NATIONAL RADIO NEWS

Silver Anniversary Issue

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

Romance of Radio 1914 to 1939

By L. J. MARKUS,
Technical Editor

L. J. Markus

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 Major Bowes' gong 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—when more than five thousand licensed amateurs were on the air, operating with any power which they could afford and on any frequency they felt like, and another five thousand were estimated to be operating without licenses on the theory that the only crime was to get caught. "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 ghosts of these stations are still lingering in the ether; Arlington can still be heard sending out its famous time signals, and Nauen can still be picked up midst an almost graveyard silence on the upper wavelengths. Eiffel Tower still has the same old call letters, even though it has now been modernized to the extent that it can even broadcast television programs. 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 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 multirange 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! And what a thrill to watch the weird blue sparks jump across the face of the crystal as the "cat's-whisker" was moved in a darkened room; here was undisputable evidence of actual power being obtained from the air!

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 by 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 equipment in transmitters was being installed and maintained by trained factory experts, many of whom were N. R. I. 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 199 tubes were going bad 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 "tinkerer" 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.

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.

"Amos n' Andy" went on the air for the first time this year. 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 The Atlantic Ocean was bridged by 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 cold-cathode tubes with indirect 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 many 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 re-

ceivers. 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 adventurous 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, and arguments as to the relative advantages of glass and metal envelopes still rage even today. 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 had automatic frequency control, and factory representatives groped blindly through mazes of vector diagrams in trying to explain their latest brain child to servicemen. 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 Green-winking cathode ray tuning eyes caught the public fancy, along with slide rule tuning dials and sleekly veneered cabinets for consoles. Events of the presidential inauguration were broadcast to the world over one of the largest Radio hook-ups in history, with many N. R. I. men at the controls in Washington. RCA conducted extensive experiments with cathode ray television.

1938 Push-button tuning was now being considered almost essential. High-fidelity receivers giving only local station reception made their appearance. Standards for television systems were approved by 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. An RCA Radio operator handled the Radio equipment on this flight. 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 Television emerges from around that corner, with regular high-fidelity television broadcasts scheduled to start in the spring of the year. High-definition 441-line commercial television receivers make their appearance in cities served by television transmitters. "Amos n' Andy" are still going strong on the air waves. Time tuning and remote wireless control are the two outstanding features of the year's new Radio models. Radio cabinet designers match accepted classic furniture styles with many console units. Automatic frequency control is no longer re-

quired to correct for errors in push-button tuning systems, for the development of adjustable iron-core coils and zero-temperature-coefficient condensers makes electrical tuning systems entirely satisfactory for many sets. Improved mechanical push-button tuning systems are also used in many midget sets. High-fidelity cabinet baffle arrangements such as the acoustic labyrinth are becoming more and more prevalent among higher-priced receivers. Transmitter power in this country is still limited to 50 kw., with the single exception of station WLW which has an experimental license for 500 kw. In Europe, where Radio is still known as "wireless," there is no limit to the amount of power, and up to 1,000 kw. is being used by some stations.

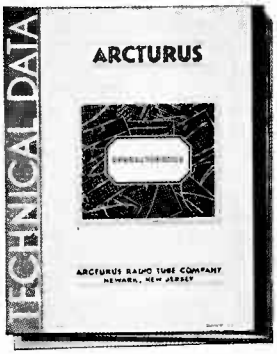
Trained Radio men find more opportunities for adventure, romance, excitement and success in Radio today than ever before in history. This is just as true today as at any time in the past quarter-century; an ambitious man cannot make a wiser choice than Radio for his career in life.

———*n r i*———

New Arcturus Characteristic Chart

In addition to giving complete data on 179 Arcturus tube types together with pin connection charts, etc., the new Tube Characteristic Chart issued by the Arcturus Radio Tube Company of Newark, New Jersey, contains complete listing of ballast tube data.

Formulas are included for the serviceman so that he can quickly ascertain just what standard RMA type number tube should be used in any



set, regardless of the original ballast units which, more often than not, carry only a private part number.

The chart has been prepared either for convenient wall mounting or for use in standard size data files. Copies may be obtained by servicemen and dealers, either through Arcturus jobbers or direct from the factory in Newark, N. J.

Dollars in Empty Belfries

A system of amplified chimes installed i eastern church not only appears to have s the problem of the empty bell towers in A can churches, but to have pointed to an sive and profitable market for sound spec and dealers.

This system utilizes as its source a set of twenty one standard tubular chimes such as those used by musicians. These are played from a small keyboard attached to the organ console and their sound is picked up by two crystal microphones, which feed into the mixing panel of a 250-watt amplifier specially developed for this service by Transformer Corporation of America. The heavy-duty, horn-type loudspeakers, four of which are mounted in the bell tower, are fed through a low-impedance line and are capable of handlin up to 160 watts output.

Centrally located in a city which has an area of approximately two square miles, it has never been found necessary to operate the system at full capacity. So realistic is the reproduction of this system that only a handful of the populace is aware that the church tower does not house a genuine carillon consisting of massive bells.

———*n r i*———

Song Birds Attract New Customers

Song birds all year around in busy Jackson Boulevard, Chicago, seems like a bit of exaggeration but it is true nevertheless. An amplifying system in Vaughan's Seed Store carries the strains of the throaty warblers to the street where they easily attract the attention of pedestrians.

This amplifying system has proved to be a very important factor in the improvement of the business of the Vaughan Seed Store in that it has called the attention of many pedestrians to the fact that they do have a pet department in their store. This has been demonstrated by the number of people who have come into their store to inquire whether or not the sounds were from records or actually birds, and how it was done. Many of these people, of course, made small purchases, became acquainted and are now regular customers. To hear these birds singing outdoors on a cloudy bleak day has an unusual appeal.

———*n r i*———

If you have great talents, industry will improve them; if moderate abilities, industry will supply their deficiencies. Nothing is denied to well-directed labor; nothing is ever to be attained without it.

THE STORY OF THE NATIONAL RADIO INSTITUTE

By GORDON BIRREL,
Personnel Director

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 one associated in any way with the Institute, whether 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 enriches our lives in so many ways, that few think of their humble beginnings and early struggles. Yet it is only fifty years or so since Heinrich Hertz set up his first crude transmitter, measured the velocity and length of the waves he generated, and paved the way for a host of early pioneers and inventors, including Marconi, 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, and one year after them, in Washington, D. C., E. R. Haas came into the world. Thus the founder, the organizer, 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.

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 maritime communication.

By the turn of the century, transoceanic wireless transmission 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 born. 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 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, in the meantime, 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, was born. 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 skeptics, 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.

The World War 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, who had secured his education 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.

J. A. Dowie, Chief Instructor
22 Years of Service with N. R. I.

The heavy demands made upon Mr. Smith for instruction left him little time for the school's business affairs, and E. R. Haas became associated with the school in charge of advertising and organization matters.

Thus in the first two years the school was organized, the present management had taken charge, and the policies that have guided us through a quarter 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. During 1918 Mr. Haas was asked by the U. S. Government to do Radio work in connection with the Army Officers' School at Yale University.

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, about half way between the old Post Office Department Building and the U. S. Treasury, a convenient, central location on historic Pennsylvania Avenue. About this time also the Service Radio School located nearby was taken over and absorbed.

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 irresistible 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-Coolidge 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 "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 transmitting in the United States and broadcast station licensing was begun. Successful ship-to-shore Radiotelephone experi-

ments 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, 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 National Radio Institute graduates.

Radio grew complex and technical. The Institute adapted its training and methods to meet 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 the southeast corner of 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.

This is our twelfth year in our permanent home. Located on Washington's finest boulevard, 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 building is simple and substantial. It is 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, and our latchstring is hanging out for you.

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 N. R. I.'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 Courses 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. Today, in our various Courses, we use approximately 115 books, including reference books, besides job sheets and other instruction material, supplemented by a library of diagrams, articles, and books on every imaginable phase of Radio and related subjects.

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, the machine now furnished N. R. I. men interested in learning the Radio code.

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 seventeen years, six distinct series of these outfits have, one after the other, been developed to meet increasingly complex and more modern 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,

Our Home—Owned and Entirely Occupied by N. R. I.

beam transmission had been developed to a practical commercial stage, and successful Radiotelephone 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 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 a member of its educational committee since the beginning, besides serving in other capacities, and other members of the Institute staff have participated actively in Council meetings 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 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 nationwide 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 Mr. C. Francis Jenkins, the inventor. In addition to these four major broadcasts, the Institute has been on the air on many other occasions.

The year 1929 was marked by the pooling of Radio patents, the beginning of popularity of console and TRF receivers. It was in addition the fifteenth anniversary of the National Radio Institute, a momentous year in our history.

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 our Advisory Board was created in 1929. Invitations were extended to and accepted by men 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., 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 Mr. Harry Diamond.

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 graciously posed with them and members of the Institute Staff for photographs and sound moving pictures.

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 had upon their lives.

At this convention the N. R. I. 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.

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 striven 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, multiplying several times over the value of the training given with little, if any, increase in cost to the student.

We'd like to take you behind the scenes here at N. R. I. 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 tell you about the black days of 1929, 1930, and 1931—how we pulled our belts tighter and tighter, took our cuts in salary, yet did not raise our price for the Course nor cheapen N. R. I. training in any way. On the contrary, it was in 1930 and 1931 when things were at their worst, that we wrote our modern Course, investing over $30,000 that could not well be spared to make the term "Radiotrician" and the letters "N. R. I." stand for something more modern and more important than ever before.

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 every foreign country and colony, besides every state in the union and every province in Canada. You'd see the record of students sent to us by 37 state rehabilitation and vocational training boards, records of blind students, and countless others—women who have made names for themselves in Radio alongside of men, men who have taken our Course, gone to sea as operators, and in the course of duty saved many lives, 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 that steadily growing body of graduates who through this training have won independence and advancement for themselves in Radio.

We'd like to tell you about our plans for this year and for next year, too—more television, more improvements in text books and practical outfits, improvements that will be quietly slipped into their proper place in the Course as fast as they can be realized.

With television immediately on our horizon we have been busy for years incorporating television in our training. Now graduates of the Institute are Teletricians as well as Radiotricians, and the newer term has also been registered for their identification and protection. 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 N. R. I. students and graduates.

As we begin our second twenty-five years we renew to every present and future student our pledge to train them thoroughly for today's needs and tomorrow's opportunities.

SOME FOLKS AT N. R

1. E. L. Degener, Publicity Director, and right hand man to Mr. Smith and Mr. Haas. 2. Agnes Swann, Lillian Ensor and Betty Gertzikoff recording incoming mail. 3. Mary Audas, Receptionist, the "voice with a smile." 4. Margaret Matthias, Secretary to Mr. Degener, and plenty nice. 5. Albert Doig, head of the Production Department. 6. Rhoda Bailey, congenial Secretary to Mr. Birrel. 7. Virginia Hayghe of the Filing Department. 8. Hal Luber, Director of Student Service, always busy. 9. Smiling Silvia Sachs of the Student Service Department. 10. A glimpse of the Stenographic Department, with Nora Turvey in the foreground. 11. Gertrude Payne, another of our efficient workers. 12. B. S. Lavins, Comptroller, Accountant Extraordinary. 13. Ida Soldano, competent Secretary to President Smith. 14. Bill Saunders in serious thought. 15. Mildred Alligood, the always pleasant Secretary to Vice-President Haas. 16. A poor picture of a fine fellow, Stuart Armstrong, Registrar. 17. L. Wells, Engineer. 18. Charles Alexander, Bookkeeper.

UGHT IN INFORMAL POSES

19. Carl Weber, Purchasing Agent, seriously at work. 20. Technical Staff members are intrigued. 21. Chief Dowle and his congenial smile. 22. Joseph Kaufman and Paul Thomsen knock out a hard one. 23. Margaret Mantel, loyal and efficient worker for the Alumni Association, Secretary to Mr. Menne. 24. George Rohrich and J. B. Straughn, Staff Consultants. 25. Isabelle Fant, Head of the Stenographic Department 26. "Hi ya, Peggy Kendall." 27. Dave Smith and Lou Menne talking it over. 28. Charles Morton and James Hollingsworth, Assistants to President J. E. Smith. 29. Julius Edwards of the Printing Department. 30. Larry Floyd, ditto. 31. Guess who? Gordon Birrel, Personnel Director. 32. Ted Rose and Bill McKenna of the Student Service Department surprised by the cameraman.—The editor regrets that lack of space makes it impossible to include all of the 110 people who make up the N. R. I. family. In subsequent issues of the News we may be able to carry snapshots of others.

Joseph Kaufman

Modern Servicing Technique

By JOSEPH KAUFMAN

N. R. I. Director of Education

EDITOR'S NOTE: *In the twenty-five years since the birth of N. R. I., many different techniques for servicing radio receivers have been developed. Mr. Kaufman pioneered in the development of many of these techniques, and incorporated some of them in the N. R. I. Course even before their presentation in technical radio publications; never, however, has he claimed that any one technique will fit all jobs. This article explains how professional servicemen as trained today by N. R. I. are taught to diagnose and repair the most complicated of modern radio receivers with almost uncanny skill and speed by varying their techniques to suit each particular job.*

NEED for a Flexible Technique. A careful analysis of the techniques advocated by various radio servicing experts would reveal that each technique is entirely satisfactory for certain types of jobs, but cannot be applied blindly to every job. Although these men speak from experience, they have allowed their own personal preferences to over-ride the obvious fact that no one definite technique of servicing can be the best for every single job. The widely varying conditions encountered in defective radio receivers and the changes in receiver design from year to year make it necessary for the Radiotrician to have a flexible and constantly changing technique. The N. R. I. Course trains Radiotricians to select the best method of diagnosis for each job, and to combine diagnosis with a logical test procedure which can be applied most rapidly and most efficiently to the particular conditions encountered. N. R. I. teaches you all of the tested techniques, pointing out the advantages and disadvantages of each and showing how these techniques can be modified to meet the servicing problems of today and those of the future as well.

Causes of Defective Receivers. The common causes for defective receivers are so elementary that they are pretty well known even by the radio mechanic type of serviceman, but some fail to realize that a receiver can be defective even though no parts in it are defective. A review of the fundamental causes for receiver failure will serve to clear up this situation.

When a receiver has hum, noise, poor selectivity and sensitivity, distortion, low volume, is completely dead or is intermittent, the trouble *may be* a weak, leaky, gassy or dead tube, a shorted or open resistor, coil, condenser, connection or other part, or a connection which is intermittently shorting or opening due to chassis heat or to vibration. With these causes in mind, the radio mechanic might proceed to test all tubes and all parts on the chassis with the hope of locating the defective part, and may waste hours looking for something which does not exist. For example, lack of selectivity accompanied by inability to pick up distant stations may be due to improper receiver alignment. Various types of distortion, as well as interference between stations, can also be due to improper alignment of receiver circuits. Improper alignment of the moving elements in a loudspeaker may cause peculiar distortion effects. The very design of the receiver itself may result in defects which are present from the instant the receiver leaves the production line, and which generally cannot be corrected without making changes in circuits and parts. Many new midget receivers have such poor selectivity that image interference or code interference will be unavoidable in certain locations. Other new receivers may have unstable local oscillator stages, which are so critical as to voltage requirements that general aging of the oscillator tube causes

lack of reception in certain sections of the tuning band.

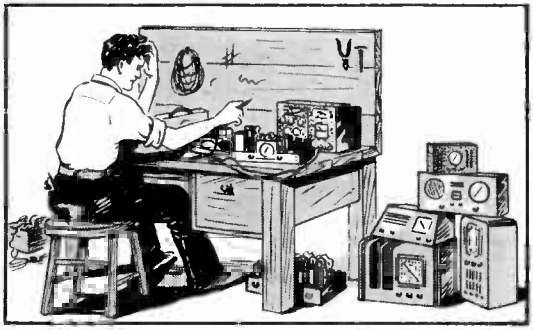
The ability to recognize improper operation which is due to circuit misalignment is very important in sound receivers and will be indispensable in the servicing of television receivers; equally important is the ability to recognize when poor performance is normal and cannot be corrected without circuit changes. Do not immediately condemn the manufacturer when you encounter a poorly-operated new receiver, for many of these sets are made to sell at low prices and perfection is not possible when cost is limited.

Choosing the Proper Technique. When a receiver is dead (does not play at all), the choice of a technique is quite simple. There are no improper operating symptoms to serve as guides, so after certain preliminary inspections have been made, you are compelled to begin a defective stage isolation procedure, followed by a logical test of the defective stage and finally by repair or replacement of the defective part or connection. No wide-awake, progressive serviceman would "tackle" a dead receiver by first testing all tubes, then checking each and every part and connection until he came to the defect; such a procedure is old-fashioned and wasteful of time and money. Radiotricians consider dead receivers as the easiest of all to service.

When a receiver operates improperly (hums, is noisy, distorts, has poor selectivity, etc.), the observable symptoms will be a guide in choosing the most logical procedures for locating the defective section, the defective stage, and finally the defective part or connection. The first thing to determine, however, is whether the trouble is due to a defect in a part or connection, to misalignment, or to the inherent limitations of the receiver circuits; the result of this analysis will determine the initial choice of techniques. Oftentimes the nature of the symptoms immediately suggests to a Radiotrician certain most likely causes which can be checked at once. Some servicing experts say that a complete defect-isolating procedure should be carried out as a routine matter even when likely causes of the trouble are known, while other experts believe it better to check the most likely causes first, and to resort to the systematic stage-by-stage elimination test afterwards. Personally, I prefer the latter procedure provided that the checking of possible causes is not carried so far that it degenerates into a guess-and-try process.

Intermittent reception calls for a somewhat different initial technique, followed by standard servicing techniques chosen according to whether the receiver is completely dead or is operating improperly during the intermittent condition.

Techniques for Dead Receivers. Even though a receiver is dead, it is still possible to find certain "tell-tale" clues pointing to the defective section or even to the defective part. Before beginning any servicing technique on a dead receiver, the Radiotrician always looks for these clues, checking to see whether the filaments of all tubes heat up, whether all top cap connections are in place and not shorting to tube shields, whether all tubes are firmly seated in their sockets, whether all parts are firmly anchored, whether antenna and ground connections are properly made, and whether the antenna system itself is in good condition. This inspection for surface defects ordinarily takes only a few minutes. If no defects are located above the chassis, the chassis is removed and the same inspection made for parts underneath. If no stations are heard but circuit noises are present in the loudspeaker, the Radiotrician immediately suspects trouble in the R.F. system, such as a defective local oscillator, a defective input sys-



Stumped! No technique; no training; guesswork fails on the first set of the day.

Clear sailing! Modern techniques and proper training rejuvenate receivers in one-two-three order.

tem, or a defective antenna. A simple check further isolates the trouble; disconnect the antenna system and place a finger on the antenna terminals. If local stations can now be tuned in, the antenna system is defective; if no stations can be heard, the local oscillator is probably at fault.

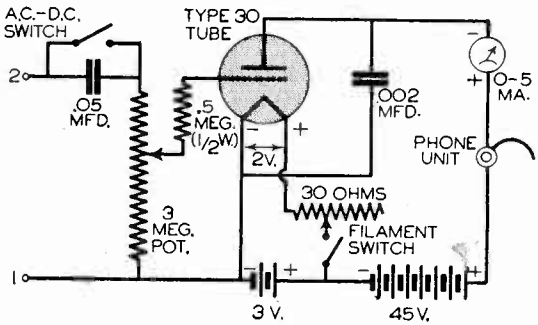
Having made sure that there are no surface defects, the Radiotrician proceeds to apply a stage-by-stage elimination procedure to locate the defective stage. Some servicemen prefer to make a complete check of all tubes before beginning this procedure, for shorted or open elements in tubes can cause dead receivers. Since most men test all tubes anyway before returning a chassis to the customer, now is as good a time as any for this work, even though it would be more logical to check only the tube in the stage found defective.

Isolating the Dead Stage. There are two different modern techniques for isolating the defective stage in a dead receiver: *1.* The circuit disturbance test; *2.* The dynamic stage-by-stage elimination test. The first is easy to apply, but the results are sometimes questionable; the second takes more time to apply but gives positive indications.

The circuit disturbance test involves shocking each stage in a receiver in a logical order, working from the output stage to the input stage, while the receiver is in operation. A stage can be shocked either by pulling out a tube and returning it, by shorting the plate or grid of a tube to the chassis momentarily, by touching or opening the grid lead to a tube, or by removing and restoring the top cap connection to a tube. Shocking a stage in this way causes a plate current surge which is relayed through following stages to the loudspeaker, where it emerges either as a click or as a squeal. As you progress from the output to the input, the first stage which will not pass the disturbance is very likely the defective stage. The stage itself may give an indication when shocked, but the stage ahead of it (toward the antenna) will not. The local oscillator will not give a click or squeal when shocked; this does not destroy the value of the circuit disturbance test, for the condition of the oscillator can readily be checked by touching the antenna terminal with a finger, as previously explained. The circuit disturbance test may give a questionable indication if the disturbance gets around the dead stage by going through the power supply system. With experience, however, the intensity of the click will indicate when the disturbance is going around a dead stage.

Stage-by-Stage Elimination Test. A dynamic stage-by-stage elimination test is based upon the simple fact that a signal will not pass through the stage which contains the defect. This dynamic test may be applied in four different ways:

1. By using a fixed signal source and connecting an indicating device across the output of each stage in turn while working in a forward manner from the signal source toward the loudspeaker. The first stage which fails to indicate the presence of a signal is the dead stage. The signal source may be a station signal picked up by the antenna or may be the modulated R.F. output of an ordinary signal generator which is connected to the antenna and ground terminals of the receiver. The indicating device may be a simple one-tube detector with headphones, an indicating meter, or a more elaborate and more costly instrument which provides a variable-gain, variable-frequency R.F. amplifier for testing the preselector, a variable-gain, variable-frequency test I. F. amplifier for checking I. F. stages, and a variable-gain audio amplifier for testing audio stages, with each of these test circuits terminating in a detector and either an aural or a visual indicator.



Circuit of an easily assembled aural and visual vacuum tube indicator which has a host of uses in radio servicing. To check for a gassy tube or leaky coupling condenser, turn on the indicator, and close the A.C.-D.C. switch so as to short the input condenser in the tester. Note the meter reading, then connect the indicator leads across the grid resistor in the stage being tested (the receiver should be turned on several minutes before making this test). If the meter reading changes (indicating a voltage across the grid resistor), the stage has either a gassy tube or a leaky coupling condenser. If the changed reading persists when the tube is pulled out, the coupling condenser is leaky; if pulling the tube restores the original reading, the tube is gassy.

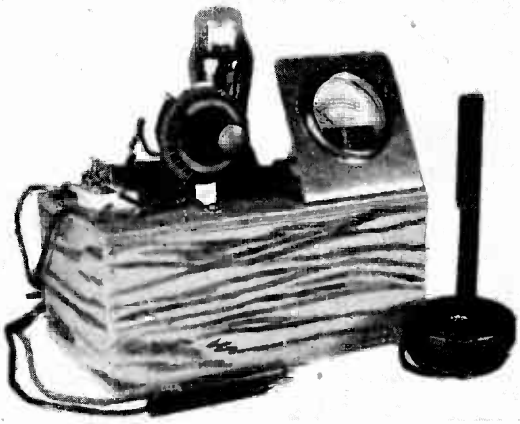
2. By using a fixed signal source just as in method 1 and moving the indicating device in a reverse direction (opposite to the direction taken by signals).

3. By using a fixed output-indicating device and moving the signal source in a forward manner, one stage at a time, toward the receiver output. The indicating device can here be either the receiver loudspeaker or a visual indicator con-

needed to the receiver output circuit. The signal source will be a signal generator set to the correct frequency for the input of the stage to which it is connected (for an antenna and ground terminal connection, set the S.G. to the frequency to which the receiver is tuned; for a connection to the input of the I.F. amplifier, set the S.G. to the I.F. value of the receiver; for an audio amplifier input connection, use an audio signal generator set to about 1,000 cycles.)

4. By using a fixed indicating device and moving the signal source in a reverse manner, one stage at a time, toward the receiver input. The signal source and the indicator are exactly the same as for method *3*.

No one of these four methods can be considered the best and used exclusively. The choice of methods for a particular job will depend upon



Completed aural and visual vacuum tube indicator for which circuit is given in this article. This unit makes a valuable addition to the essential test equipment of a Radiotrician.

the test equipment available, upon the ease of connecting it to the particular circuit involved, and to a certain extent upon the personal preference of the individual. I recommend a combination of methods *1* and *4*, carried out as follows: Set your ordinary R.F. signal generator to the I.F. value of the receiver, with the modulation turned on, and connect this signal generator either to the input of the second detector or to the output of the last I.F. amplifier stage. If the modulation tone is heard from the loudspeaker now when the receiver is turned on, the second detector and the audio system are operating properly; if no tone is heard, leave the signal generator connection as it is, and work through the A.F. system with a pair of headphones in a forward manner (method *1*) until the defective A.F. stage is isolated. If you know at the start that the trouble is in the A.F. system (the tuning indicator varies as stations are tuned in but no sounds are heard), you do not even need the signal generator; simply tune in a station with the receiver and carry out this headphone check in the same way. The tone or station signal will not be heard when the headphones are connected to the output of the defective stage.

If the signal generator tone is heard in the loudspeaker when you first connect the signal generator to the input of the second detector, proceed to move the signal generator to the input of each I.F. and R.F. stage in turn, working toward the antenna in a reverse manner according to method *4*. When you reach the mixer-first detector input, change the signal generator setting from the I.F. value to the R.F. value indicated by the receiver dial. The loudspeaker serves as the fixed indicator for this procedure. If the tone is not heard for the mixer-first detector connection when you change to the R.F. value, either the oscillator or its connection to the mixer tube is defective; if the tone is heard, proceed through the preselector with the signal generator set at the receiver dial frequency, until you reach the stage or circuit which will not pass the signal. An oscillator defect can be verified in this way: Connect the antenna to the receiver, tune the receiver to a local station, and tune the S.G. to a frequency above the receiver dial setting by the I.F. value while still connected to the mixer-first detector; if the S.G. tone is heard now, an oscillator defect is indicated, and the preselector is proved to be in good condition. The signal generator connection to the input of a stage should always be made in such a way that conditions in that stage are not altered.

Once the defective stage in a dead receiver is isolated, the electrode circuits in this stage can be checked for opens by connecting an ohmmeter between each electrode terminal and either the highest positive receiver terminal (the rectifier cathode) or the most negative receiver terminal (the rectifier plate in an A.C. receiver). If no open is found, each electrode circuit must then be analyzed for a defective part or connection. This is simple, straightforward circuit testing.

Techniques for Improperly Operating Receivers. The ability to analyze conditions existing in a radio receiver which plays improperly is of great importance if speed is to be attained in radio servicing. As I have already indicated, you can start a stage-by-stage elimination test immediately or can first check likely common causes for the observed trouble. The exact procedure will naturally vary with the nature of the improper operation.

A beginner in radio servicing will ordinarily find it best to begin the stage-by-stage elimination test (often called a dynamic test) immediately. Later, after acquiring experience, he will automatically check probable causes first. This latter approach is quite natural, not only in the radio servicing profession but also in all other fields where a defect must be found. A doctor, for example, will hardly ever check over the entire human body for possible troubles if the symptoms clearly indicate one of the more common ailments. It is a waste of time to carry out a stage-by-stage elimination test in radio servicing if all observable effects point to the loudspeaker as the source of distortion; likewise, if a glow is visible in the rectifier tube, the trouble is obviously a leaky filter condenser or a short in the power supply system, and if a noise is heard only when the volume control is adjusted, the trouble is obviously in the volume control itself.

Importance of Clear Thinking. Before making a single test, the Radiotrician thoroughly checks the performance of the receiver and considers carefully each symptom of improper operation. He is then able to decide whether the observed effects are caused by defects in parts or connections, by improper receiver alignment, or by the limitations of the receiver circuit. This preliminary diagnosis often leads directly to the defective section, stage or part, or else suggests a single simple test which will prove that the defect has been localized.

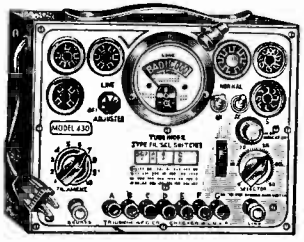
Here are some examples of clear thinking. A Radiotrician observes that while distant as well as local stations can be picked up, they are all heard at low volume and selectivity is apparently normal. Good selectivity combined with good signal pick-up eliminates the entire R.F. system, indicating a defect either in the audio amplifier or in the loudspeaker. A stage-by-stage elimination test with headphones or with a test audio amplifier and indicator will locate the defect.

If hum is heard only when a station is tuned in, the Radiotrician immediately identifies it as tunable hum and knows that it is getting into the signal circuit somewhere in the R.F. system. Clear thinking here isolates the trouble to the R.F. section, eliminating the need for checking the A.F. system or the loudspeaker.

When a Radiotrician encounters a receiver which blocks and at the same time goes into oscillation (squeals), with the pitch of the squeal varying as a station is tuned in, he knows immediately that there is a defect in the R.F. section. Since open screen grid by-pass condensers are the most common cause of this trouble, he checks them first.

When weak reception and poor selectivity is observed uniformly over the entire tuning range, the Radiotrician reasons that the preselector is tracking properly with the local oscillator but the I.F. system has low gain. He further reasons that the poor selectivity may be due to improper alignment of the I.F. trimmers; if he finds that the gain can be brought up by turning the I.F. trimmers in one direction or the other, he knows that the trouble is simply misalignment, and does not bother to look for any other defects. Of course, it would be possible to use a calibrated R.F. and I.F. amplifier with a visual output indicator and check the gain of each stage while working in a forward direction from the antenna to the loudspeaker; this would reveal that the I.F. stages are not contributing their proper share of the gain, but such a test procedure would obviously take far more time than the simple mental analysis and check of the I.F. trimmers just described.

Importance of Knowing Radio Theory. The ability of a person to reason out the most likely causes for an improperly operating receiver depends upon how well he understands the fundamental principles of radio. He must be able to visualize the action which is taking place in a normal radio receiver circuit, and must know how various defects can change this action. A thorough training in radio theory, supplemented by actual experience, enables a Radiotrician to reason out the possible causes of a trouble and apply the proper modern servicing technique with a speed and simplicity which surprises the untrained radio technician. The N. R. I. Course gives this essential training in radio theory, and the necessary experience is easy to acquire by



An R.F. signal generator, a multimeter, and a tube tester form the essential equipment required by a full time professional serviceman. For a beginner, the signal generator and a multimeter are sufficient for acquiring practical experience while studying; the tube tester need be considered only when ready to do actual radio service jobs for customers. A typical modern tube tester is shown here.

means of the procedure explained later in this article.

There will naturally be times when the observable symptoms provide no clues whatsoever to the location of the defect. In cases like this, a more or less systematic isolation procedure must

be employed. Some technicians prefer to use one standard approach for all such cases; this involves connecting a calibrated test amplifier circuit of the proper type to the input and then to the output of each stage in turn, progressing in a forward direction from the antenna toward the loudspeaker, and analyzing the signal at each point for hum, noise, distortion, poor selectivity, poor sensitivity, etc. The mental process required at each point is by no means simple, for a full understanding of the circuit action at that point is essential to a proper interpretation of the results. The apparatus required for this isolation procedure is rather expensive, and considerable practice is required in its use before defects can be located with a speed approaching

Combination signal generator and multimeter in a convenient carrying case; this unit is ideal for the student while acquiring practical experience, and is equally as useful and essential for actual service work.

that of more conventional servicing techniques which are varied according to the particular type of trouble encountered.

Let me illustrate a few cases where puzzling defects can be located with much simpler and much less expensive test equipment than the calibrated test amplifier. Hum, for example, can be quickly isolated to the defective stage by shorting the input of each stage in turn, progressing either in a forward or a reverse manner. When working in a forward direction, the hum will stop when the stage following the defective stage is shorted; when working in a reverse manner, the hum will always stop except when the stage directly after the defective stage is shorted. Noise can be isolated to the defective stage in a similar manner, but it is wiser to pull out tubes rather than short the input terminals because noise can often be relayed around a shorted stage. When poor sensitivity is the complaint, the defect can be isolated quite easily either by means of a vacuum tube voltmeter connected to each stage in turn in a forward direction, or by using a signal generator and an output indicator and advancing the signal generator in a reverse direction.

Each symptom in an improperly operating receiver calls for a careful selection of the defect-isolating technique. Here is an example of how clear thinking enabled one man to develop a technique to meet a rather peculiar situation.

He was confronted with a receiver in which noise was heard only when certain sounds were produced by the loudspeaker. He reasoned that this noise was produced by mechanical feed-back to some part, causing that part either to open or short. The noise was more or less intermittent, making tests difficult, so he reasoned that it would be necessary first to make the noise continuous. He did this by connecting an audio oscillator to the input of the A.F. amplifier and varying the frequency until an audio frequency was found which made the noise continuous; at this time he noted that the noise persisted only while a station was tuned in, clearly indicating a defect in the R.F. system. With the audio signal generator connected to make the noise continuous, he simply checked each stage with a vacuum tube indicator, working in a forward manner, until he arrived at the stage which caused the meter to flicker; this was the defective stage. A conventional defect-isolating test on this stage quickly located the defective part.

Intermittent Reception. This complaint is seldom welcomed by servicemen, for the location of the defect can take more time than will be paid for by the average set owner. Again clear thinking can speed up the location of the defect. First determine whether the intermittent defect is causing a dead receiver or an improperly operating receiver; in the latter case, reasoning may lead you directly to the source of the trouble. The interval between cut-offs is an important clue; if it is regular, you know that there is a thermal defect in a current-carrying part or in parts near sources of heat in the chassis; if cut-off is irregular, your search would naturally be broadened to include parts subject to vibration.

An intermittent defect can be located by means of a defective section or stage-isolating procedure, but a few preliminary tests may often yield a solution almost immediately. If the interval between cut-offs is short and occurs regularly, tubes should be checked. By watching for the characteristic filament glow in tubes with

(Page 34, please)

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 member of the Institute of Radio Engineers, the American Institute of Electrical Engineers (Past Chairman of the Washington, D. C. Section), the American Radio Relay League, the Society of Motion Picture Engineers, the American Section of the International Committee on Wireless Telegraphy, the National Aeronautic Association of the United States of America, the American Association for Adult Education, and the Association for the Advancement of Science. Other affiliations of Mr. Smith are those with the Washington Chamber of Commerce, the Washington Board of Trade and the Central Business Men's Association. 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 also inventor of the Natrometer (sender of Radio Code messages).

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.

OUR VICE-PRESIDENT AND DIRECTOR

AMONG those men who early saw tremendous possibilities in Radio work, E. R. Haas holds an important place, the more so because he acted upon his vision and came to play an important role in the training of workers in this great new industry. As vice-president and director of the National Radio Institute of Washington, he has aided in the development of one of the greatest educational projects of his day and in the creation of successful careers for many men in all walks of life. The Institute which he serves educates people from all parts of the world in all aspects of Radio work, placing especial emphasis upon its efforts to increase individual earning power in a profession of almost limitless opportunity.

E. R. HAAS

Mr. Haas was born on August 2, 1889, at Washington, D. C. He received his early education at the Drillery Business College, Central High School, and afterward attended the Law School of Georgetown University. Completing his formal studies, he secured employment in newspaper circles. Advertising and publicity work brought him in contact with the theatre, and he became assistant publicity director for Keith's Theatre, Washington.

It was while with Keith's that he had his first Radio associations. The theatre was running an act, "Via Wireless." Mr. Haas, seeking a spark transmitter for use in the show, obtained the desired outfit from J. E. Smith. Mr. Smith, then an instructor at the McKinley Manual Training High School, was destined to become the organizer of the National Radio Institute; and he and Mr. Haas were to become president and vice-president, respectively, of the Institute.

Mr. Haas possessed the sort of vision that immediately grasped the importance of the new "wireless," as it was then called. Afterward, when he became connected with the World Film Corporation as assistant manager for the District of Columbia, this same quality of vision enabled him to look ahead, as today he still looks ahead, to the great future developments of television. He is one of those men who consistently look ahead.

In periods of rapid change, like our own era, men seek out, by some strange magnetism, those individuals who possess insight capable of piercing the future. This fact accounts, at least partially, for Mr. Haas' popularity. One who, in the past, has correctly seen ahead is likely to do so again. Many years ago Mr. Haas predicted the universal use of Radio broadcasting and Radio's use in aviation. His keen vision still sees television's certain development and numerous applications of Radio that have not yet been made effective.

Letters of Congratulation from Representatives of the Radio Industry

General Radio Company

30 State Street
Cambridge, Mass.

It is such a rare thing in Radio to have any organization celebrate its Twenty-Fifth Anniversary that it is a real pleasure to congratulate you on your success, but it is even more pleasing because you have been doing such a particularly good job through all that time. I hope you keep up your fine work for many years to come.

Melville Eastham, President

———*n r i*———

The Muter Company

1255 So. Michigan Avenue
Chicago, Ill.

May I extend congratulations to you and the National Radio Institute on your twenty-fifth anniversary, as I feel that your work in improving the Radio service is of substantial benefit to both the listening public and the Radio industry.

The future progress of the Radio industry is entirely dependent on the character of service available to the public, and in improving this service through the National Radio Institute you are paving the way for an even wider acceptance of Radio than exists at the present time.

Future developments will all require a more highly trained personnel to give proper service, which should in turn reflect itself in the progress of the graduates of your Institute.

I trust that you may have many additional anniversaries which will all reflect your assistance in the progress of Radio.

Leslie F. Muter, President

———*n r i*———

Readrite Meter Works

Bluffton, Ohio

Congratulations on this your Twenty-fifth Anniversary! These many years of continued progress speaks well of the solid foundation and principles upon which your Institution has been founded and continues to be conducted. May the years to come be crowded with the same success and advancements which have accrued to yourselves, as it has in such increasing numbers to those you have served and are continuing to serve.

Electronics is moving along today at a very brisk pace. We can scarcely comprehend the proportions to which Radio development will extend into the future. Every day unfolds new achievements, new ideas put to new practical uses. It is no wonder that the young mind today is eager to enter this fast and intensely interesting field, forecasting a future with its unlimited possibilities of achievement in which the advancement to the average young man is assured.

Again it is my sincere pleasure to extend to you personally and to all the members of your organization best wishes for your continued success and happiness.

R. L. Triplett, President

———*n r i*———

Standard Transformer Corporation

1500 North Halsted Street
Chicago, Ill.

Permit us to congratulate you upon your twenty-fifth anniversary. We trust that in the next twenty-five years your good organization will be as great a contributing factor to the success of Radio and its allied industries, as it has in the past.

In the opinion of the writer, Radio in itself is still in its infancy and its future developments that should undoubtedly render greater services to humanity than we have thus far seen can be materially assisted in its future developments by the proper education along its specific lines.

We, like every other allied manufacturer, are always on the alert for trained minds and feel that the schooling from an organization such as yours is a tremendous advantage to one interested in making Radio his life's work.

Jerome J. Kahn, President

Electrical Research Laboratories, Inc.

2222 Diversey Parkway
Chicago, Ill.

I understand the National Radio Institute will soon celebrate its twenty-fifth anniversary—congratulations!

From year to year, the old bugaboo—"Saturation Point"—has been brought up, but has not materialized due to continuous Radio improvements, better service and understanding of technicians, and apparently the future of Radio holds forth just as much promise as ever, especially with television as an adjunct in the offing.

You have contributed to the advancement of Radio in no small part, and our best wishes are with you for the future.

E. Alschuler, President

———n r i———

D. R. Bittan Sales Co., Inc.

53 Park Place
New York City

Having been connected with the Radio industry since its inception, and, as President of "The Representatives" of Radio Parts Manufacturers, my work brings me in close contact with all phases of the Radio Industry.

In my travels I have met a considerable number of your students and graduates who speak highly of your services. Being personally acquainted with your officers and staff members of your Institute, it gives me great pleasure to extend to you warm congratulations on your 25th anniversary. Your work is commendable. Every good wish to you.

D. R. Bittan, President

———n r i———

Amperite Company

561 Broadway
New York, N. Y.

Our best wishes on your 25th anniversary. There are very few Radio pioneers who can celebrate a 25th anniversary. It certainly must prove the soundness of your courses as well as the necessity of the proper fundamental training in the Radio industry.

Although Radio will continue to become more technical it will also continue to grow. P. A. is opening up new fields for the servicemen. Musical instruments played through the home Radio will give them excellent opportunities for increased sales.

Elliot Leeds, President

———n r i———

Clarostat Manufacturing Co., Inc.

285-287 North Sixth Street
Brooklyn, New York

Without trained men for its laboratories, factories, stations, studios, stores, shops and service calls, the vast industry called Radio could not exist. The time has long since passed when the handyman could handle this intricate art. And so to J. E. Smith and his associates of the National Radio Institute, we of the Radio industry generally and the Clarostat organization in particular, acknowledge our debt. N. R. I. graduates have provided that trained personnel upon which our common good is predicated.

Therefore congratulations to N. R. I. for its splendid quarter century of service to the Radio industry and to ambitious young Americans alike! May the fine work continue.

Victor Mucher, Credit Manager

———n r i———

Aerovox Corporation

70-82 Washington Street
Brooklyn, N. Y.

RADIO marches on! Still greater possibilities lie ahead. No other industry offers such opportunities to the trained, ambitious, self-starting individual. Those tens of millions of sets in daily use in homes and automobiles alone insure the magnitude of the Radio industry, calling as they do for initial production, servicing, and ultimate replacement. But I for one consider broadcast reception as only the starting point of Radio opportunities. The non-Radio applications—the so-called electronic set—is only in its infancy. No one dare predict the tremendous opportunities.

So upon this, the NRI's 25th Anniversary, we of Aerovox salute that great institution which has done so much for Radio progress by way of mobilizing and training the growing Radio manpower. We look forward to still greater things for and from N. R. I. men. That this is no idle talk, we have just increased our production capacity four fold, in moving from our former Brooklyn plant to our own building at New Bedford, Massachusetts. Yes, Radio Marches On!

Charles Golenpaul, Sales Manager

Novel Radio Items

—BY L. J. MARKUS—

Radio Waves Heat Rivet!

A coil connected to a powerful R.F. oscillator made up the unique radio forge which brought to white heat the last rivet for the frame of RCA's exhibit building at the New York World's Fair. Explanation: The intense radio field inside the coil set up heat-producing eddy currents in the rivet. Essentially the same method is being used by a New York firm to roast coffee beans, and by European scientists for seasoning wood. With this radio-heating process, the inside of a material is warmer than the surface; in fact, it is possible to char the interior of a stick of wood without affecting the surface.—*Suggested by Radiotrician Frank D. Cadden.*

Cigar Creates Electronic Mystery!

Mysterious variations of plate current in a highly sensitive amplifier being developed in a certain research laboratory were finally traced to the lighted cigar being smoked by the engineer. The vacuum tubes in the amplifier were photo-sensitive to a certain degree, and the light from the cigar proved sufficient to change their characteristics.

Staggering RCA Statistics!

Eight tons of sawdust are produced each hour by the radio cabinet-making section of the Camden, N. J. plant of RCA; burned in a special boiler, this waste wood produces steam for the record-pressing section. An eleven-tube radio, containing 9,850 feet of wire and 3,900 separate parts, is handled by 3,800 different people in its 8-week trip through the plant. The assembly lines, longest in the world, get an empty chassis at one end and turn out a completed chassis, squawking with full volume, at the other.

Music Changed to "Northern Lights"!

Music picked up by a radio set is made visible as a delightful, ever-changing display of colored lights in a "Rhythm-Lite" invention patented by a Canadian radio engineer. High audio notes produce yellow shades, medium notes red, and low notes green and blue, with the intensity of the light varying with volume. Explanation: Filters separate the audio frequency range into "channels," each of which is amplified and fed into one colored light bulb.—*Suggested by Radiotrician Maurice E. Mercer.*

FLASHLIGHT CELL OPERATES RADIO! To prove conclusively to skeptic farmers that 1939 Philco battery receivers require only one battery and have low current drain, one dealer connects a single flashlight cell to the two battery wires. The cell lasts long enough for several demonstrations, giving full loudspeaker volume. These sets use a self-rectifying vibrator unit to step up the 1.5-volt battery voltage to 90 volts D.C. or higher for the tube electrodes.

RADIO SET CAN HAVE MANY MASTERS! Newly developed wireless gadgets make it perfectly possible to have three or more different programs coming from one radio at the same time, with no connections whatsoever to the set. Father can be tuning in his favorite jazz band with the Kadette Tunemaster, mother can be playing her favorite Bing Crosby recording on a magic wireless record player, and daughter can be teaching her dog new tricks with a crystal mike connected to another wireless record player. Explanation: Each device has an R.F. oscillator which produces the same frequency as that to which the receiver is tuned. These carrier signals, modulated with the output of a radio tuner, a phono pick-up or a microphone, are transferred to the receiver by radiation.

DEATH RAY LAMP ANNOUNCED! A special 385-watt lamp being sold by the Leray Corp., 230 Park Ave., New York City, produces a beam of infra-red rays which kills fleas and lice on dogs and cats. The beam is moved slowly over the animal; some of the dead fleas drop out immediately, and the remainder can be brushed out. Practically all insects on animals, birds or plants can be killed with this lamp, as well as moths on clothing.

The Laboratory Page

By GEORGE J. ROHRICH

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

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

AN EXPOSITION FOR EXPERIMENTS NO. 27, 28 AND 29

What to do when oscillations do not occur. In experiment No. 27, as well as in other experiments, oscillations sometimes stop entirely, or stop over a portion of the dial when the oscillator is connected to the broadcast receiver. In this case remove the wire from the ground terminal on the receiver but leave the other end attached to the oscillator. Attach another length of wire to the ground terminal on the receiver. Gradually twist this wire together with the wire which you removed, but do not allow the bare ends of the two wires to come in contact. The cotton insulation will prevent electrical contact. This will introduce a small capacity into the circuit and oscillation will be maintained.

The reason that oscillation ceases is due to the fact that an extremely large load is demanded of the oscillator which it cannot supply.

By introducing the small capacity between the two wires the load is reduced.

Therefore, with the wires connected as directed, or even leaving one terminal disconnected, oscillation will be maintained.

What to do when you use a receiver which does not have a visible ground connecting terminal. Such receivers usually obtain their ground connection with the aid of a fixed condenser coupled internally between their chasses and the power line. In other words, the power line serves for completing their aerial circuits with the ground.

Because the power line is usually involved with its chassis in such receivers, *do not make any connections* between the oscillator and this type of receiver chassis.

In order to carry out experiments No. 27 and 29 inclusive with your receiver, it is only necessary to connect terminal T_6 to the aerial terminal on the receiver, or to the aerial wire which leads to this terminal, while this wire is coiled. Terminal T_7 can be left disconnected. However, better results will sometimes be obtained if terminal T_7 is connected to a water pipe or other grounded object.

The *water pipe* now replaces the "ground terminal" for this receiver, to which the oscillator can be regularly connected. This water pipe also replaces the ground terminal of the receiver when working with Report Statement No. 27.

In some cases better results will be had if terminal T_7 is connected to the receiver, while terminal T_6 is connected to a grounded object.

The radio receiver in experiments 27, 28 and 29 must be in operation, with its power turned on, as directed in procedure No. 3 of experiment No. 27.

Report Statement No. 27. In order to carry out the work for Report Statement No. 27, it will first be necessary to make all of the adjustments as directed in the procedures for the regular experiment. The oscillator should be adjusted in order to produce a modulated signal and the

(Next page, please)

receiver should be tuned to resonance with this signal.

Then the wire leading from the oscillator to the "ground terminal" of the receiver should be removed. It will be found that the signal still can be heard in the receiver even if the complete circuit does not exist.

Failure to obtain the desired result usually can be traced to the fact that the volume control on the receiver was not advanced sufficiently in order to make up the difference for the slight decrease in signal strength.

In some instances, it will be found that the signal from the oscillator has varied in its frequency so that it will be necessary to carefully tune the receiver to resonance.

The purpose of this observation is to show that a complete circuit is not necessary in order to pick up the signals from an oscillator. Due to the high frequency of the oscillations the electrons are set in motion on the wiring which couples the oscillator to the receiver, allowing a transfer of energy to take place.

Failure to supply the correct answer is generally due to the fact that the Statement was not studied carefully.

What to do when your voice is not reproduced in Experiments 28 and 29. Probably you have noticed when using a regular telephone that you apparently do not hear your own voice although the telephone receiver is constantly held to your ear. Actually, your voice is being reproduced also in the receiver held to your ear but this is not apparent because the sounds in the air are louder than those in the receiver.

Quite often a similar condition may make you think that you are not successful with experiments 28 and 29 in outfit 3BA. If you will remove the receiver into a separate room from the oscillator and its microphone, then have some one speak into the microphone so you can only hear those signals coming from the receiver, then I feel sure you will get a sufficient indication that it is possible to modulate the radio frequency oscillation with a voice as pointed out in the experiments.

On the other hand, where you are alone and the microphone and receiver must be located together, if you will blow your breath against the diaphragm of the microphone, you will hear a rushing noise in the receiver and this is an indication that the radio frequency oscillations are being modulated by the movements of the microphone diaphragm.

If you are not successful in this last observation then your difficulty with experiment No. 28 in outfit 3BA may be due to the fact that the diaphragm of your phone is curved slightly inward and, therefore, it is too close to the pole pieces. I would suggest that you remove the cap of the phone in order to turn the diaphragm over. In other words, remove the diaphragm and replace it so that the surface which was on the outside will be on the inside, near the pole pieces. Clean the diaphragm and pole pieces to remove foreign matter. Then screw the cap *tightly* on the phone in order to raise the diaphragm from the pole pieces.

While carrying out this procedure of cleaning and turning the diaphragm over it may be well to see that the phone is connected in the plate circuit in the manner which will make the magnetism of the pole pieces the strongest. To do this, notice the amount of force required to remove the diaphragm while the circuit is working with the largest reading of plate current. Then reverse the wires of the phone leading to the meter and to terminal No. 4. Again check the amount of force required to remove the diaphragm. Leave the phone connected in the manner which requires the greatest force when removing the diaphragm, as this will insure the greatest signal strength for reproducing your voice. In this procedure you are simply letting the plate current create extra magnetism which aids, instead of opposes, the permanent magnetism delivered by the steel magnet within the phone.

Repeat the experiment by tuning your oscillator to resonance with your receiver. Obtain the loudest signal from the oscillator by advancing your volume control on the receiver to maximum.

Then gradually decrease the coupling on the oscillator until the buzzing signal disappears. At this point you should be able to hear a reproduction of your voice in the loudspeaker. The adjustment is generally best when the receiver is tuned near 1,300 to 1,500 kilocycles. Reversing the connections to T_1 and T_2 on the oscillator coil will allow you to tune your oscillator to these higher frequencies. In some cases the voice signals will be louder when the grid leak is removed. The oscillator can be made to produce the fundamental oscillations near 1,300 to 1,500 kilocycles by reversing the connections to terminals T_1 and T_2 on the oscillator coil, so terminal T_1 connects to the stator of the variable condenser and to terminal 8 on the grid leak holder.

Hold both lips of your mouth *against* the cap of the headphone when speaking into it.

of years. In the second place, the industry in many ways has "come of age," is in some measure organized, and has won the respect and consideration of the public and the government. And, finally, it is an industry of great promise and one which seems to have a bright future. Its future opportunities are comparable to those of the past. New fields—such as facsimile, television, Radio dynamics or remote control of mechanisms, and the like—all offer a wide variety of opportunities to men of intelligence and determination. In this great industry, hard work remains as the key to golden opportunities.

Alfred Goldsmith.

———— *n r i* ————

C. M. JANSKY, JR.

Consulting Radio Engineer. Formerly Associate Professor of Radio Engineering at University of Minnesota. Past President, Institute of Radio Engineers.

Eighteen years has seen tremendous growth of Radio broadcasting as an industry. Today it provides a field for the investment of millions of dollars and the employment of thousands of workers. Yet, in no sense can we see an end to new developments and the rate of expansion. Existing stations are continually installing new equipment and new and better antenna systems. New stations continue to come into being. This year's receiving sets are better than last. All this applies to the regular broadcast band which now extends from 550 kc. to 1600 kc.

New developments and research show great possibilities for broadcasting in all its branches in the ultra high frequencies, a part of the Radio spectrum about which our knowledge is as yet very incomplete. Facsimile and television are still experimental insofar as the field of broadcasting is concerned. Yet, even on this basis millions have been spent on research and employment given to many workers.

Radio has become an integral part of aviation and without it the modern commercial air transportation system as we know it today could not exist. Further expansion in both telegraphy and telephony are continually taking place in the marine field.

These are but a few examples which show that in all branches of the Radio industry the movement is ever forward—more knowledge resulting in more use, more activity, more interest, which in turn creates a demand for more knowledge. On this knowledge rests the foundations of a host of business and government activities calling for increasing numbers of men well trained to meet new problems.

C. M. Jansky, Jr.

———— *n r i* ————

HARRY DIAMOND

Principal Radio Physicist, National Bureau of Standards, Washington, D. C., Inventor. Member, Washington Academy of Sciences, Washington Philosophical Society, American Meteorological Society, Institute of Radio Engineers.

Radio has many ramifications; including Radio broadcasting, television, facsimile, Radio navigational systems, remote control by Radio, Radio therapy, Radio prospecting, and the like. Each represents a branch of science which in turn has subdivisions and sub-sub-divisions requiring specialized knowledge for their operation and understanding.

Each specialized branch of Radio was built up step by step as research workers succeeded in their search for underlying principles. As the knowledge in a branch grew, the underlying principles became clearer and simpler. Greater knowledge in one branch of the art in turn cast illumination on problems of other branches.

Your students are indeed fortunate in coming into Radio at a time when the underlying principles are beginning to be understood sufficiently so that they may be taught as fundamentals basic to every branch of the art. You are fortunate in the familiarity of your faculty with these fundamentals and in the careful preparation which goes into your lesson text-books in order that your faculty's knowledge may be imparted to your students. They need only to devote themselves to your text material to find the entire art gradually unfolding itself before them.

Harry Diamond.

Modern Servicing Technique

(Continued from page 21)

glass envelopes, you can detect thermal opens in the heater visually. Vigorous wiggling of each part and connection may result in the location of a part which, when jarred, will reproduce the intermittent condition; simple tests will then indicate whether the defect is in the part or in its connecting leads.

The procedure for isolating the defective section or stage in an intermittent receiver may be either elaborate or simple, depending upon the equipment used and upon the particular conditions encountered. In all cases, however, a certain amount of mental analysis is essential. If improper operation is evidenced during cut-off, the symptoms may indicate the most likely section or stages. If the receiver goes dead during cut-off, the indications will be absent except in cases where there is a tuning indicator. A change in the indication at the time of cut-off points definitely to a defect in the R.F. section or in the demodulator stage, whereas the absence of a change in the indication points to an A.F. system defect.

When servicing an intermittent receiver with the aid of a dynamic tester having the R.F., I.F. and A.F. test amplifiers and a vacuum tube voltmeter, it is possible to connect each section of this test instrument to one section of the receiver; a change in the reading of an indicator after cut-off isolates the trouble to the receiver section connected to that indicator.

Radiotricians ordinarily try to "sandwich in" intermittent jobs with other servicing jobs, using a simple and inexpensive vacuum tube indicator like that shown in this article for isolating the defective stage. This little instrument is both an aural and a visual indicator and may be operated either as a test audio amplifier, as a vacuum tube indicator, or as a test detector with aural or visual indication. The amount of signal fed to the grid determines whether the circuit will rectify or simply amplify; this signal intensity is controlled by the setting of the potentiometer in the input circuit. As an aural indicator it is quite sensitive, especially if a sensitive phone unit is used with it. The instrument can be connected to an A.F., I.F. or R.F. stage, then left alone until cut-off next occurs. If there is a change in the indication after cut-off, you know that the circuit is connected to a defective stage; if there is no change, connect the instrument to each other stage in turn until you locate one which changes in output during cut-off. A station must be tuned in, and you must work in a forward direction (toward the loudspeaker). When aural indications are desired, connect between the plate and chassis of a stage and adjust the potentiometer until the indication is just audible in the headphones. When cut-off occurs, you can pick up the phones; if no signal is heard and you are working in a forward direction, you know that you are connected to the defective stage. Of course, you can speed the search by first connecting to the output of the I.F. amplifier; if there is no change in the indication during cut-off, you know then that the trouble is in the A.F. system; if a change is observed, the trouble is in the R.F. system. This test circuit will work in R.F. and I.F. stages simply because any R.F. amplifier is sufficiently nonlinear to produce an audible amount of demodulation.

Requirements of a Modern Professional Serviceman. Even though a man is supplied with all the procedures for servicing a radio receiver and is given all the necessary apparatus for tests, he cannot service receivers efficiently without the two essential requirements stressed in this article, namely *training* and *experience*. He must be trained to understand the fundamentals of radio, to understand the action of circuits, to identify the various stages and parts, to trace tube circuits, to make an intelligent diagnosis of the trouble, to choose the best servicing technique for each problem, and to carry out all the mechanical procedures involved in servicing and aligning radio receivers. Experience is just as essential: experience will speed up the application of the various service techniques; experience will fix in mind the various procedures and will clarify a great many of the points studied while acquiring training; experience will make radio servicing more or less automatic, enabling a man to do his work in less time and with greater confidence.

Experience can be secured by any energetic man after completion of his training by means of a concentrated plan, without doing actual service work. Of course, this experience or actual service work can be done while studying, but experience can always be acquired faster when preceded by complete Radio training. This plan involves procuring a six- to eight-tube superheterodyne receiver, studying its circuit diagram, tracing each circuit both on the diagram and in the chassis, locating parts first on the diagram and then on the chassis, tracing continuity of supply circuits, studying the action of each circuit, introducing defects and turning on the receiver to note the results after first figuring out what should occur, aligning the circuits, aligning the loudspeaker voice coil, and carrying out every single modern servicing technique on that one receiver in a logical manner. This plan, if carried out conscientiously for one or more receivers, will give as much worthwhile experience as could be acquired from servicing scores of receivers in the ordinary manner.

OFFICERS FOR 1939

In a "nip and tuck" contest, Earl R. Bennett of Evanston, Illinois, was elected President of the N. R. I. Alumni Association for the year of 1939. Dr. George B. Thompson of Los Angeles, California, gave Bennett a real contest and he may well feel honored to know that he has so many friends in the Alumni Association. Dr. Thompson, although a staunch supporter of the Alumni Association for years, was practically unknown to the membership at large until the election of 1938, when he was elevated to a Vice-Presidency. Because he could not be a candidate for more than one office, Dr. Thompson will relinquish his office as Vice-President but he will surely be heard from again in 1940.

Earl Bennett will make a splendid President. He well deserves the honor. Few men in the Alumni Association have given so much of their time to the organization at large and to members individually. Bennett has served several terms as Chairman of the Chicago Chapter. He graduated in 1923 and immediately started making a record for himself. He has a thriving Radio business in Evanston, Ill., and is highly respected by the business men in his community. Much credit for Bennett's success belongs to his good wife Alice, who often took over duties which properly belonged to Earl in order that he might give more time to others who frequently seek his advice and recommendations.

Earl is a combination of good business man, Radio expert, writer and lecturer all rolled in one. He can be counted upon to give his very best under any circumstances, and his friends will tell you that his "best" is mighty good!

F. Earl Oliver of Detroit and Allen McCluskey of Birmingham, Alabama, were re-elected to the offices of Vice-President. Clarence Stokes of Philadelphia, who was squeezed out by a narrow margin last year, came back strong and is again a Vice-President, an office which he held for several years previously. C. B. Morehead of Chicago, Illinois, was elected a Vice-President to complete our roster of four. Morehead fills a national office for the first time, but he is no stranger to the boys in the Middle West where he has been very active in the affairs of the Chicago Chapter, particularly in his capacity as Editor of Chicago Chapter News. He is a smart Radio man, has a magnetic personality and makes friends very easily. More important—he keeps them.

J. D. Wood of Archer City, Texas, polled a large number of votes as did also E. H. Symons of Regina, Sask., Canada, although not enough to be elected. Both of these men ran for the first time and did remarkably well. R. H. Rood of Los Angeles and Louis J. Kunert of Middle Village, Long Island, New York have plenty of admirers in the Alumni Association who simply cannot resist voting for them each year. Rood is a former Vice-President and Kunert is Secretary of the New York Chapter.

Earl Merryman was re-elected Secretary. Merryman is a charter member of the N. R. I. Alumni Association. Even a good man like Clarence Steed could hardly be expected to overcome the popularity of Merryman.

L. L. Menne was re-elected Executive Secretary. The heavy vote given to Merryman and Menne is most gratifying and deeply appreciated by them. Harry W. Merchant of Arlington, Virginia, ran for office for the first time this year, and he, too, will be a strong candidate in 1940.

Our very best wishes to our new officers. Our members will give them their wholehearted cooperation in their efforts for the advancement, protection and guidance of Radio servicemen everywhere.

N. R. I. 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 N. R. I. 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 famous N. R. I. 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 N. R. I. graduates were these seventy-five Alumni, each respected in his community, each well on his way toward a successful career in Radio.

That was ten years ago. So, as N. R. I. this year celebrates its Silver Jubilee Twenty-Fifth Anniversary, we of the Alumni Association simultaneously celebrate our Tenth Anniversary.

Our record for the past ten years is one of which every member—every N. R. I. 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 three thousand members from every state of the Union, from every Canadian province, and from almost every foreign country, we have one of the strongest Associations of this kind in the world. Our members have profited greatly from their contacts with fellow Alumni through Chapter meetings

The Charter Members of N. R. I. 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 10th BIRTHDAY

and through our official publication NATIONAL RADIO NEWS, and we in turn have guided the Institute in its dissemination of Radio knowledge.

The picture shown was taken at the time the N.R.I. Alumni Association was formed in 1929. In this group will be recognized the late 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.

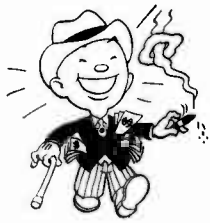
That convention in 1929 was brought to a close with a banquet at the Arlington Hotel in Washington. As part of the ceremony, a handsome loving-cup was presented to the National Radio Institute through its President, Mr. J. E. Smith. The actual presentation was made to Mr. Smith by the then newly elected Vice President of the Alumni Association, Mr. Hoyt Moore of Indianapolis, 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 N. R. I. 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 N. R. I. Alumni Association, Mr. Haas— Honorary Vice President of the N. R. I. 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 Tenth Anniversary and congratulate the seventy-five original members, most of whom are still associated with the Alumni, 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 N. R. I. in 1929 by the Charter Members of the N. R. I. Alumni Association. It is handsomely engraved, including the name and state of residence of each Charter Member.

Here and There Among Alumni Members



Stanley Ponte, who is Chief Operator at WKBH, LaCrosse, Wis., is soon to take the long hike up the center aisle with a bride on his arm. That's the way they go, fellows. Old Dan Cupid is a tough guy.

———n r i———

After a long and tiresome shopping tour Chief Dowie took Mrs. Dowie to a picture show to see "You Can't Take It With You." When he got back to his car he found someone had jimmied the lock and swiped all of the packages which had been left in the car. Some fun, hey Chief!

———n r i———

Ed Sorg of Chicago has given up the Big Apple as being out-of-date, and he is now giving all his spare time to the Chicago Chapter in his capacity of Chairman for 1939.

———n r i———

J. L. Bapna, Gandhi Mohric, Jaipur, India, is all enthused over his forthcoming marriage and invites students and graduates in India to communicate with him. But he doesn't mention the date.

———n r i———

Who slipped Menne a phoney cigar at a Chapter meeting in Baltimore? Phooie! Must have been stuffed with rubber. No one is under suspicion—that is, no one except Pete Dunn.

———n r i———

Arthur P. Dillow, formerly of Colorado, who graduated fourteen years ago, dropped in the other day. He is still in Radio with the U. S. Coast Guard, at Curtis Bay, Maryland. Had a nice visit with J. E. Smith, E. R. Haas, J. A. Dowie, George Rohrich, Don Looney, Carl Weber and A. Doig, all of whom he met personally in 1924. It was quite a reunion.

———n r i———

John I. Judge of East St. Louis, Ill., renewed his membership in the N. R. I. Alumni Association until 1945. He says he doesn't want to miss an issue of the "biggest little book!"

———n r i———

Meet Miss Lorna L. Crane, recent graduate of N. R. I., owner and operator of a Radio shop in downtown Holton, Kansas. Miss Crane has been doing all repair work for Gamble Stores, and sets up rented P. A. systems—and all that.

———n r i———

Russell Witt of Norwood, Ohio, drives a bus 224 miles a day, six days a week, attends night school classes two nights a week, taking four high school subjects and yet does very well in spare time Radio servicing with six or seven jobs on hand at all times. There's determination that gets results.

———n r i———

The good wife of Stanley Zimmer of Superior, Wis., writes to tell us how much she enjoys these columns. Thanks, Mrs. Zimmer, and congratulations to those four boys and one girl.

———n r i———

Neil M. Hepburn of Winnipeg, Man., Canada, writes to say he has obtained a position with Trans-Canada Air Lines as Radio Operator. We have a live group of members in Winnipeg.

———n r i———

Dr. John H. V. Bache of New Orleans, La., Research Engineer, graduate of N. R. I., has made a lot of measurements between the different dialectric constants of oil and gas and various stratas found in the earth and has completed an instrument which he says will locate oil and gas by this method of measurement. Large concerns have already approached him.

———n r i———

In a recent quiz of ten questions based upon the servicing of a 1939 receiver, conducted by Radio Manufacturers Service, Richard Casteel of Logan, Utah, got the highest mark. We are pleased with that because Casteel is an N. R. I. graduate.

———n r i———

Two N. R. I. men were among the twenty-five winners in the contest conducted by the Weston Electrical Instrument Corporation. They are D. E. Wilkerson of Little Rock, Ark., and T. A. Hermann of Milwaukie, Ore. Congratulations!

———n r i———

Ivan Raymer of Raymer Radio Service, Tulsa, Okla., writes that the stork has been hanging around his home. And is he happy in anticipation of the event.

———n r i———

George Rohrich, who has conducted our Laboratory Page for, lo, these many years, doesn't know whether he is being kidded or not—since he got a letter from a fellow who said he liked his LAVATORY Page.

———n r i———

J. H. Grant of South Bend, Ind., is mighty proud of his brother, Robert A., who is a member of Congress.

———n r i———

Jerry McCarthy of Washington, D. C., Radio expert and saxophone player extraordinary, is the proud daddy of a girl—the third girl in the family. Jerry is going to have a lot of young men hanging around his front porch in a few years.

———n r i———

Chief Radio Operator, Police Station, Hamilton, Ohio is T. S. Norton, who is tremendously interested in his fascinating work.

Chicago Chapter

Officers for this year were installed at a sparkling ceremony in the home of Earl R. Bennett. This special occasion was attended by the wives and sweethearts of our members and after the installation of officers was completed, the business session adjourned and we really made merry.

The new officers are:
Chairman—Ed Sorg
Vice Chairman—Thos. Lackner
Secretary-Treasurer—R. Cordero
Librarian—C. B. Morehead
Technical Editor—Earl R. Bennett

Those who missed this meeting have plenty to regret. Bennett has a spacious place and notwithstanding the good attendance, there was plenty of room for card players, dancers, food for the hungry and refreshments for the thirsty. It was a real blow-out. Bang!

We meet on the first and third Friday of each month at 8:30 P. M. in Eckhart Park Field House, Chicago and Noble Streets (800 north and 1400 west). Come out and meet the boys. You will find it well worth while.

R. Cordero, Secretary.

n r i

Philadelphia-Camden Chapter

We have changed our meeting quarters to 1619 West Girard Avenue, Philadelphia. We are holding regular meetings on the first Thursday of each month. All N. R. I. students and graduates are cordially invited to attend these meetings. They are extremely interesting. At each meeting some one of our members takes up an important subject and after a thorough explanation there is an informal discussion which is very beneficial to all.

Officers for the year of 1939 are as follows:
Chairman—Charles J. Fehn
Vice Chairman—Joseph Strano
Recording Secretary—Allen Schiavoni
Financial Secretary—Herman Doberstein
Treasurer—Clarence W. Stokes
Librarian—Adolph Zintner
Sgt. at Arms—Bert Champ

Some very important subjects are scheduled for discussion. N. R. I. men in the Philadelphia-Camden area simply cannot afford to miss these discussions.

Allen Schiavoni, Secretary.

New York Chapter

Our last meeting was addressed by Mr. George C. Connor, Commercial Engineer, Hygrade-Sylvania Corp. Mr. Connor gave us some good tips on Radio servicing.

Officers for 1939 are as follows:
Chairman—Alfred E. Stock
Vice Chairman—Kenneth Barlow
Secretary—Louis J. Kunert
Treasurer—Harold Struble

Our new officers have great plans for forthcoming meetings. You fellows in the New York area can't afford to miss these meetings. Remember, the first and third Thursday, each month, at Damanzeks Manor, 12 St. Marks Place, New York City.

Louis J. Kunert, Secretary.

n r i

Detroit Chapter

Our new roster of officers is as follows:
Chairman—John Stanish
Vice Chairman—M. Genta
Secretary—F. E. Oliver
Asst. Secretary—Wm. C. Smith
Financial Committee—C. H. Mills, J. A. Quinn
Librarian—Stanley Gilhooley

Stanish is a real "pepper-box" and the members of our Chapter are assured plenty of action throughout the year. Mr. Oliver, our former Chairman, has accepted the office of Secretary and Mr. Mills, our former Secretary is serving as a member of our Financial Committee.

Our attendance has been good, but we desire to increase it in order that we might obtain some really prominent speakers. This Chapter is strictly for the benefit of local N. R. I. men and we earnestly solicit their presence. We are moving our Headquarters directly across the street from our former meeting place at 11305 Woodward Avenue. Here we have complete equipment for practical demonstrations and for use, at Headquarters, by any member of the local Chapter. Meetings are held on the second and fourth Friday of each month.

F. Earl Oliver, Secretary.

n r i

Baltimore Chapter

Election of officers for our Chapter will not be held until our next meeting, too late to report in this issue of the News. We have a lot of things we want to mention in the next issue. Keep your eye on the Baltimore Chapter. You will hear plenty from this live gang.

I. A. Willett, Secretary.

Students and Graduates Join N. R. I. in Celebrating Its 25th Anniversary

May I take this opportunity to express my congratulations on the twenty-fifth anniversary of the founding of the National Radio Institute of which I am a proud graduate. We, who are associated with this marvelous invention in our every day work, know and fully realize that only the surface has been scratched and that many new developments such as facsimile Radio and television will make Radio an everlastingly fascinating study.

As the pioneers in Radio home study courses, the National Radio Institute has helped to advance the art of Radio by educating men in its mysteries and many of these men, in turn, have contributed some new invention or idea which has made Radio what it is today. Accept, once again, my sincere congratulation on your Silver Jubilee and I hope the Golden Jubilee will find good old N. R. I. still on top in the Radio educational field.

Ted J. Telaak, Buffalo, N. Y.

n r i

Congratulations to you and the National Radio Institute, at this, the twenty-fifth anniversary of the School! The wonderful work you have done in training men in Radio has been a great contribution to the Art and Industry. May you continue to train men for a place in the Radio World, and may each succeeding year bring you joy and satisfaction in giving to the field competent men.

Lawrence J. Vanek, Cincinnati, Ohio

n r i

With the coming of 1939, I am reminded that ten years ago a group of N. R. I. graduates celebrated the 15th anniversary of the teaching of hundreds of Radio technicians by your Institute. What a gala event! We all agreed that we had come a long way in Radio. And now you are celebrating your Silver anniversary. Again we might say we've come a long way. Then again, it might be better to say we have a long way to go yet, for continued discoveries in the Science of Radio seem to point to ever-widening horizons of effort. There are unbelievable things yet to be done, new impossibilities to be made fact. So accept my congratulations on your 25 years of service to Radio and Radio men. To these are added my sincerest hopes that such service may continue to mean much to Radio for many years to come.

Hoyt Moore, Indianapolis, Ind.

n r i

Congratulations to the National Radio Institute for twenty-five years of helping average men to become expert Radio service-men. As an alumnus of the N. R. I., I have only praise for the fine training it gives to its students. With television, a brand new field, just around the corner, any man at all interested in this line should not hesitate to inquire about particulars from this largest of Radio schools. May your golden anniversary find you as far out in front of the field as does your silver.

Gerald Miller, Hartford, Conn.

n r i

My congratulations to the National Radio Institute on your twenty-fifth anniversary. I graduated from your school in 1927. There are greater possibilities now in Radio than when I graduated. Radios now cannot be repaired by inexperienced men. Radios have become very complicated which makes it so much better for the trained man. I have never found a Radio I could not repair—which shows N. R. I. has the course of instruction which will qualify any one as a certified Radiotrician. May you have many more happy anniversaries.

F. J. Brink, Grove, Okla.

n r i

Heartiest congratulations to the National Radio Institute on this, its Silver Jubilee. The progress of Radio during the past 25 years owes much to you. Every State in the Union, and every province of Canada contains many of your graduates who hold responsible positions, and who are splendid examples of what N. R. I. training can do. In these days of uncertainty, one thing is certain—there is a bright future in the field of Radio for the thoroughly trained man. The man with N. R. I. training can look confidently ahead. May your success of the past be continued in the future years.

F. R. Hills, Regina, Sask., Canada

n r i

I wish to extend to the National Radio Institute and its officers my most hearty congratulations on their twenty-fifth anniversary, and for the highly trained men that the N. R. I. has fitted for this growing industry. The Radio field at this time needs men trained for all its branches, and I feel that the N. R. I., as in the past, will continue to fit men for these positions.

Glen A. Williams, Cuba, N. Y.

n r i

I am very happy to take this time out from my busy activities to congratulate the National Radio Institute on its twenty-fifth anniversary. It marks the end of a quarter century of valuable training to the people of the United States and other countries. The services rendered during these past twenty-five years have done a

great deal in making Radio what it is today. Surely we may all be proud to say that we graduated from such a fine school. And after graduation we are not forgotten, but continue as members of this great organization for the betterment of all mankind.

There is no end to the advancement that the future holds for the man who is interested in Radio, if he is willing to apply himself. With the realization of Television at hand who can predict what the future holds in store. I wish to extend at this time my best wishes to Mr. J. E. Smith, and all the other members of the school, and assuring them that I have proven that N. R. I. training really pays.

F. Maurice McLaughlin, Livermore Falls, Maine

n r i

My sincere congratulations to the National Radio Institute on its twenty-fifth anniversary. I attribute all of my success here with The Standard Radio Co., Simla, to the most practical training which I received from the N. R. I. I am indebted to you for the fine service and personal interest that you and your firm have been taking throughout. Your watchword unquestionably is service to your students and graduates. Long Live the N. R. I.

M. Ghiyasuddin, Simla, India

n r i

I offer my sincere congratulations on the completion of your 25th year of outstanding service in the Radio field. Your Institute has earned a position of respect and accomplishment second to none in the entire industry. With reduction of prices, increased efficiency of Broadcast receivers, and Television in the background, I am confident that Radio offers unlimited possibilities for those who are well-trained, and there is no question but that N. R. I. furnishes the ultimate in this training. Please accept my sincere good wishes for your continued success.

E. H. Leftwich, Nashville, Tenn.

n r i

Please accept my sincere congratulations on this your twenty-fifth anniversary as an institute that has so ably met the demand of the Radio industry for competent technicians. I am indeed proud to be a graduate of N. R. I., because it has proven to be an organization capable of the rapid advancement that Radio demands.

P. E. Armstrong, Jamestown, N. Y.

n r i

Let me congratulate the National Radio Institute on its twenty-fifth anniversary. It is a wonderful school. Students turned out by N. R. I. are the go-getters in the field of Radio today. The future of Radio is brighter than in years gone by because of improvement in Radio sets, aerials, and now television. All this means more profits for the trained men.

William Beff, Dunmore, Pa.

NATIONAL RADIO NEWS

FROM N.R.I. TRAINING HEADQUARTERS

Vol. 8 No. 7

SILVER ANNIVERSARY ISSUE, 1939

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

NATIONAL RADIO INSTITUTE
Washington, D. C.

The Official Organ of the N. R. I. Alumni Association

Editorial and Business Office, 16th & You Sts., N. W., Washington, D. C.

L. L. MENNE, EDITOR

L. J. MARKUS, TECHNICAL EDITOR

NATIONAL RADIO NEWS accepts no paid advertising. Articles referring to products of manufacturers, wholesalers, etc., are included for readers' information only, and we assume no responsibility for these companies or their products.

Index