on a single disc, with attendant saving in storage space.

1949 No one any longer questions that Television is here. Everyone looks forward to the rapid growth of TV reception. In fact, progress was so rapid that the FCC had to freeze new grants in order to re-examine the method

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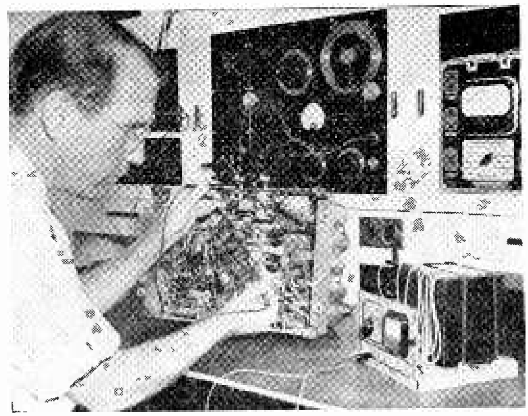
Servicing With The NRI Tester



Raymond H. Schaaf

By RAYMOND H. SCHAAF

NRI Senior Laboratory Instructor

THE voltage and resistance ranges of the NRI Tester for Experiments were chosen so that, if desired, the instrument could be used for general radio service work. The outstanding features of the instrument are its high input impedance, broad resistance coverage (5 ohms to 100 megohms), ability to serve as an "output" indicator for receiver alignment, and the fact that it can be used as an aural indicator for signal tracing in audio circuits. A front view of the tester is shown in Fig. 1.

Although the NRI Tester for Experiments is basically a battery operated vacuum-tube type multimeter, it is used just like any other multimeter. The ohmmeter circuit operates on the series principle. The "R" ranges are zero adjusted with the meter pointer at the right end of the scale. With the test leads open, the meter pointer rests at the left end of the scale. To measure direct current values, it is necessary to open up the circuit to be checked so as to connect the tester *in series* with the current to be measured.

The design of the tester is such that to obtain a meter deflection to the right, direct voltages and currents must be applied to the input jacks so as to reduce the bias on the 1C5 tube. To insure proper polarity, place the black test lead in jack 28 ($-V_{DC}$) for all voltage and current measurements. Direct voltages are then measured with the red test lead plugged into jack 29 ($+V_{DC}$) and direct currents are measured with the red test lead plugged into jack 27(+I). To measure a.c. voltages, place the red lead in jack 30(V_{AC}) so as to include the .005-mfd. blocking condenser in the meter circuit. Jacks 26 and 27 (R) are used for resistance measurements without regard as to the color of test leads for the jacks.

The instrument must be accurately calibrated at 0 and 1.5 on scale DC before any voltage or current measurements are made. It is not necessary to check the calibration preceding each individual measurement unless you believe that the calibration has been changed by an overload. Calibrating instructions are given in the instruction manual for Radio Kit 2RK. If calibration cannot be achieved, appropriate corrective measures should be taken.

For resistance measurements, the meter pointer should move all the way over to 0 at the right end of the R scale when the test leads are plugged into the "R" jacks (26 and 27) and the clips of the leads are held together to simulate zero resistance. If necessary, adjust the 1000 ohm potentiometer until the pointer does reach approximately zero. This adjustment may or may not shift the open circuit position of the meter pointer to the right of 100 on the R scale. If so, make an appropriate correction in your readings for deflections along the left half of the scale, or use the ohmmeter range that brings the pointer into the right half of the scale. If adjusting the 1000-ohm potentiometer won't bring the pointer all the way over to the right, use the voltage method of calibration (described in the previous paragraph) and the ohmmeter range that keeps the meter pointer along the left half of the scale.

All except the basic 0-4½ volt voltage range, and the megohm range, require the use of a multiplying factor. This is indicated by the point of the knob on the range selector switch. Be sure to use the correct multiplying factor. When the selector switch is turned all the way to the left to the position marked $\frac{V}{Meg.}$, d.c. voltages are read directly on the 0-4.5 volt DC scale, a.c. voltages are read directly on the 0-5.5 AC scale, and resistance values are read directly *in megohms* on the R scale.

Precautions should be taken to avoid overloading. Do not apply more than 4.5 volts d.c., or 5.5 volts of 60 cycle a.c. to the input jacks with the range selector set at $\frac{V}{Meg.}$. Overloading generally produces sufficient grid current to appreciably decrease the plate current (due to the increase in negative bias caused by the grid current) and make the meter indicate a voltage value considerably less than that actually applied to the tube. To avoid this effect, always use the range that gives you the highest value in volts, not the greatest meter pointer deflection. Overloading may also temporarily change the calibration of the instrument.

We will now run through the measurements you might have to make to determine why a given receiver is "dead." We shall assume that a careful visual inspection has revealed no surface defects, and that the tubes are good. The circuit of the receiver chosen for the purpose of illustrating service procedure with the NRI Tester is given in Fig. 2. It is the circuit of the Westinghouse Model WR-150, a typical a.c.-d.c. receiver.

Operating Voltage Measurements

One way to find the trouble is to check each individual part until the defective one is located. This method takes too much time. The best way is to isolate the trouble to a section and then to a stage as described in the NRI course. Then take voltage measurements. Isolation techniques are ignored in this article as we wish here to make you familiar with the use of the NRI Tester itself, as used in making general servicing measurements.

In the receiver shown in Fig. 2 we can measure the operating voltages applied to the various tubes. If they are normal, the defect must be in some signal-carrying circuit. On the other hand, abnormal voltages (either high, low, or a total lack of voltage where a considerable voltage should exist) provide definite clues as to what the trouble is and where to look for it.

The first step is to find a common reference point to which all operating voltages can be measured. In most instances, B— is taken as the reference. This point is always the set side of the "on-off" switch which is commonly connected directly to the receiver chasis (for the purpose of a convenient return circuit). A glance at the diagram of the model WR-150 shows this to be true of this particular receiver. Our voltmeter connections are thus simplified, for we can connect the black test lead from the $-V_{DC}$ jack to the chassis and leave it there, and simply move the red test probe from point to point. This also helps maintain the proper test lead polarity which is essential when d.c. voltages are being measured.

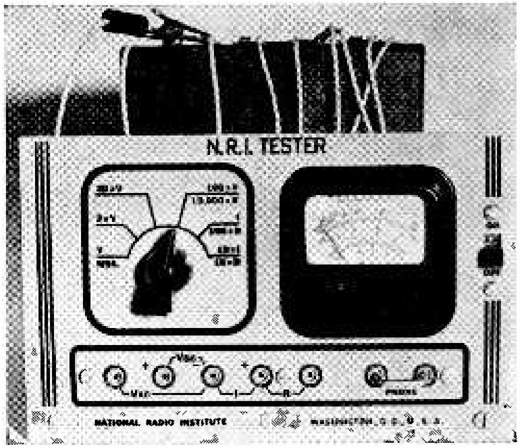


Fig. 1. This is the NRI Tester for Experiments.

The next step is to select the proper points to which the red test probe connects for the various measurements we want. First, we will want to measure the output of the rectifier to see just how much voltage is being supplied to the plate and screen circuits. Next we will measure, first the plate, then the screen, voltage *at each tube socket*. Lack of voltage may be due to an open in the circuit supplying that particular tube element, or to a shorted by-pass condenser. Low voltage may indicate a leaky by-pass or an open filter condenser (this last particularly if the rectifier output is low).

Before connecting the tester to the selected measurement points, we must decide at what position to set the range selector switch. Since this is an a.c.-d.c. set having a half-wave rectifier, we know the maximum d.c. output of the rectifier can't be much more than the line voltage. It is safe, therefore, to set the range selector at $30 \times V$, which gives us a range of 0-135 volts d.c. Other sets, particularly those having power transformers, may require that the $100 \times V$ (0-450 volts d.c.) range be used for the plate and screen voltage measurements; this requirement being due to the fact that the tubes are operated at much higher voltages (200 to 300).

To measure the output of the rectifier in Fig. 2, turn the set ON; make sure the test leads are in the correct jacks (red in $+V_{DC}$, black in $-V_{DC}$ and connected to the set chassis); the range selector should be at $30 \times V$ (0-135 volts d.c.) and the tester properly calibrated; then, turn the tester ON and hold the red test probe on either the #4 or the #8 pin (marked K_1 and K_2 in the diagram) of the rectifier tube socket and read the meter.

The next voltage to be measured is the plate

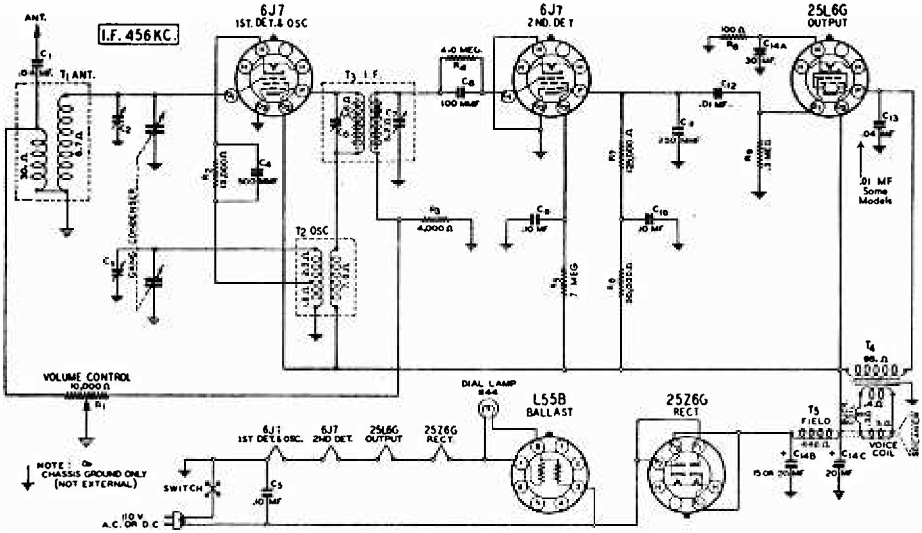


Fig. 2.

voltage of the output stage. Leaving the black test probe connected to the chassis, hold the red test probe on the #3 pin (P) of the 25L6 tube socket, and note the meter reading.

The screen voltage applied to the 25L6 may now be checked by holding the red test probe on the #4 pin (G_2) of the output tube socket. The plate and screen voltages of the second-detector and first-detector-oscillator stages are checked in the same manner. Plate voltage is measured by holding the red probe on the #3 pins (P) of the tube sockets; screen voltage by holding the red probe on the #4 pin (G_2).

Of course, the pin you select to hold the red probe on is going to depend on the tube base layout. For instance, if 6SJ7 tubes had been used, plate voltage would have been measured at the #8 pins and screen voltage at the #6 pins. If you aren't sure about the pin arrangement, look it up in a tube chart. This isn't necessary when the diagram shows the actual position of each element in relation to the tube socket as does the diagram in Fig. 2. However, all diagrams aren't drawn in this way.

Whether or not you will have to make further voltage measurements depends on the results obtained from these primary tests. For instance, if you obtained normal screen voltage at the 25L6 socket (about the same as that of the rectifier output) but no plate voltage, you would conclude that the primary winding of the output transformer was open. (If condenser C_{13} were shorted it would probably pull the screen voltage down, too.) No further test for voltage would be needed; you'd use an ohmmeter to check the output transformer primary for continuity.

Let's suppose the output stage to be normal. Now, if you obtained screen voltage on the second-detector, but no plate voltage, you wouldn't know whether R_6 or R_7 was open, or C_{10} or C_{11} shorted. You can obtain a clue as to which it may be by measuring the voltage between the chassis and the junction point of R_6 and R_7. Voltage here indicates R_7 open or C_{11} shorted. No voltage here suggests an open in R_6, or a short in C_{10}. In either case, R_7, C_{11}, R_6 and C_{10} can be checked with an ohmmeter. How to do this with the ohmmeter section of the tester will be explained later.

You will note that in these measurements the tester has been used just like any ordinary d.c. voltmeter. The only difference is that the NRI Tester draws far less current than does an ordinary d.c. voltmeter.

It is important that every precaution be observed to prevent the instrument from being left turned ON for long periods of time, to prevent running down the batteries. As you become adept at using the tester, it will only take one or two minutes to make the series of voltage tests described above. Thus, no attempt need be made to shut the tester OFF and then turn it ON again in between these measurements. However, should you wish to interpret the result of a measurement as soon as you have made it, and need time to do it, turn the tester OFF until you are ready for the next measurement.

Another voltage measurement we can make is that of the bias for the 25L6 tube. The measurement can be made, as shown in Fig. 3, by holding the red probe on the #8 pin (K) of the 25L6 socket. (The black probe is still connected to the chassis.) The *normal* bias is measurable on the $3\times$V range, but should R_8 be open, the voltage across it will equal the plate voltage. Hence, you should first check with the $30\times$V range, then go down to the $3\times$V range after you are sure it won't be overloaded.

As we just indicated, a bias far above normal indicates an open R_8. Assuming a good tube and normal plate voltage, this is the only bias circuit defect which would cause a dead set.

Receivers having power transformers are checked in exactly the same manner. If B— is connected to the chassis, then the chassis can be used as one terminal for all d.c. operating voltage measurements. Again connect the black test probe to the chassis and move only the red probe from point to point. Remember that the plate and screen voltages of power transformer sets will be much higher than those in a.c.-d.c. sets so use the 100 x V range (0-450 volts d.c.), unless the reading on this range indicates that it is safe to switch to a lower range. And when switching to a lower range, keep in mind the fact that the 30 x V maximum is only 135 volts whereas the 100 x V maximum is 450 volts! It may be necessary, therefore, to use the 100 x V range and to judge the meter reading as best you may under the circumstances, since the meter deflection may be quite small.

Measuring A.C. Voltages

It may be desirable to check the filament voltage right at the tube sockets, or to check the output from the high-voltage secondary winding of a power transformer. If you are in a customer's home, you may want to check the power at the wall outlet into which the radio is normally plugged to see if there is voltage available and whether it is a.c. or d.c.

As already pointed out, alternating voltages are measured with the black test lead in $-V_{DC}$ and the red test lead in the V_{AC} (the jack at the extreme left end of the jack strip). This places a blocking condenser in series with the test circuit. The condenser is useful in many ways. Here are a couple of examples. First, suppose that you want to find out whether a certain wall outlet provides a.c. or d.c. power. Set the range selector switch to 30 x V, turn the tester ON, and insert the test probes in the wall outlet (being careful not to short the test probes together and thus blow a house fuse). If you get a reading of approximately 4, on scale AC, the power is a.c. and the voltage 120 volts. If the power at the outlet

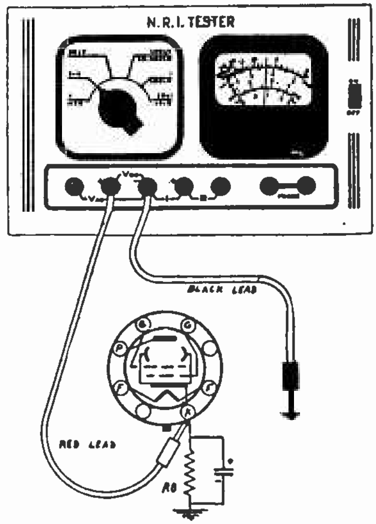


Fig. 3.

is *d.c.* you will get no reading except a momentary movement of the meter pointer as the blocking condenser charges up. By using the d.c. jacks, however, you will get the normal indication.

In checking the output from the high-voltage secondary winding of a power transformer, two measurements will have to be made, for the voltage developed across the entire secondary winding of most power transformers is far in excess of the 550 volt maximum of the 100 x V range for a.c. Connect one test probe to the center-tap of the high-voltage secondary. Hold the other test lead first on one end of the secondary winding, then on the other. See Fig. 4. The total voltage developed by the secondary is the sum of the two readings.

To measure the a.c. filament voltage right at a tube socket, it is only necessary to set the range selector switch to the position that will give a reasonable meter deflection (the 3 x V range for 6.3-volt filament tubes) and then to hold the test probes on the filament terminals of the tube socket. As an example, if the filament voltage applied to a 6L6 type tube is to be measured, set the range selector switch at 3 x V, turn on the set and the tester; then hold one test probe on the #2 pin of the tube socket, and the other test probe on the #7 pin of the tube socket. Read the AC scale of the meter.

As in the case of plate, screen, cathode, and control grid terminals, the filament terminal positions may be shifted according to the tube types. Thus, they are not always in the #2 and #7 positions. If you aren't sure of the arrangement, look it up in a tube chart. This is important,

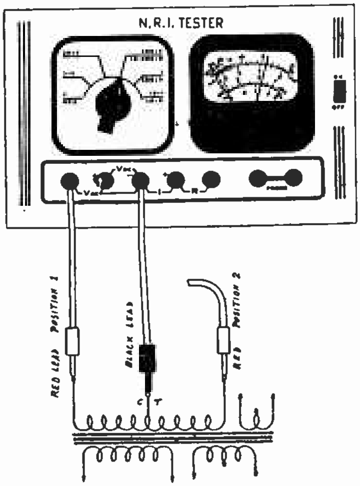


Fig. 4.

for you will likely have the range selector set at a comparatively low range and you should not accidentally connect the test probes to terminals carrying high voltages.

There are, of course, other a.c. voltage measurements that can be made. These examples are given to illustrate the principles involved in measuring a.c. voltage with the NRI Tester. Always use the V_{AC} jack for the red test lead so as to take advantage of the blocking condenser. The black test lead in the $-V_{DC}$ jack should always be connected to the voltage terminal nearest ground potential.

Measuring Direct Currents

It is seldom necessary to measure current values to find what's wrong with a receiver. Nevertheless, two current ranges are provided in the NRI tester. They are 0/4.5 and 0/45 milliamperes respectively. The current to be measured is made to pass through resistors of known value. The resulting voltage drop is applied to the grid circuit of the tube so as to reduce the bias and thus produce a meter deflection. The resistor values are such that, for direct current, the meter calibration points coincide with the d.c. voltage calibration points. Current values, therefore, are obtained by reading the DC scale.

The method of connecting the tester for current measurements is exactly like that used with ordinary d.c. milliammeters. In other words, the circuit whose current is to be measured must be broken and the tester connected in series with it. Correct polarity for the test leads must be observed, as we have already pointed out.

You will note that the $-V_{DC}$ jack is also the $-$I jack. Therefore, put the black test lead in this jack. The red test lead is to be inserted in the +I jack. Connect the test probes *in series* with the current to be measured so that the electrons, which make up the current, flow into the tester through the black test probe and leave the tester at the red test probe.

As an example, suppose we measure the cathode current of the 25L6 output tube of the receiver shown in Fig. 2. Keeping in mind the fact that the circuit must be broken so the tester can be connected in series with it, disconnect the 100-ohm resistor R_8 from the cathode terminal of the tube socket. Now, since electron flow through this resistor is toward the cathode, connect the black test probe to that end of the resistor which you have just disconnected from the cathode, and hold the red test probe on the cathode terminal of the tube socket.

Before turning either the set or the tester ON, set the range selector switch to the 10 x I position. This range is used because the cathode current of a 25L6 is far more than 4.5 milliamperes, the maximum of the basic current range. Now turn the set and the tester ON and read the DC scale of the meter. Multiply the meter reading by 10 to get the actual current in milliamperes.

In measuring current values, always keep in mind the fact that the maximum current the tester can safely measure is only 45 *milliamperes*. When it is necessary to measure larger current values, use a standard type milliammeter of the correct range, or connect a *low-resistance, high-wattage* resistor of known value in the circuit and measure the *voltage drop* across it. The current can then be calculated by means of Ohm's Law ($I = E/R$, voltmeter reading divided by the value of the resistor in ohms).

Using the Tester as an Ohmmeter

When measuring resistance, the tester operates as a series-type ohmmeter. A known voltage (4½ volts) and a known resistance (determined by the setting of the range selector switch) are connected in series with the unknown resistance. The resulting current flow sets up a voltage drop across the known resistance which is inversely proportional to the value of the unknown resistance. This voltage reduces the bias and produces a meter reading.

The fact that the ohmmeter circuit is a series circuit should be remembered when you are interpreting ohmmeter readings. Thus, with nothing connected to the test leads, or when the test leads are connected to a part or circuit which is "open" *the meter pointer stays at the left of the meter scale,* for no current can flow through the open circuit or part to produce the voltage necessary to give a meter reading. On the other hand, when the test leads are held together, or are connected to a circuit or part having the property of electrical resistance, current from the ohmmeter battery flows through the test circuit and sets up a voltage drop which actuates the tube and meter.

We should say a word or two here about what tolerance to allow. The minimum variation of the complete instrument, under the best of conditions is $\pm 10\%$. Thus, an applied voltage of 100 volts may be indicated as any value between 90 and 110 volts. The variation is due to the normal commercial tolerances of the resistors in the voltage divider network on the range selector switch, variations in tubes, and battery voltages. In addition to the 10% to be allowed for the tester, you should also allow an additional 20% to 30% for variations in the parts you check. If this seems to be a considerable allowance, don't forget that as a serviceman you will seldom need to determine the *exact* value of a resistor. What you are primarily interested in when using an ohmmeter is establishing continuity through a circuit or part, and determining whether or not condensers are shorted or so leaky as to make a replacement advisable. *You can do this even with a 50% variation!*

There are no trick ways of using the NRI Tester as an ohmmeter. The procedure is entirely conventional. To check resistors on your workbench, simply plug the test leads into the "R" jacks, connect the test probes to the resistor leads, select a range which gives approximately mid-scale deflection, and read the R scale of the meter. Naturally, you will have to multiply the meter reading by the "multiplying factor" shown by the range selector pointer knob.

Resistors connected in a set may often be checked in a similar manner. To avoid the effects of parallel current paths which would give false readings, however, it is best to disconnect one end of the resistor from the circuit so as to completely isolate it. The same precaution applies to tests for continuity in circuits. Be sure there is no parallel path that the current from the ohmmeter can take and thus give a false indication of continuity.

In checking condensers, the procedure and test results depend on the kind of condenser being tested. As you know, paper and mica condensers in good condition effectually block the flow of direct current, provided the voltage applied to them does not exceed the rated break-down voltage. Electrolytic condensers used in filter systems, however, permit a certain amount of d.c. current to flow through them. Electrolytics are polarized, while non-electrolytics are connected without regard to polarity.

Because paper and mica condensers block the flow of d.c., we get only a momentary movement of the ohmmeter pointer as the test probes are connected to one of these types of condensers. This is due to the charging of the condenser as the ohmmeter battery voltage is connected to it. After the condenser has become charged, there is no more current flow and the meter pointer drops to the normal position at the left of the scale, provided the condenser is a good one. If the condenser is open, you won't get the momentary pointer movement to the right, for an open condenser cannot charge up. If the condenser is shorted, you will get a full-scale deflection and the pointer will stay over to the right as long as you have the test probes on the condenser leads. If the condenser is only partially broken down, or as radio men say "leaky," you will get a partial scale deflection according to the actual d.c. resistance between the condenser terminals.

Again, to avoid the effects of parallel current paths, disconnect one lead of the condenser from the circuit before you check it. Remember, the momentary deflection which indicates that a condenser is not "open" depends on the capacity of the condenser. Don't rely on this test for condensers whose capacity is less than .01 mfd., as small capacitances can receive only a small charge and will not give a noticeable meter deflection.

In checking electrolytics, take *two* readings. One reading must be taken with the red probe to the positive terminal of the condenser and the black probe to the negative. Short the condenser to discharge it and then take another reading, this time with the black probe to the positive and the red to the negative. One reading will give a higher resistance than the other. If the condenser is to be considered good, the *highest* reading should be 100,000 ohms or more.

Because of the large capacity of most electrolytics, they will take some time to charge up. Thus, the meter pointer will take a corresponding length of time to drop back to the left after its initial movement to the right. This action is normal. Just be sure that the pointer goes back far enough to the left to indicate a good condenser, as described above.

In using *any* ohmmeter, and especially the NRI Tester, care must be taken when using the highest range not to hold the metal portions of the test probes in your hands. If you do, the resistance of your body will be in parallel with the circuit or part being checked and a reading much lower than the actual circuit or part resistance will be the result. Make it a habit to hold only the insulated portions of the test probes in your hands.

Tests for circuit continuity, shorted turns, leakage between transformer windings and the transformer core, etc., are made just as described in your lessons. The tester is used like any series-type ohmmeter; a few representative tests on the Westinghouse model WR-150 which we used for voltage measurements will serve to illustrate this fact.

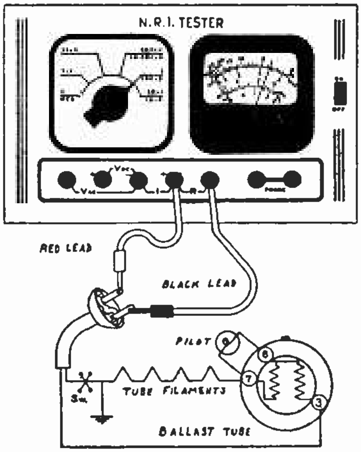


Fig. 5.

It is frequently necessary to check the continuity of the filament circuit in a.c.-d.c. receivers. This is particularly necessary when all the tubes check OK but fail to light in the set. The obvious conclusion is that either the ballast tube or the line cord is open. A continuity test will show which it is. Before making tests, be sure to remove the radio plug from the electric outlet.

The ballast tube of the model WR-150 can be checked by connecting one ohmmeter test probe to the #3 pin of the ballast tube socket and holding the other test probe, first on the #7 pin to check the entire resistance element, then on the #8 pin to check the pilot lamp tap. The range selector switch can be set at 10 x R for these measurements, for the resistance will very likely be some value between 150 and 400 ohms.

If the ballast tube is OK, the line cord is probably defective. To check this, proceed as follows.

First, remove the line cord plug from the power outlet and turn the receiver power switch ON so that the line switch will establish continuity between the line cord and the tube filaments. Make sure each tube (including the ballast tube) is firmly inserted in its respective socket. Now, hold the ohmmeter test probes on the prongs of the power cord plug as shown in Fig. 5. If the circuit is open, no reading will be obtained. You will, however, want to make one more test to prove conclusively that it is the cord.

To do this, hold the ohmmeter lead on the receiver chassis and touch the other one to the #3 pin of the ballast tube socket. A reading for this test, coupled with an open-circuit reading for the first test, is proof that the open in the filament circuit is caused by a defective line cord or a defective OFF-ON switch.

Now let's suppose you didn't get any plate voltage on the second-detector stage (See Fig. 2). To find the trouble with an ohmmeter, remove the receiver power cord from the wall outlet and with your ohmmeter measure the resistance between the plate of the second-detector and the cathode of the rectifier. You will have to use the 10,000 x R range for this test, for the resistance of the plate circuit is quite high. The normal value is roughly 175,000 ohms. If you get no meter pointer movement, the circuit is open. Leave the test probe on the rectifier cathode terminal and move the other probe to the junction point of R_6 and R_7. If you get a reading now, R_7 is open and you can confirm this by holding the test probes on the terminals of this resistor. No reading will be obtained.

Of course, if you still don't get a reading, R_6 could be open. To check this, hold one test probe on the junction point of the two resistors and put the other one on the *screen* terminal (pin #4) of the 25L6 outlet tube socket. Failure to get a reading here indicates that R_6 is open.

But suppose you measure continuity between the plate of the 2nd detector and the cathode of the rectifier. The conclusion is that the lack of voltage is due to a short to ground rather than to an open in the plate circuit. Either C_{10} or C_{11} may be shorted. Disconnect one lead of condenser C_{10} and check it. Then disconnect one lead of condenser C_{11} and check it. The leakage resistance in either case should be very high, above 10 or 20 megohms. A low resistance reading indicates a leaky or shorted condenser.

The electrolytic condensers in this set may be checked quite easily. Just disconnect the positive leads and check between one of them at a time and the chassis. Remember, take two readings on each section, short the condensers to discharge them between readings and accept the units as being really serviceable only if the higher of the two readings for each section is above 100,000 ohms.

Output Indicator for Alignment

Some means of indicating when maximum output has been obtained is required when aligning a receiver. For this purpose, the NRI Tester for Experiments can be used in either of two ways. If the receiver being aligned employs a.v.c., connect the tester to measure the d.c. voltage across the diode load resistor. In case the receiver does not have a.v.c. (as in the Westinghouse model WR-150 diagrammed in Fig. 2), set up the tester to measure a.c. voltages and connect the tester to measure the a.c. voltage between the receiver chassis and the plate of the power output tube. For the receiver shown in Fig. 2, the black test lead would be plugged into jack $-V_{DC}$ and fastened to the receiver chassis while the red lead would be plugged into jack V_{AC} and the red clip fastened to pin #3 on the 25L6 tube socket. When the audio output of a receiver is used, the test oscillator must supply a modulated signal.

Signal Tracing

Although the NRI Tester for Experiments can be used to measure r.f. voltage values, the input capacity, which is generally between 40 and 45 mmfds., will detune any resonant circuit in the broadcast and higher frequency ranges, thus making it impossible to use the tester as an r.f. signal tracer in the full sense of the term. The input capacity of the tester has no effect upon audio circuits, however, and the instrument can be used as an aural indicator by simply removing the wire jumper from jacks 24 and 25 (marked Phone) and plugging an ordinary headphone unit into these jacks. The tester is then set up as for a.c. voltage measurements, the black test lead clipped to the chassis, and the red lead used as a probe to check the audio at various points in the a.f. section of the receiver under test. In the Westinghouse model WR-150 receiver under consideration, an audio signal should be picked up by holding the red probe on the following points if the black lead is fastened to the chassis: pin #3 of 2nd. detector socket, and pin #5 and pin #3 on the 25L6 socket. It is assumed that the receiver is tuned to a station and that the r.f. end of the set is all right.

Some distortion will be noticed in audio signal tracing due to the fact that the tube in the tester is normally biased to cut-off. A clearer audio signal will be obtained by moving the calibrating lead of the tester back to the —6C terminal of the C battery group so as to operate the tube closer to the straight portion of its characteristic curve. This will produce an initial meter pointer deflection which can generally be ignored for what little audio testing is required.

If the limitations of the NRI Tester for Experiments are kept in mind, and the calibration kept accurate, it should prove to be a perfectly satisfactory test instrument for general service work. Its use in television service work is limited primarily by the high voltage encountered in TV work. Remember, the maximum d.c. voltage it is designed to handle is only 450 volts. Television receivers employ voltages ranging from 1500 volts to as high as 30,000 volts! It can still be used for the low voltage and for resistance measurements, however.

Editor's Note: NRI students are advised to defer using their NRI Tester for Experiments for general service work until they have completed their Practical Demonstration Course. By doing so you'll be sure that you have gained sufficient skill in handling the instrument to avoid damaging it, and you will conserve the batteries for the experimental work required to complete your course.

The Romance of Radio

(Continued from page 9)

of allocation. With the assurance that the present 12 channels will not be disturbed but merely supplemented in the future, industry scheduled the production of two million TV receivers in 1949. Reports show that this production figure should be reached or even surpassed.

The RCA 16-inch metal tube has made its appearance. Other makes are featuring the 15-inch glass and the 16-inch metal picture tube. The public wants larger screens. Apparently the 7-inch will be the portable, the 10-inch the low-priced, the 12-inch the normal, and the 15- and 16-inch the better TV receivers. Prices are dropping at this writing and a 10-inch television receiver can be purchased for well under two hundred dollars, whereas the same receiver in 1947 and 1948 sold for over three hundred. The industry is even talking about color television, although the methods are not certain.

RCA got out its own micro-groove record, introducing the 45 rpm 7-inch record with a unique fast-acting reproducer. The industry is faced with the problem of building phonographs that will take the old 78 rpm, the new LP 33 1/3 rpm and new RCA 45 rpm records. The solution seems to lie in the three-speed record changers now appearing on most new console receivers.

Opportunities are everywhere! The man who has an understanding of the fundamentals of Radio, Television, and Electronics—the necessary training—should make rapid strides in this vast and growing field.

n r i

Philip Space says:—

He's a self-made man but why didn't he wait till he finished the job before knocking off from work?

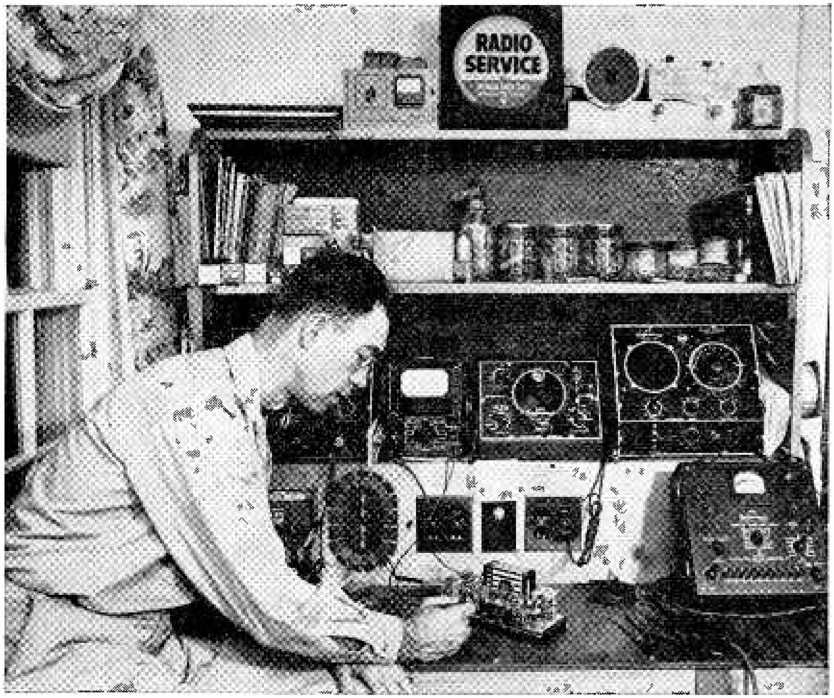
n r i

TELEVISION BOX SCORE

Stations Operating	78
Construction Permits Granted	37
Applications Pending	348

(As of Sept. 1, 1949)

Graduate Schaffer Enjoys Spare Time Radio Work



Dear Mr. Smith:

"Here is a photo of the bench which was built by myself from the plans in your course. As you can see, I have the complete line of NRI test instruments and they are sure fine—every one!

I've repaired sets ranging from two tube midgets to 15 tube consoles and auto radios. My customers have been exceptionally well pleased with the jobs.

I must say truthfully I enjoy Radio work so much that I hope to develop it into a full time job. When I get to fussing on a set my wife has to stop me or I'd work all night. But she is almost as much amazed at my ability as I am. My only regret is that I didn't start years ago. I'm anxious to expand into TV installation and service.

Thanks for a swell course and the personal helps rendered to me in the past. I am still reviewing the course with interest."

Sincerely yours,

George Schaffer
37 Laurel Drive
Packanack Lake, N. J.

OUR PRESIDENT AND FOUNDER

J. E. SMITH

J. E. SMITH was born at Rochester, New Hampshire, on February 3, 1881. His family traces its origins in America to Colonial days. His father had been a farmer in his native state through practically his whole life.

Mr. Smith attended the public schools of Rochester, and early acquired an interest in mechanical things. For fifteen months he was a locomotive fireman and a member of the Brotherhood of Locomotive Firemen. He later became a student at the Worcester Polytechnic Institute, from which institution he received a Bachelor of Science degree in Electrical Engineering in 1906. He was then employed by the Westinghouse Electric and Manufacturing Company, in East Pittsburgh. In 1907, Mr. Smith came to Washington, D. C. to accept an appointment as an Instructor of Steam Engineering and Applied Electricity at the McKinley Manual Training High School, which he held until 1918.

Mr. Smith clearly saw the future and read its meaning. The world, revolutionized by Radio, needed trained men. In 1909-10 he introduced the study of Radio into the Washington, D. C. public school system and in 1914 Mr. Smith founded the National Radio Institute.

In addition to his other activities, Mr. Smith is a Senior member of the Institute of Radio Engineers, a life member of the American Institute of Electrical Engineers (Past Chairman of the Washington, D. C. Section), member of the American Radio Relay League, Radio Club of America, Washington Radio Club, National Education Association of U. S., the National Aeronautic Association of the United States of America, the American Association for Adult Education, and the American Association for the Advancement of Science. Other affiliations of Mr. Smith are those with the Washington Chamber of Commerce, the Washington Board of Trade, National Better Business Bureau, Washington Better Business Bureau, and Television Broadcasters Association. For many years he has been Treasurer of the National Home Study Council. He is past president of the Round Table International, and a past president of the Washington section of the Worcester Polytechnic Institute Alumni Association. He is a director of the Washington Y.M.C.A.

It has been written of Mr. Smith: This man, the president of the organization which is training you for success in Radio, has in his student body men and women in every civilized country in the world. All his life he has known hard work—he's still at it and will be as long as he is physically able. He has known hardships but he claims that his successful graduates more than repay him in the knowledge of good work done, for all the obstacles he has had to overcome.

THE STORY OF THE NATIONAL RADIO INSTITUTE

By GORDON BIRREL

NRI Director of Personnel

Gordon Birrel

THIS story, like that of Radio itself, is no mere meaningless list of names and dates. Rather it is a record of pioneering and achievement that may well stir pride in the heart of every student, graduate, or member of the Institute staff.

Here is a tale of men with faith in Radio and in themselves; a drama of obstacles met and overcome, of promises made and (more important) kept, of hard work, of loyalty, and above all, the transformation of the ambition of thousands, through Institute training, from dreams into reality.

Today the Institute is so strong and thoroughly organized, the Radio industry is so large and has enriched our lives in so many ways, that few think of their humble beginnings and early struggles. Yet it is only sixty years or so since Heinrich Hertz set up his first crude transmitter, and paved the way for a host of early pioneers and inventors, and their discoveries.

A few years earlier, to be exact, February 3, 1881, in Rochester, New Hampshire, J. E. Smith was born. In bonnie Scotland the year before Hertzian experiments were begun, J. A. Dowie was born. Thus the founder, and the chief instructor of the Institute of today were born in the same decade with Radio itself. They grew up with it, so to speak, and what a growth it has been!

The first twenty-five years of Radio ending in 1914 saw Marconi's successful transmission and reception of wireless messages, the formation of his Wireless Telegraph and Signal Company, and the adoption first by naval forces and later by shipping companies, of wireless as an essential method of extending maritime communication.

By the turn of the century, transoceanic wireless was in sight. Dr. J. Ambrose Fleming invented the diode vacuum tube in 1906, the year in which Mr. Smith graduated with the degree B.S.E.E. from Worcester Polytechnic Institute.

Shortly after this, Dr. Lee de Forest invented the "audion" and experimented with sound broadcasting in New York City. The Society of Wireless Telegraph Engineers was founded. By this time Mr. Smith, the ambitious young electrical engineer, was working for Westinghouse in East Pittsburgh, a position he gave up to become an instructor in electrical and other subjects in the Washington, D. C. school system.

In 1914 the first World War was let loose on an unsuspecting world. Thus the stage was set for the founding of the National Radio Institute.

Mr. Smith had become deeply interested in various phases of wireless and had thrown himself with customary enthusiasm into the task of mastering the newest and most fascinating branch of electrical science. Such enthusiasm became contagious. Mr. Smith was besieged with requests for information on wireless problems, and in response to the demand, finally organized a class of four students in a small room in the old United States Savings Bank Building at 14th and U Streets, Northwest, Washington, D. C. The National Radio School, as it was known at first, had come into being. Additional students sought admission and the young school filled an increasing need by giving practical training in this new field.

From time to time students who were compelled to leave the city for one reason or another expressed desire to continue their studies. The first effort to teach Radio through the mail was undertaken. In the face of critics and skpetics, the National Radio School proceeded to develop a successful home study method of training parallel with its classroom training, thus establishing definitely our position as the pioneer home study Radio school. In our files we have a set of lessons graded by Mr. Smith for a student in Livermore Falls, Maine, and bearing dates as early as February 14, 1916.

World War I was giving tremendous impetus to the development of Radio. Even before the United States entered the war these effects began to be felt. By 1916 the staff of the school had been increased to six, one of them Mr. Dowie, educated at Polytechnic Institute, London, the Chicago Electrical School, the Marconi School of New York, and Penn State College Engineering Division, besides doing electrical work and experimenting in Radio, coming to the young school in May, 1915. Four rooms were required for classes. The heavy demands made upon Mr. Smith for instruction left him little time for the school's business affairs, and Mr. E. L. Degener became associated with the school in charge of advertising and organization.

J. A. Dowie, Chief Instructor
Senior Member, Institute of Radio Engineers.
34 Years of Service with NRI

Thus in the first two years the present management had taken charge, and the policies that have guided us through more than a third of a century were taking form. A year later, in 1917, the United States entered the World War and the demand for wireless operators filled the classrooms to overflowing. Facilities were expanded, a staff of twenty instructors was engaged and over 150 local students were in training. Radio technicians were made part of the regular military forces. In the Spring of 1918 the U. S. Government gave Mr. Smith entire charge of training 800 students at Howard University for Radio work in the U. S. Army.

Steadily increasing demands for instruction in wireless telegraphy and the growing interest in wireless telephony or "Radio" as it began to be known, expanded both the home study and residence classes. The former required all available facilities at the original 14th and U Street address, so classes were moved to 1345 Pennsylvania Avenue, Northwest, a convenient, central location on historic Pennsylvania Avenue. About this time also the Service Radio School located nearby was taken over and absorbed by the Institute.

These were "the good old days." The National Radio School had become the National Radio Schools. We operated a Radio station with call letters 3YN between the downtown and uptown locations for the instruction of local students. Mr. Smith and Mr. Dowie personally graded lesson papers besides handling consultation and classes. On more than one occasion, Mr. Smith or Mr. Dowie carried the mail across the busy avenue to the Post Office themselves to set the standard of personal, prompt service that inspires their staff to this day.

In 1920 Westinghouse KDKA began broadcasting. An irrisistable wave of popular interest in broadcasting swept the country. This was the day of the crystal receiver and the head set. An interesting sidelight is the story of the Harding vs. Cox election returns. Washington's two largest newspapers have offices on Pennsylvania Avenue and flashed election returns on screens for the information of election crowds. Their returns received by ordinary telegraph service were often behind the returns received by station 3YN as broadcast from KDKA and other early stations, and we were thrilled when "National Radio" scooped the Nation's Capital!

The same year and month, November, 1920, the National Radio School was incorporated under the laws of the District of Columbia as the National Radio Institute. For a while a branch residence school was operated at Howard and Franklin Streets in Baltimore.

The kaleidoscopic growth of Radio continued. In two years after the first broadcast there were nearly 600 stations in the United States and broadcast station licensing was begun. Successful ship-to-shore Radio-telephone experiments were conducted and practical Transatlantic shortwave communication demonstrated.

The year 1923 was marked by the introduction of the neutrodyne receiver. Broadcast receivers generally began to acquire complex technical features requiring competent servicing. Prior to this time servicing equipment consisted of a screw driver, pocket voltmeter, ammeter, and a hydrometer for battery checking! Any tinkerer could service a set—and did.

The need for trained Radio service men brought to light the need for a name for men who were properly trained. "Electrician" fell short of the mark, "Radio man" referred to operators on shipboard. The term "Radiotrician" was coined and used by us as early as 1922. Registration for the term was secured in the U. S. Patent Office in November, 1928, and has since been secured in Canada, England and elsewhere for the exclusive benefit of NRI graduates.

In 1938, the term "Teletrician" was registered with the U. S. Patent Office for the exclusive use of NRI Graduates. These names have been carefully protected ever since. Unless a man has taken the NRI Course, he cannot properly call himself a Radiotrician or a Teletrician.

Radio grew complex and technical. The Institute adapted its training and methods to keep in step with the new situation. The residence schools were gradually closed out. In 1923 the Institute was established at 1223 Connecticut Avenue, Northwest, near the famous old British Embassy Building, since torn down, and the entire effort of the Institute was thrown into home study training.

First one floor was occupied, then two. The Institute continued steadily in growth, and in October, 1927, our present large building, then two stories high, located at 16th and U Streets, Northwest, was purchased and the second floor occupied. The next year it was necessary to take over the first floor also, and in 1930 the third floor was added to provide urgently needed additional space.

E. L. Degener, General Manager.
31 Years of Service with NRI

By 1946 we had outgrown our building. We purchased another three story building, two blocks from our main building. This we call the Annex. The new addition was completely renovated, air conditioned, made spick and span, and a number of our departments moved into it.

But again we are feeling the need for more space and we are looking forward to the day when we will have our own modern school building and all of our NRI family, now numbering more than two hundred and fifty, will again be housed under one roof.

The ground for our proposed new building was purchased some years ago when we realized we would eventually outgrow our present quarters. The plans for building are all drawn. We are ready to start operations but are marking time because there is still a shortage in some of the building materials of the kind we will need for this fine edifice we have planned as a monument to J. E. Smith, the founder of NRI.

Our present buildings are located on one of Washington's finest boulevards, sometimes called the Avenue of Presidents, a little over one mile north of the White House and within easy distance of the Department of Commerce, the Federal Communications Commission, the Bureau of Standards, and the Congressional Library. We feel we are at the heart of Radio in this country. Our buildings are simple and substantial. They are always clean, bright and a beehive of purposeful activity. Yet we are never too busy to stop and greet a new student or an old one.

Closely paralleling the physical growth of the Institute and responsible for it, has been the growth of the Course and of the instruction staff. It is a matter of pride to the Institute that some of the earliest members of our organization are still with us. They have grown up with the Radio industry and with the school. As we have grown, new blood and new ability have been added, also, to meet the continual demand for the latest practical and experimental knowledge in the field and to maintain our position of leadership in Radio home study.

The story of our training is a long one in itself and a fascinating one. The very first text book was one used by the Signal Corps of the U. S. Army. This was soon supplemented by Dr. A. N. Goldsmith's book on Wireless Telephony, Audel's Handbook of Easy Lessons in Wireless Telegraphy, and E. E. Bucher's "How to Pass the U. S. Government Wireless License Examinations," a forerunner of NRI's own Quiz Book.

The constant development of Radio with its new discoveries and new applications, the requirements of home study students for more convenient lessons and more readily understood instruction and the success of the Quiz Book between 1918 and 1924, pointed the way to the writing of all our own lesson books. First came a series of fourteen, later increased to eighteen, on wireless telegraphy, and then a course of eight books on Radio telephony, a total of twenty-six books by 1920.

Rapid strides in broadcast station and transmitter development as well as in broadcast receivers forced complete rewriting of the Course and extensive additions so that by 1926 there were forty books in the Course, and by 1928, fifty. In spite of every effort to maintain the Course at a high level of accuracy and completeness, the continuous strides of Radio, during the twenties led to a complete revision of our Courses. Every text book was completely rewritten from cover to cover and many new books were added on various branches of servicing, merchandising, broadcast station operation, commercial and ship station operation, aircraft installations, television, sound pictures, public address systems, and many others.

This policy has been faithfully pursued; every year some books are revised, others replaced with entirely new ones. Every book must pass critical inspection for its technical accuracy and equally critical examination for its simplicity and readability.

The earliest experience with home study emphasized strongly to the practical mind of Mr. Smith the importance of combining practical work with the study of theory. The first equipment furnished was for teaching the sending and reception of wireless telegraph signals. Mr. Smith later developed, patented, and undertook the manufacture of a special machine known as the Natrometer for automatic sending of code signals. This was eventually replaced with the even more efficient Nacometer.


J. Morrison Smith, son of J. E. Smith, assistant to the General Manager, and Secretary of NRI.

With the rise of set servicing came the need for practical experience in handling Radio receiving and servicing equipment, a need which was met by development of practical home experimental equipment. In the past twenty years several distinct series of these outfits have, one after the other, been developed to meet increasingly complex training requirements.

Now that our story has brought us down to date with modern and highly specialized training, modern equipment, a modern training plan, and an efficient staff, let's sketch in some of the significant developments that took place in intermediate years.

Back in 1926 at the beginning of the batteryless receiver era, the Radio compass was coming into general use, the Piezo crystal had been developed, beam transmission had been developed to a practical commercial stage, and successful Radio telephone experiments were conducted between New York and London.

In the same year both the National Broadcasting Company and the National Home Study Council were organized. The Council is an association of private home study schools and was incorporated in the District of Columbia, October 29, 1926, with Mr. Smith as one of the original incorporators and the National Radio Institute as a charter member.

The purpose of the Council from the very beginning has been to elevate the standards of home study training. Mr. Smith has been a member of the board of trustees of the Council and long a member of its educational committee, besides serving as Treasurer and in other capacities, and other members of the Institute staff have participated actively in Council meetings and as Committee Members to the end that all home study students may receive better training, better service, and a square deal all the time.

In 1927, the year the Institute moved to our present main building, the Federal Radio Commission was created by Act of Congress. Transatlantic Radiophone service was opened to the public. The International Radio Telegraph Conference held from October 4 to November 25 in Washington was attended by members of the Institute staff.

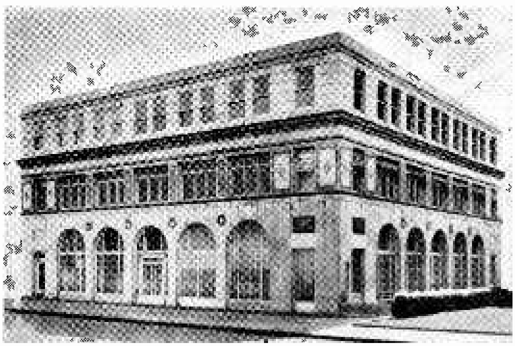
The following year Station WRNY broadcast television signals. That autumn the Institute put on a series of Radio broadcasts over a nation-wide N.B.C. hookup, featuring "The Radiotricians," S. L. Rothafel ("Roxy"), Dr. J. E. Dellinger of the U. S. Bureau of Standards; Mr. Smith and Dr. C. Francis Jenkins, the inventor. In addition to these four major broadcasts, the Institute has been on the air on many other occasions.

From the earliest days of the Institute, Mr. Smith, Mr. Dowie, and other members of the staff had taken up important problems pertaining to the Course and Radio with recognized leaders in their fields. Mr. Smith wished to be able to do this on a more formal basis and give students and graduates the benefit of the most authoritative opinions available on Radio questions. To this end the National Radio Institute Advisory Board was created in 1929.

Invitations were extended to and accepted by men carefully selected for their variety and breadth of experience, as well as their outstanding records as Radio engineers. The six original members of the Board represent some of the great names in Radio: Dr. Lee de Forest, Mr. Edgar H. Felix, Mr. Paul A. Greene, Mr. George Lewis, Prof. C. M. Jansky, Jr., and Major-General George O. Squier. We have always felt it an honor to be recognized in this manner and to pass along to our students the advice and recommendations of such leaders in Radio.

Dr. A. N. Goldsmith was added to our Advisory Board in May, 1934, to take the place of Major-General Squier who had died shortly before. With the rapidly growing importance of Television, Mr. Philo T. Farnsworth was invited to serve on our Board and accepted in August, 1935, followed in 1938 by the late Mr. Harry Diamond. When Mr. Diamond passed away recently, Dr. Cledo Brunetti, Chief of Engineering, Electronics Section, National Bureau of Standards, was added to our Advisors.

In connection with the 1929 celebration of our Fifteenth Anniversary, a group of seventy-five Graduates from widely separated parts of this country and Canada assembled here in Washington. The Honorable Charles Curtis, then Vice-President of the United States addressed them from the steps of the Senate Office Building where he posed with them and members of the Institute Staff for photographs and sound moving pictures.



This is our main building at 16th and U Sts., N. W., in Washington. Visitors are always welcome.

Advantage was taken of the convention to hold a big dinner at the Arlington Hotel. In addition to the graduates present, Mr. Smith, the staff of the Institute, and a number of leaders of the Radio industry—including several members of the Advisory Board — attended. Congratulatory letters were received from many others and read. At the close the graduates presented Mr. Smith with a beautiful silver loving cup in appreciation for the influence he had upon their lives.

At this convention the NRI Alumni Association was formed, the first officers elected, and a unanimous pledge taken to work for the interests of the Institute. This was the first alumni association of graduates of any home study school, an association which has flourished continuously since, and which every graduate of recent or of long standing is eligible to join. Since then local Chapters have been organized in a number of cities. Among these, Baltimore, Philadelphia, New York, Detroit and Chicago Chapters are the strongest and most active. Baltimore Chapter was the first organized.

The first President of our Alumni Association, elected in 1929, was, during the war, Assistant Director, Broadcasting, Office of Censorship for the United States Government. One of the first Vice-Presidents, Mr. Hoyt Moore, who was present in Washington in 1929 when the Alumni Association was organized rose to a State Senator in Indiana. Many of our Alumni members have risen to high places in the business world.

Our story is getting long yet we have had barely space to mention subjects about which we would like to write whole pages. We'd like to tell you how with every development of Radio and every change in the industry we have strived to include the change in the Course. We'd like to tell you how we have increased the amount of information in the Course and the effectiveness of the training year after year with little increase in cost to the student.

We'd like to take you behind the scenes here at NRI and show you what a competent, aggressive, conscientious staff has been built up to serve students, show the equipment and methods developed to serve quickly, intelligently, and helpfully. We'd like to bring you into some of our staff meetings here where you could hear us thrash out our student problems and our own, so that the actions we take and the advice we give represent not the hasty thought of one individual but the considered judgment of all those competent to contribute. While Mr. Smith no longer grades the lessons, and Mr. Dowie cannot personally answer all student letters, nevertheless, their ideal of personal service is our daily inspiration.

We'd like to tell you about each member of our staff—who he is, where he came from, his qualifications, and what he does to make our training or service more worthwhile, just as we'd like to get acquainted with scores of students whom we never see.

We'd like to show you our three separate laboratories. These are for research and development, one for Radio receivers, one for Communications equipment and one for Television.

We'd like to show you some of our student records. You'd see records of students and graduates in almost every branch of Radio and in almost every foreign country and colony, besides every state in the Union and every province in Canada. You'd see the records of students assigned to us for vocational training by the Rehabilitation Boards of thirty-five of our forty-eight states, the Territory of Hawaii, and Canada. You'd see records of thousands of war veterans who enrolled with us through the GI Bill of Rights. You'd see records of men who have risen high in government and industry, yet nevertheless acknowledge gratefully the debt they owe the National Radio Institute, and above all you'd see records of that steadily growing body of graduates who, through this training, have won independence and advancement for themselves in Radio.

In 1945, Mr. J. E. Smith, brought his son, J. Morrison Smith, into the Institute and took him under his wing. Young Mr. Smith is a graduate of Worcester Polytechnic Institute, as is his father. For eight years before coming with NRI, J. Morrison Smith worked as an Industrial Engineer with United States Steel and DuPont. When J. E. Smith felt his son had received enough "hard knocks" in the outside business world to prepare him for an executive position at NRI, Morrison joined us. He is assistant to Mr. E. L. Degener the General Manager and in 1947, upon the death of Mr. E. R. Haas, young Mr. Smith, now thirty-three years of age, was made Secretary of the National Radio Institute, a position he is filling in the genuine J. E. Smith tradition.

This is our annex located two blocks from our main building. We own and occupy every inch of our 17,500 square feet of floor space.

During the war we did our bit too. In January, 1942, we mailed bulletins at the expense of the Institute to all NRI graduates and students telling them of the U. S. Signal Corps need of Radio men in civilian jobs. More than 3,000 NRI men responded, and the Signal Corps Colonel in charge of this activity informed us that the Signal Corps "employed HUNDREDS of these men." In May, 1942, we furnished the names of 1,000 graduates for possible Civil Service employment by the Signal Corps. Signal Corps Officers of various Corps Areas wrote these men about jobs available and employed many of them.

Recently NRI completed and announced a new course in Radio-Television Communications. This new course was prepared by the NRI staff, with the cooperation and advice of leading authorities at the U. S. Bureau of Standards, Engineers from broadcasting stations, consulting radio engineers, a prominent research physicist, a famous mathematical physicist, and professors of well-known universities and colleges. It took more than four years to write and prepare this new course. It includes both the theory and practical experience a student needs for a job in Radio-Television Communications. The course includes seventy-eight lesson texts and nine big kits of Radio parts. The student builds circuits, tests them under operating conditions, observes the sources of failure. He builds an actual working model of a transmitter representative of a 250-watt to a 5-kilowatt commercial high-power high-voltage transmitter. Already this course has proved very popular for the student who wishes to specialize in Radio and Television Communications.

Here at NRI we are thinking and planning for the future Radio world as we expect it to be. Great as has been Radio's growth in the past—we foresee even greater growth ahead. More Radio men and BETTER TRAINED Radio men will be needed than ever before. NRI training must be up to date, and you may rest assured we are keeping it that way. It must be MORE PRACTICAL, and we are often making changes like this, slipping them quietly into the Course for the benefit of our students.

With Television definitely here we have been busy for years incorporating Television in our training. Now graduates of the Institute are Teletricians as well as Radiotricians. It is our aim to build on the past, not to live in it, and to build for the future—the future of our students and graduates.

Yes, the most important part of the story of the Institute is not the record of past events, not the story of what we have done, but the story of what we are doing today; that, and the day by day achievement of NRI students and graduates.

As we finish our thirty-fifth year and launch strongly into our thirty-sixth, with all it promises, we renew to every present and future student our pledge to train him thoroughly for today's needs and tomorrow's opportunities.

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 and H. J. Rathbun Are Nominated for President Of NRIAA for 1950

The polls for voting for nominees to hold office during 1950 were closed on August 25. The tally of ballots showed that our Alumni members have chosen Harvey Morris of Philadelphia, and H. J. Rathbun of Baltimore as nominees for President of the NRI Alumni Association during 1950.

Both candidates have served several terms as Vice President. Both have served several years as Chairman of their own local chapters. Both have always been very regular in their attendance at chapter meetings, have made many personal sacrifices to aid their fellow Alumni members, and either will make an excellent president of our organization which now can boast of more than 8,500 members located in every state of the Union, every province in Canada and a number of foreign countries.

To be chosen as a nominee for office in this international organization is in itself a real honor. Our congratulations to these nominees.

For Vice Presidents we have eight nominees. Four are to be elected. The nominees are F. Earl Oliver of Detroit; Alex Remer of New York; Lloyd Immel of Chicago; Oliver B. Hill of Burbank, Calif.; P. A. Abelt of Denver, Colorado; Charles H. Mills of Detroit; J. B. Gough of Baltimore; and Claude Longstreet of Westfield, N. J.

Mr. Abelt, Mr. Hill, and Mr. Longstreet have no chapter affiliations. It is gratifying to have some of our nominees for office chosen from among that great majority of our members who do not have chapter support. It gives good balance to our ticket.

Now for the election. Choose between Harvey Morris and H. J. Rathbun for President. Vote for one or the other. Choose also your Vice Presidents from among the eight nominees for that office. Vote for four. See ballot on page 27. It will take but a few minutes to mark it.

Polls close at midnight October 25, 1949. Mark your ballot now and mail it promptly as the ballot suggests. All NRI Alumni members are eligible to vote. Your interest in the choosing of our Alumni officers will be appreciated. If you are a member of the NRI Alumni Association by all means vote—before October 25. Do it now.

New York Chapter

The big event since our last report was a visit to our chapter by Mr. J. E. Smith. One hundred and five members were present to greet him.

Mr. Smith gave us one of his deeply sincere talks which went home with all of us. To put it briefly, Mr. Smith pointed out that more and more is it necessary for a man to have some form of specialized training. He placed particular emphasis upon the quality of perseverance—to stick to the purpose of completing anything once begun. Too many men, knowing their short-comings resolve to do something about it, only to weaken when the undertaking gets a little tough—put it off—find excuses—lose interest, and finally quit. Men like that seldom get anywhere, pointed out Mr. Smith, because they have not learned how to be masters of themselves.

You can bet a lot of our members went home with new determination to dig in to their Radio lessons and Radio work after hearing this inspirational talk by the President of our school.

A highlight was when our member, Otto Schwarz was called forward, and with the eloquence of Bert Wappler, a gift was given to Mr. Smith. It was a hand made plaque, a picture of J. E. Smith made by Mr. Schwarz of a mixture of glue, zinc white, gilders leaves and some terra cotta paint powder covered over masonite. To make such a plaque the surface is covered with a steel bar. Then the design is made by a needle in a special holder. Oil paint is rubbed over the surface, then turpentine is washed over the surface, then varnish is applied for permanence. The beautiful frame is made to look antique. Mr. Smith fairly beamed in appreciation and said he would guard it as one of his prized possessions particularly because it was given to him by one of his students and in this very impressive manner.

There was good entertainment by our own members including a very humorous skit by Alex Remer, W. Fox and C. Gomez. It had something to do with the fallacy of expecting something for nothing. A sign which read "Izzy Dough" for easy money, was the tip-off on what was to come. Those three fellows are real comedians.

Among those who spoke were Bert Wappler, our Chairman, Alex Remer, who acted as Master of Ceremonies, Lou Kunert, Frank Zimmer, and L. L. Menne, who accompanied Mr. Smith to N. Y.

All students and graduates in this area are welcome at our meetings which are held at 8:15 p.m. on the first and third Thursday of each month, at St. Mark's Community Center, 12 St. Mark's Place—between 2nd and 3rd Avenues, in New York City.

LOUIS J. KUNERT, Secretary

Election Ballot

All NRI Alumni members are urged to fill in this ballot carefully. Mail your ballot to National Headquarters immediately.

FOR PRESIDENT (Vote for one man)

- ☐ H. J. Rathbun, Baltimore, Md.
- ☐ Harvey Morris, Philadelphia, Pa.

FOR VICE PRESIDENT (Vote for four men)

- ☐ F. Earl Oliver, Detroit, Mich.
- ☐ Alex Remer, New York City, N. Y.
- ☐ Lloyd Immel, Chicago, Ill.
- ☐ Oliver B. Hill, Burbank, Calif.
- ☐ P. A. Abelt, Denver, Colo.
- ☐ Chas. H. Mills, Detroit, Mich.
- ☐ J. B. Gough, Baltimore, Md.
- ☐ Claude Longstreet, Westfield, N. J.

SIGN HERE:

Your Name ....

Your Address ....

City .... State ....

Polls close October 25, 1949. Mail Your Completed Ballot to:

C. ALEXANDER, BOOKKEEPER
NATIONAL RADIO INSTITUTE
16th and U Streets, N. W.
WASHINGTON 9, D. C.

NRI ALUMNI ASSOCIATION

In the reception room at National Radio Institute is a simply-bound book—black with red corners—which today is one of the most prized possessions of the Institute. You may have seen this book yourself—your own name may be inscribed in it—for this priceless book is the register in which all visitors to NRI are invited to inscribe their names.

Opening to the first page of this interesting volume, we find that the first seventy-five names are all dated November 23, 1929; these are all graduates who came to the Institute on that day to participate in the celebration of the Fifteenth Anniversary of National Radio Institute. To commemorate the event and to join together fraternally and constructively the far-scattered Alumni of the National Radio Institute, this group of men on that day declared a convention and founded the now well-known NRI Alumni Association. Thirty-four states from Maine to California, from Florida to Minnesota, were represented in the first roster of members, along with four Canadian provinces and several countries outside of North America. Typical NRI graduates were these seventy-five Alumni, each respected in his community, each well on his way toward a successful career in Radio.

That was twenty years ago. So, as NRI this year celebrates its Thirty-fifth Anniversary, we of the Alumni Association simultaneously celebrate our Twentieth Anniversary.

Our record for the past twenty years is one of which every member—every NRI student and graduate—can well be proud. We were the first Alumni Association ever to be organized among graduates of a home study school; today, with more than eighty-five hundred members from every state of the Union, from every Canadian province, and from a number of foreign countries,

The Charter Members of NRI Alumni Association, photographed in 1929, when our Alumni Association was formed. On this occasion our Charter Members were addressed by the late Charles Curtis, then Vice President of the United States, who is also shown in the photograph, first row, fifth from the right.

CELEBRATES 20th BIRTHDAY

we have one of the strongest Associations of this kind in the world. Our members have profited from their contacts with fellow Alumni through Chapter meetings and through our official publication NATIONAL RADIO NEWS, and we in turn have guided the Institute in its dissemination of Radio knowledge.

The picture at the left was taken at the time the NRI Alumni Association was formed in 1929. In this group, first row fifth from the right, is Charles Curtis, then Vice President of the United States, who congratulated our members upon their fraternal spirit and their foresight in binding together for the common good of servicemen and technicians everywhere.

That convention in 1929 was brought to a close with a banquet at the Arlington Hotel in Washington. As part of the ceremony, a handsome loving cup was presented to the National Radio Institute through its President, Mr. J. E. Smith. The actual presentation was made to Mr. Smith by the then newly elected Vice President of the Alumni Association, Mr. Hoyt Moore, of Indianapolis, who later became a State Senator in Indiana.

On the face of the cup is engraved the following legend: "Fifteenth Anniversary of the National Radio Institute. Presented to J. E. Smith, President, by the NRI Alumni, November 23, 1929." On the opposite side is engraved the name and state of residence of each charter member of the Alumni Association.

Mr. Smith — Honorary President of the NRI Alumni Association—and all of the members of our Executive Staff extend greetings to the members of the Alumni Association on this occasion of their Twentieth Anniversary and congratulate the seventy-five original members, for their devotion in carrying out an ideal which was founded upon the solid principle that in union there is strength.

This loving cup was presented to NRI in 1929 by the Charter Members of the NRI Alumni Association. It is handsomely engraved, including the name and state of residence of each Charter Member.

Detroit Chapter

This is a belated report of our annual dinner party which is always attended by our ladies. This year we held forth at the Lutheran Veterans Hall. The hall was ideal in every way for our purposes, and while the dinner did not come up to our expectations, in all other respects the party was a complete success.

Our sincere thanks to Chairman Mains, Harry Stephens, Earl Oliver, E. C. Baumgarth, Harold Chase, Leo Blevins, Steve Novosel, and others who took care of the arrangements. In the thick of things someone dropped Stephens' camera.

Harold Chase acted as Master of Ceremonies. He really is a natural. Had plenty of good-natured kidding about many of the members. Harold is a very entertaining speaker and keeps up a ready fire of interesting remarks.

Vice President Chas. H. Mills was presented with a gift by Chairman Mains. It was a lead pencil with a piece of strong cord attached to it. It was slipped through the opening in the lapel of the coat. Then the trick is to get it off. Some fun! Chase gave one to Menne, who was our guest from Washington, with instructions to present it to Mr. J. E. Smith. Mr. Smith says, as soon as he has time, he is going to figure out the trick because he does not want to get caught as Mr. Mills did. Sends thanks to all the ladies and gentlemen in Detroit for thinking of him during the hours they were "cutting up" a bit in relaxation.

Floyd Buehler came in for some well-deserved praise. He was presented with a tripod for his camera, with Earl Oliver acting as spokesman. Photography is a hobby with Floyd. Radio is his business. In fact the gift was to show him that his ability as an instructor is greatly appreciated by Detroit Chapter members. Buehler is a member of the staff of instructors at Electronics Institute in Detroit, through whose courtesy our meetings are held in their very modern classrooms.

Val Guyton, back in Detroit after an extended road trip, was present. He was warmly congratulated because of having been promoted to Division Freight Agent for the Wabash Railroad. Says there is much activity in communications equipment by his company.

Program Committee has been at work on fall and winter schedule of meetings. By all means attend regularly. You can't afford to miss out on the Radio and Television lectures.

We meet at 8:15 p.m. every second and fourth Friday at Electronics Institute, 21 Henry St., Corner of Woodward (fourth floor).

F. EARL OLIVER, *Recording Secretary*

Phila-Camden Chapter

New members are Harry Euker, Z. Vukasovich, E. F. Platti, Earl Vogt, Julius Cohen, Alfred C. Lemper, Carmen Piccinini and Robert F. Ross.

Our very fine Chairman, Harvey Morris, is doing a grand job for our members with his Television talks.

Have an invitation to visit Baltimore Chapter. These get-to-gethers are always good fun.

Help us make this fall and winter season our best ever by attending our meetings on the second and fourth Mondays of each month at 4510 Frankford Ave. in Philadelphia. We open meetings at 8:00 p.m.

ROBERT L. HONNEN, *Secretary*

Chicago Chapter

Opening fall meeting should get us off to a good start. Here is the program. Mr. Jack Cappels of Tele Service Co. will lecture and demonstrate on Television. Mr. Larry McGee of Precision Electronics Co. will lecture and demonstrate on Amplifiers and Signal Tracers. We will have movies on Electronics and refreshments will be served. How does that sound!

Our Harry Andresen, who is Alumni Association President this year, spent two days in Washington on Alumni business. He persuaded the Executive Secretary to attend our next meeting in Chicago.

Visit our new laboratory. We meet the second Wednesday of each month at room 1745 American Furniture Mart, 666 Lake Shore Drive. Enter building for our meeting hall on the McClurg Court side.

RICHARD, MCCOY, *Secretary*

Baltimore Chapter

Talk is about our big meeting scheduled for September 27 (as this goes to press) at which time we expect some visitors from Phila.-Camden chapter as well as L. L. Menne and J. B. Straughn from Washington.

New members are Harry Kreitz, Anton Vestby, Frank Kolarik, R. Bryant and H. Matzor.

Television talks by Mr. C. M. Whitt are of great interest and we have other good talks, too, as well as some practical demonstrations.

We meet every second and fourth Tuesday, at 8:15 p.m., Redmen's Hall, 745 W. Baltimore St. Don't wait for a notice of meeting. You are welcome, any time.

ARTHUR F. LUTZ, *Secretary*

Here And There Among Alumni Members

We were pleased to have many NRI Alumni Association Members visit us during the vacation season. Mr. Guy K. Achey, of Lebanon, Pennsylvania, along with his wife and two children, paid NRI a very pleasant visit. Graduate Achey has a spare time Radio shop.

———n r i———

Alumnus A. J. Hogue, of Pittsburgh, Pennsylvania, stopped at NRI. He was spending a few days in Washington with his family. Radio is Hogue's hobby, and he plans to take the new Communications Course now offered by NRI.

———n r i———

Graduate Marian A. Kinnett, of Wilmington, Ohio, appeared in person at NRI to join the NRI Alumni Association, and he also purchased several NRI Test Instruments.

———n r i———

Another Ohioan, Graduate James W. Hutton, of Cincinnati, Ohio, along with his wife and son, included NRI as a point of interest during their vacation tour of Washington, D. C.

———n r i———

Peter George, of St. Paul, Minnesota, had a chat with Chief Instructor Dowie at the time of his visit to NRI. Mr. George has a spare time Radio servicing business, and works full time for Western Electric, thanks to his NRI training.

———n r i———

Mr. Leopolk Meades, of Panama City, Panama, who graduated from NRI in 1925, was a visitor at NRI. Mr. Meades attended the International Radio Conference in Washington, as a delegate from Panama. Note the date of his graduation—24 years ago.

———n r i———

Clifford M. Whitt and Frank Ingram of Baltimore Chapter have opened a radio and television shop at 1510 N. Gay St., in Baltimore. Good luck!

———n r i———

We were pleased to meet Lieutenant Commander Howard C. Arnold, of Beverly, Massachusetts. Lieutenant Commander Arnold has been stationed in the Philadelphia Navy Yard, assigned to Naval Communications. He is also an active amateur, call W1RXE or K3USN.

We had an interesting talk with Flying Officer Kenneth Cooper, of East View, Ontario, Canada. Graduate Cooper is serving as a flying officer in a transportation squadron of the RCAF. His military duties brought him to Washington.

———n r i———

Alumnus Joseph E. Collins, of Arlington, Virginia, has an interesting position. He is in charge of maintenance of all Electronic, Radio, and Television equipment in the local Statler Hotel here in Washington. He is practically his own boss, and likes his work.

———n r i———

Francis H. Fingado, of Denver, Colorado, was recently elected President of his local "Radio-Television Service Guild." This is quite an honor. Fingado keeps his Radio and Television service shop open six days a week, and is also attending night classes at the University of Denver, which include work in Television.

———n r i———

We received word that Graduate Roger D. Raymo, of Knoxville, Tennessee, is soon to be connected with the Atlanta Industrial Laboratories, where he hopes to carry on research and development in the industrial electronics field. Congratulations on your new position, Graduate Raymo!

———n r i———

Graduate Samuel O. Fonville, 708 W. 3rd Street, Pecas, Texas, tells us he has an excellent Radio shop, with more work than one man can handle. He would like to locate another NRI Graduate who might be interested in purchasing half interest in his business.

———n r i———

Norman P. Fornoff, Pekin, Illinois, now has his amateur call, W9EDY. He is running 330 watts on 10 meters, and expects to go on 2 meters with 60 watts.

———n r i———

Graduate J. Tarrant, of Melbourne, Victoria, mailed us some interesting newspaper clippings pertaining to the first full demonstration of Television in Melbourne.

———n r i———

Miss Mary Frances Brinkley and NRI Graduate James H. Bangley, Jr., were recently married at Cypress Chapel, Virginia.

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