rri journal

Golden Anniversary Issue 1914-1964

35 Cents

In this issue:

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DIVISION OF NATIONAL RADIO INSTITUTE

MODEL 500
3 Band Novice Receiver

MODEL 400
3 Band Novice Transmitter

Announcing NEW NRI-designed

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The Model 400 25-watt Transmitter

Inside this attractive 10" x 7½" x 6½" dark blue cabinet is a remarkable powerhouse. Yet, it's so simple to build, so easy to tune, even an inexperienced kit builder can be on the air in one evening. Covers the popular Novice bands—80, 40 and 15 meters. 3" square panel meter for fast "tuning up." Special variable-impedance current-limiter assures purest signal on any band, protects your valuable crystals (crystals not included). Other features: Pi-network output; transformer power supply with dual silicon rectifier to produce ripple-free DC for plate power; bleeder resistor to regulate and discharge high-voltage capacitors when gear is turned off; co-ax output.

KIT PRICE: $32.50
(Stock #400UK)
Assembled: $46.50
(Stock #400WT)

Shipping wt. 10 lbs., parcel post insured

The Model 500 3 Band Receiver

Identical in size and color to the Transmitter. Offers features of receivers priced much higher. Superhet circuit has TWO stages of i-f amplification to "dig down" for weak signals. Antenna trimmer lets you adjust front end for peak reception on each of the three bands. Bands cover stretches over nearly full travel of large tuning dial. Separate, stable bfo for clear reception of CW and SSB signals. Variable i-f gain. Following the detector are two stages of audio amplification to drive either the built-in speaker or headphones. Transformer operated with semiconductor rectifier to supply power for various circuits. Receives AM, CW and SSB. So easy to build, so easy to use, so easy to own. Order yours today.

KIT PRICE: $37.50
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Assembled: $56.50
(Stock #500WT)

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USE THE HANDY ORDER FORM ON PAGE 27—Cash or Terms

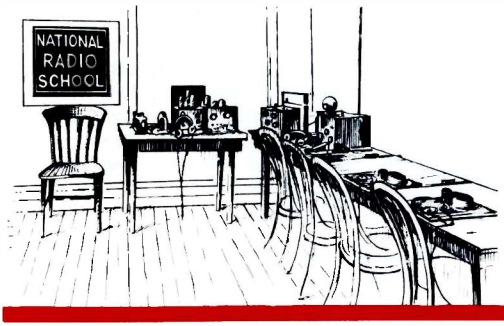
nri journal

SEPT./OCT.,1964

VOL. 21, NO. 6

Features

NOT ON OUR COVER —



is this artist's conception of the original classroom of National Radio Institute, circa October, 1914. Instead the front cover, gold in honor of our 50th anniversary as well as this golden era in electronics, is the building housing NRI now, 50 years and three-quarters of a million students later. See how we grew? And that we is not editorial.... NRI's continuous growth is directly attributable to the continuous aspiration of you, the students.... or as J. E. Smith, founder, puts it: "Any man who thinks he achieves success by himself is badly mistaken."

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NRI----FOREVER YOUNG

The extraordinary organizational vigor of the National Radio Institute can be attributed largely to the character of its founder, James E. Smith. One of his early associates says this about their meeting in 1916: "I was immediately impressed with his sincerity, earnestness and steadfastness of purpose. His personality radiated enthusiasm."

Today, at 83, his enthusiasm is undiminished. He believes that an individual—and an organization—stay young by tackling new projects, drawing inspiration from their vision of the future. He believes that the man who enthusiastically planted a tree at 90 was a man of vision. He intends to continue to "plant trees."

If the vigor of its founder can partially explain NRI's continued growth and leadership, a second, less personal, cause can be found in the very nature of the Electronics industry itself. No industry can be said to have such a profound and continuous effect, full of dramatic surprises, on our civilization. No industry accelerates so fast, nor spawns more diversified services and products. No industry penetrates more deeply into often unexpected areas of economic activity. There's nothing cut and dried about Electronics... it has its own built-in excitement and challenge. Indeed, to stay on top and take advantage of today's opportunities means doing tomorrow's work today.

How well is NRI doing tomorrow's work today? Turn to the NRI catalog of 1927, page 45:

"When Television is perfected, and it won't be very long, the whole Radio industry will be done over again."

The NRI catalog of 1932 offered a special course in Television, with an eye on the future (to be taken only after the NRI Radio course complete with practical training kits). Some of the topics: Essentials of Television, Television Standards and Quality Requirements, Deflection Systems, Typical Circuits, Ghost Images and Fading.

It was a course "designed to give you the fundamental principles of this coming field... you will find instructions in this course for building a Television receiver." Perhaps this 1932 receiver did not look like the present Custom 70 TV Receiver (Training Kit 8YR), but quite a few NRI students in 1932 built a TV Receiver that worked!

Now turn to page 22 of the current NRI catalog describing Training Kits 9 and 10 of the Electronics Technician Course:

You... "continue your study of pulse circuits, building both a simple ring counter and a binary counter... experiment with feedback control systems, analog computers and digital logic elements. You solve simple mathematical problems on an analog computer you build."

The sweep of NRI's operations—our planning (and doing)—of tomorrow's work today is indicated by the names of NRI's various divisions, some of which are in full operation, others in the "think" stage: CONAR Division, Appliance Training Division, Electronics Training Division, NRI International Division, Automation Technology and Management Division, Industrial Training Division, and Electronic Teaching Equipment and Materials for Group Training Division.

With the first Sputnik, the U. S. public became alarmed about the quality of American vocational education. Articles entitled: "Are We Cheating Twenty Million Students?", "Last Chance For Our Schools?", "How Good (or bad) Are The Vocational Schools in This Country?" appeared by the score.

Educators now speak of "vocational technical training showing direct relationship to employability." Let the student "explore for himself." Let the student "observe, analyze, then let him make a write-up in his own handwriting, thus gaining in expression and comprehension." Let the student "use the historical approach and stand alongside the scientist as he works toward a great discovery in Electronic theory."

Indeed, Time magazine (Feb. 1, 1963) hailed the "burst of reform... beginning to push all U. S. education toward dramatically new ways of learning," the basic idea being "discovery."

Revolutionary? New? Not to NRI. Learn by doing? The NRI catalog of 1924 was telling men to "learn by doing... by ac-

BY HARRY B. BENNETT **Director of Administrative Services**

tually working with these circuits with your own hands and watching the results." "Discovery?" The 1931 NRI catalog states: "By doing actual work—actual testing and repairing—working out for yourself fundamental Radio principles, you know from your NRI training and experience exactly what to do—you know the 'how' and the 'why'... because you have discovered the answers for yourself."

Historical approach? Read NRI's James B. Straughn's summing up of the educational "philosophy" behind NRI Training Kits: "The principles of electronic circuitry were developed by scores of original investigators. You gain the best understanding of these principles by training which follows steps used in their discovery.

The third cause for NRI's continued vigor and leadership is simple: NRI training is laid right on the line. Marianne Besser, an award-winning writer in the area of education, in a recent article, says: "U. S. vocational training is badly out of date. Many high school graduates are often trained with obsolete materials for jobs which no longer exist.

A publicly supported high school, or technical school, does not have a crisis if the above is true—students will continue to attend and teachers will continue to be paid. But NRI could not keep its doors open many months if its students and graduates did not get the kind of training they are promised. The NRI objective, clearly, simply and concisely stated in the 1964 catalog, is "to create instruction materials and provide services that prepare each person enrolling with NRI to become an employable Technician as quickly as it is practical, and at the lowest possible tuition cost."

So—the inspired vigor and vision of NRI's founder, James E. Smith; the challenge and excitement of Electronics itself; and the fact that NRI training methods are continuously tested by students and graduates on the job—will keep NRI planting trees for many, many years to come.

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0Z4	6AC7	6C4	6K8	6X4	7H7
1A7GT	6AF4	6C5	6L7	6X5	7N7
1B3GT	6AG5	6C6	6N7	6X8	7Q7
1H4G	6AG7	6CB6	6Q7	6Y6G	7X7/XXFM
1H5GT	6AH4GT	6CD6G	6S4	7A4/KXL	7Y4
1L4	6AH6	6CF6	6S8GT	7A5	7Z4
1L6	6AK5	6CG7	6SA7	7A6	12A8
1N5GT	6AL5				
1Q5GT	6AL7				
1R5	6AM8				
1S5	6AN8				
1T4	6AQ5				
1U4	6AQ6				
1U5	6AQ7GT				
1V2	6AR5				
1X2	6AS5				
2A3	6AT6				
2AF4	6AT8				
3BC5	6AU4GT				
3BN6	6AU5GT				
3BZ6	6AU6				
3CB6	6AU8				
3CF6	6AV5GT				
3CS6	6AV6				
3LF4	6AW8				
3Q4	6AX4GT				
3S4	6AX5GT				
3V4	6B8				
4BQ7A	6BA6				
4BZ7	6BC5				
5AS8	6BC8				
5AT8	6BD6				
5AV8	6BE6	6CL6	6SC7	7A7	12AQ5
5AW4	6BF5	6CM6	6SF5	7A8	12AT6
5BK7	6BF6	6CM7	6SF7	7B4	12AT7
5J6	6BG6G	6CN7	6SJ7	7B5	12AU6
5T8	6BH6	6CS6	6SK7	7B6	12AU7
5U4G	6BJ6	6CU6	6SL7GT	7B7	12AV6
5U8	6BK5	6DE6	6SN7GT	7B8	12AV7
5V4G	6BK7	6DQ6	6SQ7	7C4	12AX4GT
5V6GT	6BL7GT	6F6	6SS7	7C5	12AX7
5X8	6BN6	6H6	6T4	7C6	12AZ7
5Y3GT	6BQ6GT	6J4	6T8	7C7	12B4
5Y4G	6BQ7	6J5	6U8	7E6	12BA6
6A7	5BY5G	6J7	6V6	7E7	12BA7
6A8	6BZ6	6K6GT	6W4GT	7F7	12BE6
					12BF6
					12BH7
					12BQ6
					12BR7

12BY7	26		
12CA5	35A5		
12J5	35B5		
12K7	35C5		
12L6	35L6GT		
12Q7	35W4		
12SA7	35Y4		
12SG7	35Z5GT		
12SJ7	37		
12SK7	39/44		
12SN7GT	42		
12SQ7	43		
12V6GT	45		
12W6GT	50A5		
12X4	50B5		
12Z3	50C5		
14A7/	50L6GT		
12B7	50X6		
14B6			
14Q7			
19			
19AU4GT			
19BG6G			
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___	1B3	.79	___	5BK7	.86	___	6BC5	.61	___	6DG6	.62
___	1DN5	.55	___	5BQ7	1.01	___	6BC8	1.04	___	6DJ8	1.21
___	1G3	.79	___	5BR8	.83	___	6BE6	.55	___	6DK6	.59
___	1J3	.79	___	5CG8	.81	___	6BF5	.90	___	6DN6	1.55
___	1K3	.79	___	5CL8	.76	___	6BF6	.44	___	6DQ6	1.10
___	1R5	.77	___	5CQ8	.84	___	6BG6	1.70	___	6DT5	.81
___	1S5	.75	___	5EA8	.80	___	6BH8	.98	___	6DT6	.53
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___	3BZ6	.56	___	6AG5	.70	___	6C4	.45	___	6FV8	.79
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___	3DK6	.60	___	6AL5	.47	___	6CG8	.80	___	6GN8	.94
___	3DT6	.54	___	6AM8	.78	___	6CL8	.79	___	6H6	.58
___	3GK5	.99	___	6AQ5	.53	___	6CM7	.69	___	6J5GT	.51
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___	3S4	.75	___	6AT6	.49	___	6CQ8	.92	___	6K6	.63
___	3V4	.63	___	6AT8	.86	___	6CR6	.60	___	6S4	.52
___	4BQ7	1.01	___	6AU4	.85	___	6CS6	.57	___	6SA7GT	.99
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___	4DT6	.55	___	6AU8	.87	___	6CU5	.58	___	6SJ7	.88
___	4GM6	.60	___	6AV6	.41	___	6CU6	1.08	___	6SK7GT	.95
___	5AM8	.79	___	6AW8	.90	___	6CY5	.70	___	6SL7GT	.84
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___	6U8	.83	___	12AT7	.76	___	12DW8	.89	___	19T8	.85
___	6V6GT	.54	___	12AU6	.51	___	12DZ6	.62	___	21EX6	1.49
___	6W4	.61	___	12AU7	.61	___	12ED5	.62	___	25AX4	.70
___	6W6	.71	___	12AV6	.41	___	12EG6	.62	___	25C5	.53
___	6X4	.41	___	12AV7	.82	___	12EK6	.62	___	25CA5	.59
___	6X8	.80	___	12AX4	.67	___	12EL6	.50	___	25CD6	1.52
___	7A8	.68	___	12AX7	.63	___	12EZ6	.57	___	25CU6	1.11
___	7AU7	.65	___	12AY7	1.44	___	12F8	.66	___	25DN6	1.42
___	7EY6	.75	___	12AZ7	.86	___	12FA6	.79			
___	7Y4	.69	___	12B4	.68				___	25EH5	.55
___	8AU8	.90	___	12BD6	.50	___	12FM6	.50	___	25L6	.57
___	8AW8	.93	___	12BE6	.53	___	12FR8	.97	___	25W4	.68
___	8BQ5	.60	___	12BF6	.60	___	12FX8	.90	___	32ET5	.55
___	8CG7	.63	___	12BH7	.77	___	12GC6	1.06	___	35C5	.51
___	8CM7	.70	___	12BK5	1.00	___	12J8	.84	___	35L6	.60
___	8CN7	.97	___	12BL6	.56	___	12K5	.75	___	35W4	.42
___	8CS7	.74	___	12BQ6	1.16	___	12L6	.73	___	35Z5	.60
___	8EB8	.94	___	12BR7	.74	___	12SF7	.69	___	36AM3	.36
___	8FQ7	.56	___	12BV7	.76	___	12SK7GT	.95	___	50B5	.69
___	9CL8	.79	___	12BY7	.77	___	12SL7	.80	___	50C5	.53
___	11CY7	.75	___	12BZ7	.86	___	12SN7	.67	___	50EH5	.55
___	12A4	.60	___	12CN5	.56	___	12SQ7GT	.91	___	50L6	.61
___	12AB5	.60	___	12CR6	.67	___	12U7	.62	___	70L7	.97
___	12AC6	.55	___	12CU5	.58	___	12V6	.63	___	117Z3	.85
___	12AD6	.57	___	12CU6	1.06	___	12W6	.71	___	807	.75
___	12AE6	.50	___	12CX6	.54	___	12X4	.47			
___	12AE7	.94	___	12D4	.69	___	17AX4	.67			
___	12AF3	.73	___	12DE8	.83	___	17DQ6	1.06			
___	12AF6	.67	___	12DL8	.88	___	18FW6	.49			
___	12AJ6	.62	___	12DQ6	1.04	___	18FX6	.53			
___	12AL5	.47	___	12DS7	.84	___	18FY6	.50			

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A fundamental principle of education should be to make the pupil realize the meaning of excellence, of the first-rate, and to send him out of school and college persuaded that it is his business to learn what is first-rate and to pursue it--not only in the job by which he earns his living but in all the great fields of life and, above all, in living itself.

Sir Richard Livingstone.

"PATHFINDERS FIRST"

Nor fleeting time shall dim my ardent views,
As with the hours I coax a joyous cruise
Thru melody from this and distant lands,
Into this embered room where I amuse
Or soothe my mind, which bears no reprimands.
No secret ire within, as doleful tones
Are joined with those that reach bejeweled thrones:
Linked closely with their designated zones.

Reliable these waves that span the earth
And safely guide a ship upon the sea.
Do not they reach without a costly fee
Imprisonment, and those of humble birth;
On wearied beds the sick in passive plea?

Incessantly the cycles pass beyond,
Non-ending in a ceaseless, tireless flow.
Swift as the light and sure as nature's bond--
This mighty force of which we little know.
I cannot see a greater aid to man
Thru centuries to come. The nation's eyes
Unveiled and honor bound have turned to scan
The Pioneer--the builder of this prize
Emblazoned path wherein the future lies.

NRI Graduate Ralph G. Robinson
. . . . Reprinted from October, 1929 issue.

* * * * * * * * * * * *

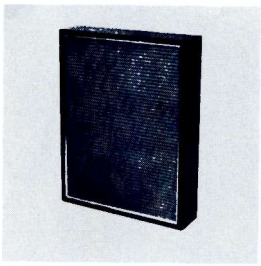
New Products

* * * * * * * * * * * *

The following write-up (with variations) appeared in the "New Products" section of recent issues of Popular Electronics, Radio Electronics, and Electronics World magazines:

"Conar Instruments announces a totally new Center-Channel Stereo Loudspeaker System. Designed for use with any existing stereo amplifier, it provides the "left plus right" center signal without the necessity for additional crossovers, gimmicks, or amplifier.

With it, the left and right speakers can be separated 15 to 30 feet for proper stereo



perspective. Conar says, "The wider, the better!" and suggests many new wall-to-wall and room-to-room placement ideas.

Specifications: Frequency response 40 to 17,000 cps; Power Capacity 25 watts; Impedance 8 or 16 ohms; Dimensions 25" × 20" × 5" deep. Includes 12 full range speakers which provide the center channel "mix." The Model 3SP is available in oiled walnut with anodized aluminum trim, is easy to install, and costs only $59.50. CONAR INSTRUMENTS, 3939 Wisconsin Ave. N.W., Washington, D. C. 20016.

This device is the brain child of Joe Belotte, Assistant Merchandising Manager of NRI's Conar Division. In speaking of it Joe asks, "Why crush a symphony orchestra or name band into 6 or 8 feet of space (the size of a spinet piano) when Conar's third channel system enables you to have it in full true perspective, broad stage sound?"

* * * * * * * * * * * *

J. E. SMITH: 50 Years. . .

A Short Time With Friends

BY ALLENE MAGANN

Just about any day you can expect to see a familiar figure walking the halls of the National Radio Institute, visitors in tow, explaining to them the intricacies of the research and development lab, the latest CONAR device, or any of the continual processes, with all the boundless enthusiasm of a dedicated guide showing off the Taj Mahal.

And whether the visitors are graduate or current NRI students, school groups, from District embassies (as frequently occurs), or just plain interested people, they have a hard time keeping up with him.

And watching, you'd be hard put to say which of the two he's enjoying most: what he's showing, or the people he's showing to. And why not? He's "matchmaking," in the most natural way, two of his lifelong great mainsprings: people and the field of radio and electronics.

That's J. E. Smith for you, and being 83 years old chronologically is no deterrent to doing what he's done well... for well over a half century. He retired as President in 1957, succeeded by his son, J. Morrison Smith, and is now Chairman of the Board.

It follows naturally, then, that that kind of unchanging spirit has motivated numberless others. It filters down through the organization itself in such a way that new employees are prone to feel very quickly, and marvel, "I feel so much at home! Everyone's so friendly!" It's built up a total enrollment of more than three-quarters of a million students in the 50 years of NRI's existence. J. E. Smith no longer personally grades each student's lessons, but the precedent he established still holds: each enrollee is assigned a personal instructor for consultation, answering any and all questions, and in general maintaining what is perfectly true: each one is treated on an individual basis. That is evidenced by the deluge of daily mail instructors and technical editors receive, far from being just lesson studies... political,

J. M. Smith, graduate of Worcester Polytechnic Institute and with a broad background of industrial engineering, succeeded his father as President of NRI in 1956.

marital, and economic views and pictures make the students as real to the instructors as the students are to them.

What kind of man does it take to generate that kind of feeling? J. E. Smith is his own best living testimonial to what hard work and faith can do to make abstract ideas grow into concrete form, and the story of NRI is perhaps best exemplified in a resume of his own growth and development in the field, because the two are interchangeable.

BEGINNINGS WERE LIMITED

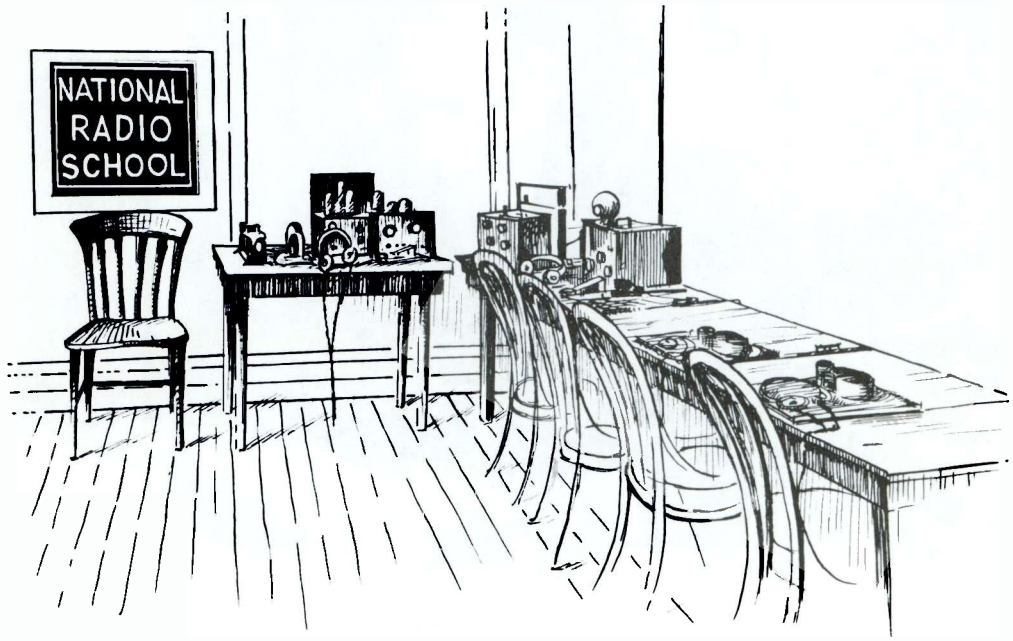
Let's go back to nearly the beginning, when this now limitless field of electronics was confined in substance to the miraculous effects of a hunk of grayish-white crystal called galena, dug from the bowels of the earth as lead sulfite; a thin piece of wire called cat-whisker, and a set of earphones. And, Eureka! You could pick up sounds for miles!

At the turn of the century, when J. E. Smith graduated from Rochester High School in Rochester, New Hampshire, anything else was strictly experimental, with no established rules and day-to-day experimentation, observation, and tests. Anything else existed only, as Marconi put it years later, "only in the brains and vision of its searchers." It was enough for the young, athletic son of a New England farmer, whose mind was stirred by visions of a broader use of the infant field of harnessing radio waves ... enough so that he worked for two years in a shoe shop and a year and a half as a locomotive fireman to help finance his way through college. In 1906 he made it, with a B.S. degree in electrical engineering from Worcester Polytechnic Institute in Worcester, Mass.

That parlayed into an extension of his summer job of performing test work on electrical equipment for Westinghouse Electric and Manufacturing Company in Pittsburgh, which probably would have settled any normal young man into a routine of interesting job, learn-what-you-can existence.

But the fates had other things in store for this young man. Out of the blue a college classmate, an instructor at what was then McKinley Manual Training School in Washington, D. C., became ill and asked his friend James to substitute for him the rest of the school year...subject, of course, to Smith's approval by the school's examiners. That, equally of course, was a breeze.

"After two days of examinations...I was hired." But the substitute teacher, employed only temporarily for classes in applied electricity from early April through June, didn't remain a substitute long. At the end of the school term he was offered a permanent instructorship, which he promptly accepted,



remaining with the school system from 1907 through 1918. "It seems," he recalls mildly, "that I had a talent for teaching."

The "talent" generated, a year or so later, introduction of a closeknit course in "wireless" for some of the eager students, the first of its kind in the District school system. In 1910 he directed construction, installation and operation of a radio transmitting and receiving station at the school, by then known as McKinley Technical High. The regular courses reduced time that could be spent in the extra wireless classes, and four of the students were eager for more, "so they could get licenses as wireless operators." Smith had fostered the interest, taking them to see the first big area radio transmitter in Arlington.

He had some afterthoughts about after-hours classes, since by then he was married and had small children, and time and the initial finances were hard to come by. (He was also helping to coach the basketball team.) "But I figured if companies like Westinghouse and American Tel and Tel could invest so much in the field, I could take a gamble myself."

And that was the beginning of his "Modern Electric Shop," forerunner of NRI. Smith rented a 10 × 12 room in the old U. S. Savings Bank Building at 14th and U Streets, set up "a coding system, some old wooden chairs, and me...," and the first evening class began ...on October 14, 1914. By the time those students were qualified, there were more applicants and, like Topsy, the whole idea just "growed"...to the extent that he was teaching three nights in Washington (besides his five-day school week); had secured a permit and supervised operation of experimental Radio Station 3YN; arranged through Peoples Drug Stores to build and install several hundred crystal receivers (highly popular).

PIONEERED FIRST HOME STUDY

Remember, this was back in the days when wireless was still considered more or less a fad (highly laughable) to be forgotten. (By 1915 human voices had been heard across the Atlantic, and a radio-telephone conversation held between an operator at Arlington, Va. and the Eiffel Tower in Paris, with "eavesdroppers" along the way even in Honolulu.) And if this much inspired skepticism and criticism, it was nothing compared to what Smith was accorded when, in 1916, he instituted pioneer home study courses, first of their kind, for some of his students who had to leave the city, and were anxious to continue their studies. He graded all their papers personally, as files back as far as February, 1916, attest.

(The story goes that an aide from the Marconi Institute in New York, at that time strictly limited to classroom training, called, incensed at the idea that the upstart young Smith thought he could train men to be wireless operators in their own homes. Later that school added home study courses to their own curricula.)

By then Smith's "National Radio School" had increased to a staff of six instructors, and four rooms. Largely, student told prospective student, and, Smith said, "I did a...little advertising." His face, with the slogan, "I can

'RADIO ON THE FARM, 1929' (Courtesy USDA)

train you at home..." began to be familiar to thousands of readers of technical publications.

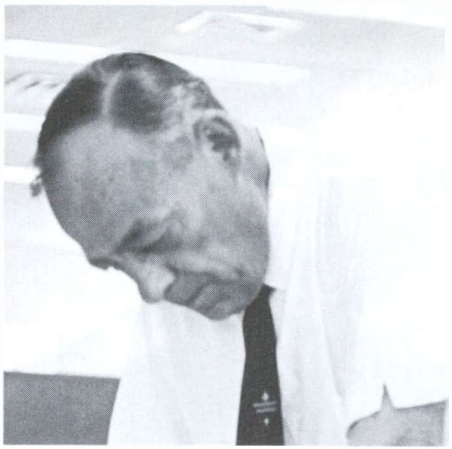
In 1917, when the United States entered the first World War, the demand for wireless operators filled the classrooms to overflowing. Facilities were expanded and the staff increased to 20 instructors. By the spring of 1918, the U. S. Government gave him the charge of training 800 soldier-students in the U. S. Army for telegraphy and telephony, then beginning to be known as Radio, at Howard University. Many NRI graduates -- no exact number was kept in the whirlwind of need -- answered the Army and Navy calls for volunteer telegraphers and technicians. Steadily increasing demands for instruction in wireless telegraphy and telephony expanded both the resident and home study classes still further. That meant a move to larger quarters, since the home study classes required all the available facilities for preparing and grading courses, and the resident classes were moved to 1345 Pennsylvania Ave., N.W. Later the Service Radio School at 9th and Pennsylvania was acquired for an annex.

About the time special hard high vacuum tubes, first developed for the Navy, began to replace soft ones as amplifiers, Smith resigned his public school instructorship... after all, how many hours are there in a day? He was finding out that there weren't nearly enough, if you included sleeping a few hours among things that must be done.

"The first few years were a struggle, physically and financially," he admits now. The early students included some figures later notable in this broad field, including Philo T. Farnsworth, who did much of the early television development, and has invented probably as many radio and electronic devices as any man in the United States; John T. Fetzer, who became censor of broadcasting facilities during the war; and one of the first women students, Maria Delores Estrada, who was sent by General Carranza of Mexico to learn telegraphy from Smith. After she finished the course the General built a transmitting and receiving station for her exclusive use for him. Still later he was slain, and history does not record what happened to the station.

In 1919 the war was over, but interest in radio...and the National Radio School...was not. Besides the career telegraphers, the number of amateur operators mushroomed. Despite the expansion of his staff, Smith kept on instructing as well as supervising, incorporating into the courses such new devices as vacuum tube oscillators to replace the old spark transmission. Scores of commercial wireless stations were being built, many using the Alexanderson alternator which fed power directly to the transmitting antenna. Smith

WILLIAM F. DUNN, Director of Education



JAMES B. STRAUGHN
Chief of Consultation Service

opened a branch resident school in Baltimore, teaching there two nights a week.

Late in 1920 the school was incorporated under District of Columbia laws, as National Radio Institute, Inc., with Mr. Smith as president, a post he maintained until 1956.

Radio opportunities were abundant, and enrollment zoomed... in 1928 12,000,000 sets were in use in American homes, and Dr. Lee De Forest, "the father of Radio" exulted in his column in National Radio News, about "the almost limitless fields of communication, by wire and wireless, telegraph, telephone, photographic and facsimile transference... railroads... aviation... prospecting... talking motion pictures... in every line of human industry in America, radio is playing a more important or indispensable role."

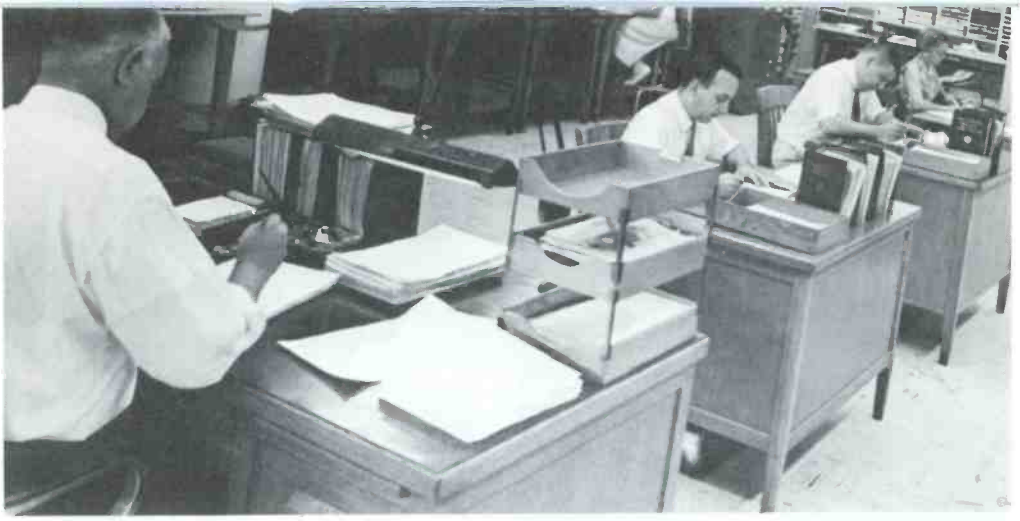
Two years later both resident schools were closed, and the Institute moved to 1223 Connecticut Ave., N. W., with total effort going towards the now well-established correspondence school. That, too, was the year when neutrodynes were developed. A new NRI building, at the corner of 16th and U Streets, was purchased in 1927, when 10 million American homes were still without electricity, television was more a word than a reality, with all the bugs in its transmission and reception; Bell Telephone Company was experimenting with synchronous operation of radio stations. And NRI started monthly publication of National Radio News for current and graduate students, an eight-page, 8-1/2 × 11 inch effort. Smith helped organize the National Home Study Council.

Smith's next interest was a machine for automatic sending of code signals. Aided by Clarence Burger, he developed, patented, and manufactured the venture of the Natrometer, and later the highly accurate Nacrometer.

Moving pictures were transmitted through the air, and radio apparatus was changing so fast, NRI President Smith commented, "that people are delaying buying..... until they are satisfied that receivers are standardized and will not become obsolete over the weekend." The format of National Radio News was changed to a 20-page monthly, 5-1/2 × 8-1/2, and Television home study courses added.

C. Francis Jenkins demonstrated his television apparatus to some of the NRI staff, now numbering 125. On NRI's 15th anniversary, 80 graduates (a minute percentage of the total), representing 32 states and two Canadian provinces, met and organized the NRI Alumni Association, the first alumni group of a home study school (now with a membership close to 40,000). They carried out the idea themselves, electing their own officers and pledging to work for the interests of NRI. Then the Depression hit, and naturally NRI was affected. Salaries and expenses were reduced (but not student services), but "we kept track," says Smith, "and gave the money back to them when we started to prosper again..."

A second World War eventually meant frozen radio models, acute shortage of parts; Television development was halted, and existing facilities used to train air raid and civil defense personnel. And on the radio cruiser "Helena," sunk by the Japanese, seven of its eight Radio operators were NRI graduates. After the war, NRI advertising manager Stuart M. Armstrong was instrumental in getting a provision for home study training in the GI Bill, and Veterans Administration approval of NRI Courses. And 169,493 enrolled in NRI under that provision! The years that followed



Chief Lesson Grader Don Quade, left, and part of the lesson collating-grading section.

have seen NRI keeping pace in the electronics field, through all its almost day-to-day changes, adding or discarding equipment, revising or completely rewriting textbooks and adding new ones, development of practical home experimentation equipment for students.

The research and development lab, for instance, is the scene of constant activity, with technical editors utilizing the highly extensive... and expensive... equipment, such as the TIC test Television transmitter. An elaborate parts file system and a library with probably the largest schematic files in the country, as well as ample authoritative reference textbooks, manuals, and other publications helps. NRI now publishes more than 250 textbooks and reference manuals, none less than 32 pages and many twice that. At an average of 800 words a page, that's at least 6,500,000 words written BEFORE revisions and additions and replacements! And every publication is edited not only for technical accuracy but for simplicity and readability.

And if all the wires used in NRI research and kits and equipment for 50 years were spliced together, how many times would they circle the globe? Don't answer that question, students... it's purely academic. But just to give you an idea, eight million feet of one popular type alone were used last year. In line with the striving for accuracy and up-to-date developments, the service lab rebuilds, repairs, corrects student errors in assembling kits, and builds students' experimental projects. The quality control lab tests equipment purchases, to maintain high quality standards; the assembly lab puts together NRI's own CONAR products such as oscilloscopes, signal tracers, generators, tube testers, radios, TV, coils, trimmers, and the like (returns far less than 1%).

And many other busy hands and minds keep things rolling at the level J. E. Smith set 50 years ago... Administrative Services, Graduate Services, draftsmen, artists, photographers, lesson graders, typists, printers, mailroom personnel... and on and on.

And students are not the only ones proud of NRI's continued growth. A bronze plaque in the lobby perhaps says it best.

> "April, 1957
> We proudly commemorate the dedication of this building which we regard as a dynamic monument to the many and great accomplishments of James E. Smith, founder, our good friend and inspiring leader since 1914.... NRI Employees"

It was no accident that NRI's new building, built to specifications at 3939 Wisconsin Ave. N.W., was next door to a branch post office... NRI has the largest private mailing in the District of Columbia. Every day's mail brings letters of inquiry literally from all over the world, at least from all the free countries, which NRI's Sales Department handles. The letters are from enrolled students, and from those who have seen our advertisements in national publications distributed internationally, and either want to enroll or to "sell" NRI courses in their countries. (NRI still uses no outside salesman.)

For example, a small sampling of mail at the time of this writing included inquiries from, to name a few, Mysore State in India; Ceylon, Port-Louis, Mauritius; Canadian provinces, Lagos and Davoa City in the Republic of Nigeria; Kuwait and Bahrain in the Arabian Gulf; Tel Aviv, Israel; Sunderland, England, and many others. About forty per cent of the countries won't allow their nationals to take

Some NRI 'Friends' At Work

ARDEN L. WIDMAN, Technical Editor

HUGH S. LITTLEJOHN
Assistant to Director of Education

E.B."Ted" BEACH, Technical Editor

HARRY TAYLOR, Technical Editor

CONSULTANTS, from left, RICHARD STANCHIK, STEVE BAILEY, and JOSEPH SCHEK

the courses, and the Sales Department so informs the writers. But something like 130 countries, and all U.S. possessions, do permit it (with some limitations on a few), and so NRI students literally circle the globe. The letters come in all languages, which are translated by various embassies as a courtesy. As we said, it was no accident that NRI moved next door to a post office, but the area was strictly serendipity (finding something pleasant unexpectedly)... its name, Friendship Branch.

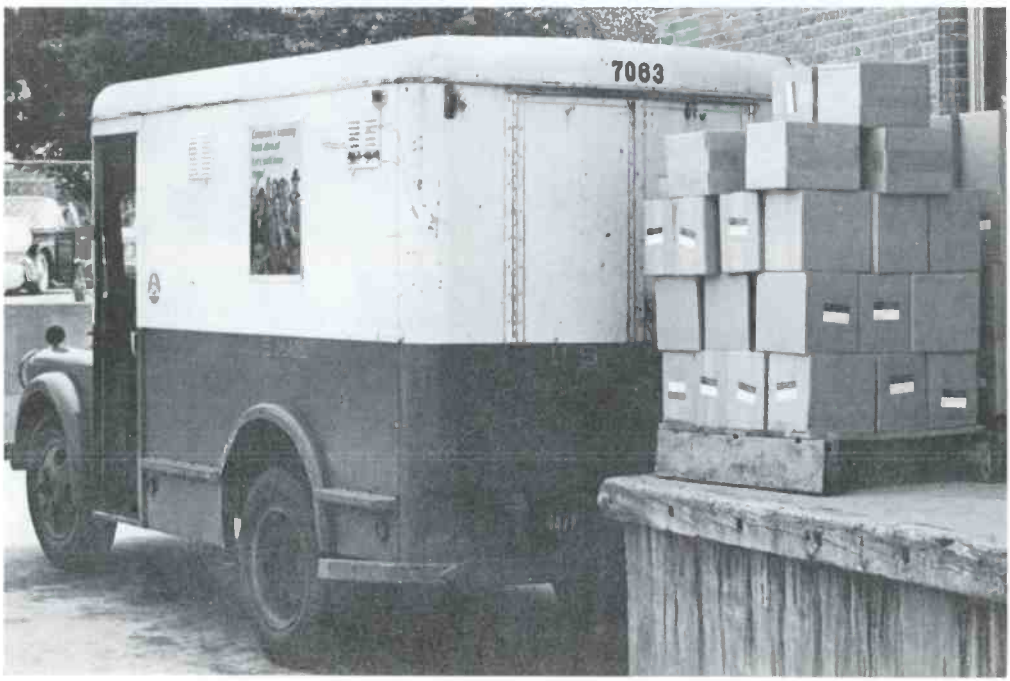
And back to J. E. Smith: Today his eyes are as bright and his handshake as firm as those of a man half his age. He starts the day with a 6 a.m. swim in the pool at his home, "Macamor" (derived from the first syllables of his three children's names — Marjory, Carol, Morrison) on the banks of the Potomac in McLean, Va. He still comes to the office every day, and his door is always open, but he plays "hookey" two afternoons a week when the weather is fair to play golf, shooting in the low 80's, and is, his golfing partners say, a hard man to beat.

He and Mrs. Smith were married 50 years on November 23, 1960. They've visited every state in the U. S., Canada, Scotland (by auto), Hawaii, Cape Breton Island, South America, Europe, Alaska, Montego Bay, Jamaica, and last year took a trip that included visits to Ireland, Tokyo, Hong Kong, Bangkok, Delhi, Bombay, Cairo, Jerusalem, Beirut, Istanbul, Athens, Corinth, and Lisbon.

In line with his strong belief in education and specialization in a world becoming more specialized every day, Mr. Smith, himself conferred an Honorary Doctorate of Laws by Southeastern University in 1955, established two four-year, full-tuition scholarships at his and his son's alma mater, Worcester Polytechnic Institute. In 1955 he also established the National Radio Institute Charitable Trust, which contributes regularly to charitable, religious, and educational purposes. An additional Career Education Plan for employees pays full tuition for further education in fields related to their work.

He attributes his vigor to "being blessed with good health." He has been blessed as well with vision and foresight that has been justified immeasurably in the world of communications... and to him "communicating" has all the ramifications of the word, inextricably tied up with education. He says, "Education is probably one of the greatest factors for making a person a success. It is also one of the greatest instruments for peace... when we become educated to really know one another, we can't fight each other any longer..."

And of all the honors and accolades heaped upon him in his long and fruitful life, and they are many, perhaps the one of educator would please him most. And what other man could say he's taught at least three-quarters of a million people, men and women of all ages and all nationalities?



OLD FRIENDS SAY GOODBY

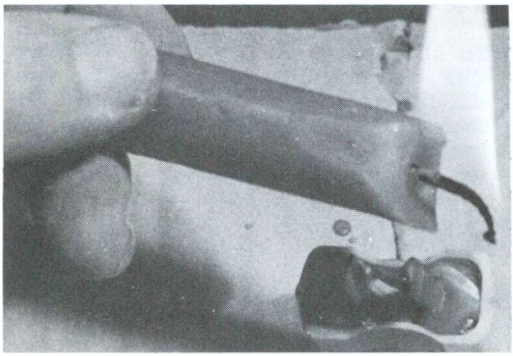
" 'The only true gift is a portion of thyself,' " quoted Elizabeth Butt in saying the coworkers' farewell to Stuart M. Armstrong, center, retiring NRI advertising and public relations director, "and you chose for yourself an outgoing, overflowing way of life. Out of this abundance, you have enriched us all." J. E. Smith, left, was on hand along with the entire staff to say official farewells to a good friend, one who left a rich impact on all those he worked with...

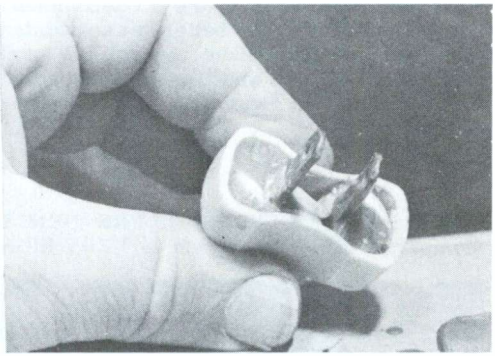
Armstrong, who started with NRI in 1928 as a correspondent in the Student Service Department, later became director of the department before becoming assistant and advertising manager. A long-time gardening enthusiast and expert, he landscaped the grounds for NRI's new building, doing all the planning, purchasing, and most of the planting. He served three terms as president of the American Horticultural Society, six years as president of the Sligo Park Hills Garden Club, and has been a garden club lecturer of note for many years. (His own home is a gardening showplace, with his specialty azaleas, many original varieties.

A life member of the Washington Advertising Club, he has been its president; chairman of the Steering Committee of the National Home Study Council; president of the Sligo Parks Hills Citizens' Association, and chairman of the NHSC Public Relations Committee since its inception 10 years ago.

He and Mrs. Armstrong have three sons, all graduates of Haverford College.

He is succeeded at NRI by Jack Thompson, acting advertising manager since Mr. Armstrong's illness a year ago.





You can make an extension cord plug shock-and-short proof by the simple expedient of melting wax from an ordinary candle around it. Here it is seen that the bared ends of the wire are imbedded in melted wax which has hardened. A film of wax on the prongs of the plug will make it slip in and out of the receptacle easier.

HANDY TOOL BOX ADDITION

Despite its inefficiency as a light source an ordinary candle makes an extremely useful addition to any tool box. It makes an excellent pincushion for small sharp objects, pins, brads, thumb tacks, tiny screws, etc., and it can be used in many other ways as well. Melted wax will hold an insulated wire in place without the use of clips or tape, and it will also hold a pin or screw to the end of a screwdriver or wrench for starting in a close place. It will serve as an adhesive, as a lubricant (for door latches, etc.) and as an insulating substance if not subject to heat. Melted wax will prevent corrosion and will stop a small nut from loosening when subject to vibration.

Passing of all-channel law opens new vistas to serviceman ready for

THE REBIRTH OF UHF

By LON CANTOR

April 30, 1964, can be considered the birthday of UHF. That was the date when the all-channel law went into effect. In reality, the all-channel law is a UHF law. It requires that all TV receivers built from now on be equipped to receive UHF.

Of course, UHF is still in its infancy. There are only 124 UHF stations in the United States today, compared with 530 VHF stations. However, many new UHF stations are going on the air. And by 1970, it is estimated that there will be 1000 UHF transmitters in operation.

What does this mean to the TV technician? It means that you had better get acquainted with UHF --- fast. Make yourself the local expert on UHF and you'll be in an excellent position when the first UHF channel comes to your town.

WHAT IS UHF?

UHF stands for ULTRA HIGH FREQUENCY (compared with VHF, which is VERY HIGH FREQUENCY). It includes the spectrum 470 mc to 890 mc. There are 70 UHF channels, 14 through 83. Like VHF channels, each UHF channel covers six megacycles. There are no guard bands in the UHF spectrum.

In general, UHF transmissions won't go as far as VHF. Since frequencies are much higher than those of VHF, UHF is more restricted to line-of-sight distances.

Further, TV receiver noise figures are not as good at UHF as at VHF. This means you need stronger UHF signals to get "snow-free" pictures.

To offset these problems, the FCC allows UHF channels to go up to 5 million watts effective radiated power. The low band VHF channels, 2 through 6, are restricted to a maximum of 100 thousand watts effective radiated power, while the high VHF band is allowed 316 thousand watts ERP.

This factor tends to equalize reception of

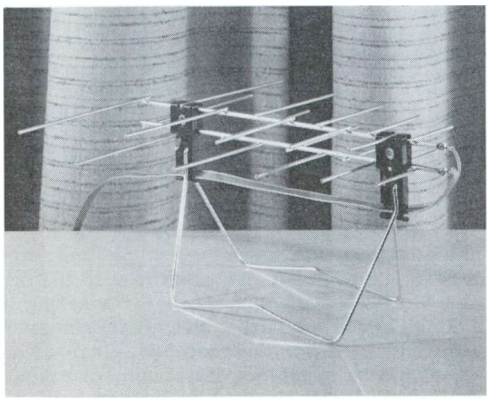


FIG. 1. A typical indoor UHF antenna with "bowties".

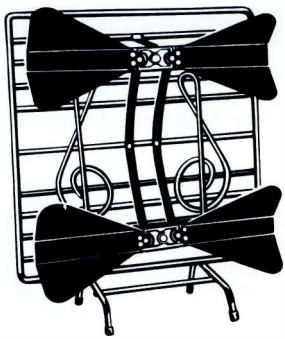


FIG. 2. Periodic type indoor antenna is highly directive, delivers 10 db gain over isotropic.

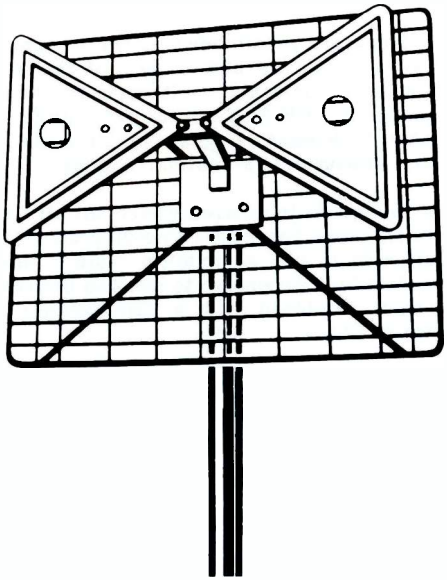


FIG. 3. Bowtie-with-screen type outdoor UHF antenna.

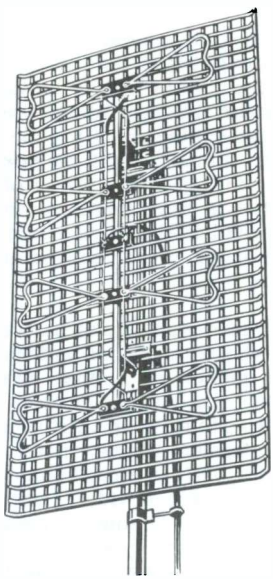


FIG. 4. Bowtie-with-reflector type outdoor UHF antenna.

UHF and VHF within a radius of about 40 miles from the transmitter. As a matter of fact, UHF is in many ways superior to VHF at these distances. Interferences, both man made and atmospheric, are very much reduced. Because UHF channels are so spread out, there will be no adjacent channel or co-channel problems with UHF. And UHF channels are allowed to use low-powered relay transmitters and translators to fill gaps in their coverage patterns.

UHF ANTENNAS

One of the nicest things about UHF compared with VHF is antennas. Since wavelength is inversely proportional to frequency, UHF antennas are a lot smaller than their VHF counterparts. You not only get more antenna gain for your money, but UHF antennas offer less wind resistance and, therefore, require less expensive supporting masts, fewer guy wires, etc.

Close to the TV station, most home-owners will use indoor antennas. Indoor UHF antennas work very well despite the fact that "building losses" are high at UHF. For one thing, UHF is often able to penetrate a large steel and concrete building better than VHF. This is because an ordinary window is less than a wavelength wide at UHF. However, the most important factor is antenna gain.

VHF "rabbit ears" are simply dipoles. This type of antenna yields only about 2 db gain over a theoretical isotropic antenna. Also, match is very poor. Fig. 1 shows a typical indoor UHF antenna, sometimes known as a "music stand." This antenna consists of two dipoles stacked in front of a reflector screen. While it's not very large, the music stand provides up to 8 db gain. However, the response of this antenna is dependent on the size of the dipoles, or "bowties," and their distance from the screen. Gain varies significantly with frequency. This can be especially annoying with color TV, because the gain at the color sub-carrier frequency may differ from the gain at other frequencies in the channel. This can cause phase shifts in the color information.

Also, the music stand is not very directional. The real problem in urban TV reception is not weak signals but multiple signal reception which causes ghosts. Ghosts come from two basic causes: (1) reflections from high buildings, water tanks, hills or bridges, and (2) standing waves which are set up within a building. Antenna directivity is the only effective weapon against ghosts.

Fig. 2 shows a new type of indoor antenna, based on the periodic principle found so effective in the U. S. Satellite program. The periodic antenna is not as attractive as the music stand but it is highly directive, response is uniform, and gain is somewhat higher--about 10 db.

The standing wave pattern set up within a building can be very complex at UHF. This is because UHF waves are so short - they repeat much more often in a small space than do VHF waves. The effect of this is to

make antenna placement and orientation much more critical at UHF than at VHF. Placement on top of the TV set will not always work for a UHF indoor antenna. You may actually have to probe around the room for the best signal. Then, the antenna must be very carefully turned to avoid ghosts. Because of the shorter wavelengths, a very small movement of an UHF antenna has the same effect on the picture as a much larger movement of a VHF rabbit ear.

In areas where signals are blocked by buildings, or where an indoor antenna just can't eliminate ghosts, or further away from the transmitter, an outdoor antenna will be required. Experience with UHF so far indicates that many homes where rabbit ears were adequate for VHF will need outdoor UHF antennas. There are a wide variety of outdoor UHF antennas available, ranging from the Bowtie with screen type (see Fig. 3) to the stacked conicals - with - reflector (Fig. 4), through periodic types (see Fig. 5), Yagi

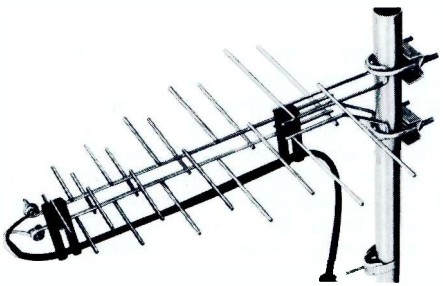


FIG. 5. Periodic type antennas provide high, uniform gain with very clean lobes.

arrays and parabolics. Some of these antennas can be stacked for 3 db higher gain (see Fig. 6).

The bowtie antennas are good in areas where there are no real reception problems. For higher gain and greater directivity, the periodic types are recommended. Where signals are very weak, the higher gain of the Yagi antennas is desirable, although frequency response of UHF Yagis is far from uniform. Finally, in deepest fringes, the parabolic reflector antennas do an outstanding job.

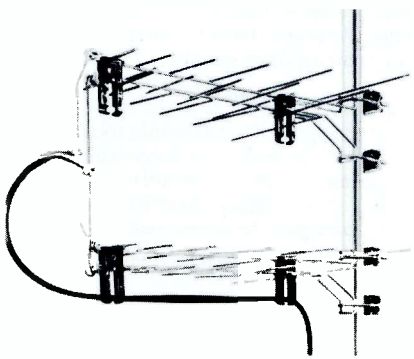


FIG. 6. Stacked antennas provide 3 db extra gain.

What do you do in an area where not all UHF channels come from the same direction? One solution is to use an antenna rotator. However, it's less expensive to use two separate antennas combined with a UHF coupler as shown in Fig. 7.

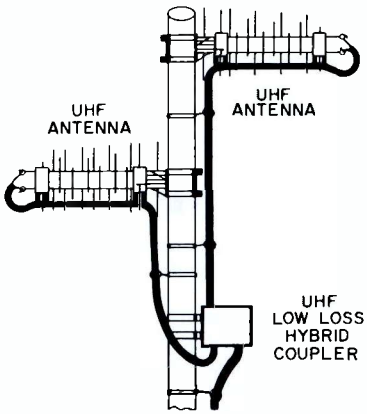


FIG. 7. Low loss hybrid type UHF coupler is used to combine antennas pointing in different directions.

Now what about an area with both UHF and VHF channels? Eventually, there will be true all-channel antennas. In the meantime, we'll have to get by with separate UHF and VHF antennas. These antennas can be mounted on the same mast. To prevent interaction, however, reasonable spacing is required. Ideally, the distance between the antennas should be as long as the longest element of the VHF antenna. But you can generally get by reasonably well with a minimum of three feet between UHF and VHF antennas. The UHF antenna should always be on top.

Fig. 8 shows how to combine the signals from a UHF and a VHF antenna, using a frequency sensitive coupler.

BOOSTERS

A mast-mounted booster is the best way to bring in really weak UHF channels. The trouble with weak signals is not just that they are weak, but that they are weak in relation to the noise. Noise shows up on the TV screen as snow.

Most present day TV receivers have plenty of amplification. In fact, many new sets are

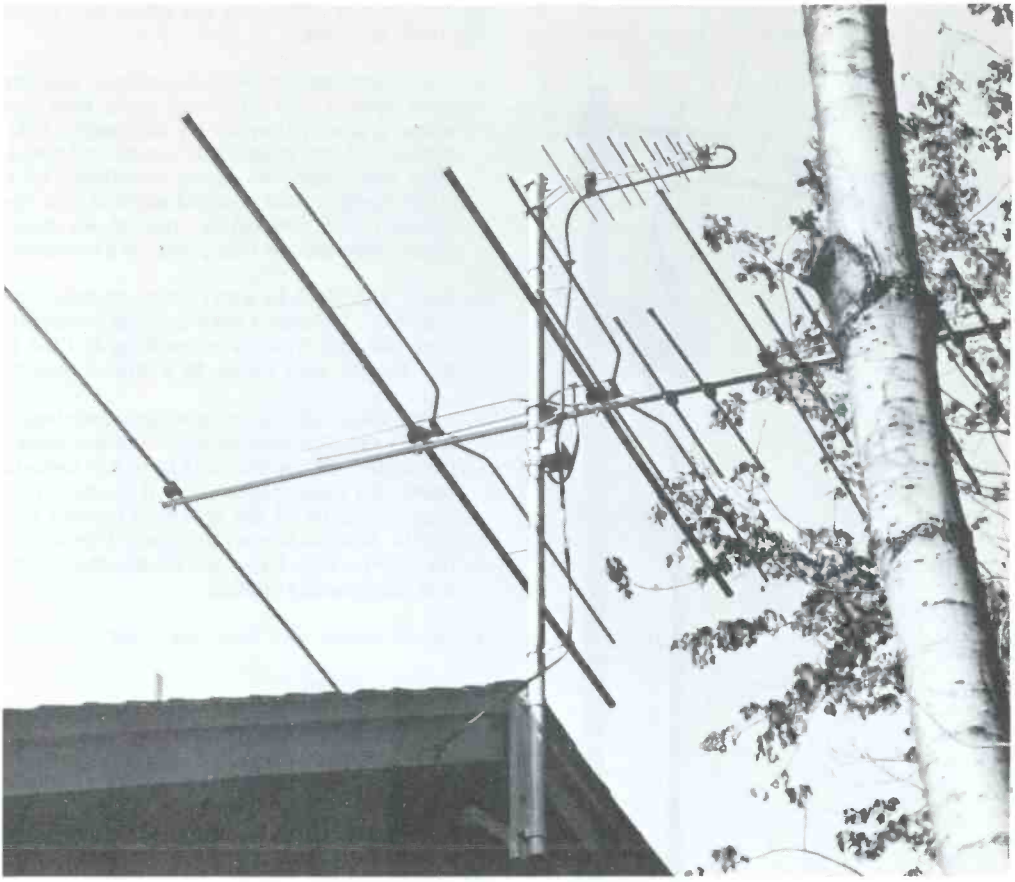


FIG. 8. Separate UHF and VHF antennas may be mounted on same mast and combined with UHF/VHF coupler.

so powerful that even when no signal is present, the receiver is driven to AGC action by noise alone---you get full contrast on the snow.

The relationship between signal and noise is called the signal-to-noise ratio. A poor signal-to-noise ratio means a snowy picture. The problem is that when we amplify the signal, we also amplify the noise.

Our aim, then, is to improve the signal-to-noise ratio. No amplifier or pre-amplifier can do this at a given point. As a matter of fact, every amplifier adds noise of its own, thus deteriorating the signal-to-noise ratio.

Why, then, do we use a pre-amplifier at all? The answer is that while we don't improve the signal-to-noise ratio at any given point, we can make a tremendous improvement in system signal-to-noise ratio.

The best available signal-to-noise ratio in any system is right at the antenna. However, the lead-in wire deteriorates this ratio. Therefore, it we pre-amplify the signal before it goes down the lead-in wire, we can improve picture quality a great deal.

Until recently, there were few UHF pre-amplifiers on the market. Most were expensive units, covering only a portion of the UHF spectrum (see Fig. 9). Today, however,

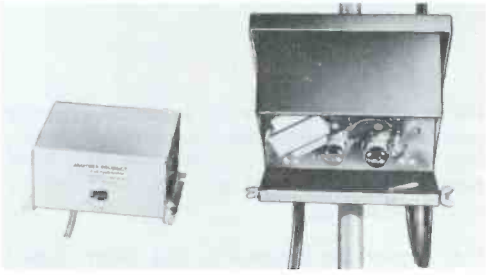


FIG. 9. UHF amplifiers of this type are expensive, yet cover only a portion of UHF band.

FIG. 10. New type UHF amplifiers (such as Blonder Tongue Model ABLE-U2 shown) cover entire TV spectrum.

excellent UHF channel pre-amplifiers such as the unit shown in Fig. 10 are available at a reasonable price.

LEAD-IN WIRE

It's surprising how few TV technicians really know how to handle lead-in wire properly. You can make a lot of mistakes with VHF installations and still get by. But UHF is more demanding.

The higher the frequency, the more signal attenuation any given lead-in wire causes. Also, at UHF stray capacitance is an important factor. Here are the important rules for UHF lead-ins:

1. Use a quality foam-filled cable. Ordinary twin lead works all right when dry, but when it's wet it severely attenuates UHF signals. Also, it tends to crack and break with age. This can mean a callback on a UHF system that worked when it was installed, but eventually caused so much signal attenuation that pictures are snowy.

2. Keep the lead-in away from metal. Remember, it doesn't have to touch the metal. You can get capacitive coupling at UHF if the line is just close to a metal object.

3. Use good standoffs, but use them sparingly. Every standoff causes loss. And the closer the metal of the standoff is to the lead-in wire, the more signal loss it causes. Use long standoffs of the type that doesn't encircle the lead-in with metal. This keeps the wire away from the house, the mast, and most metal objects.

4. Don't staple or tack the UHF lead-in.

5. Avoid splices.

CONVERTING TV SETS

What can be done with the 50 million TV sets in use that aren't equipped to receive UHF? Eventually, they'll all be replaced, but this will take years. In the meantime, they can be converted for UHF.

There are two ways to do this:

(1) Add a UHF tuner or a UHF channel strip.
(2) Add an external UHF converter.

Many TV manufacturers have provided for conversion of their receivers to UHF. For example, Westinghouse has made available UHF tuners and tuner adapters. Fig. 11 shows the circuitry of the Westinghouse UHF input adapter with its accompanying 44 mc adapter strip. When the TV set is dialed to channel one, these units provide the connections and wiper contacts to switch the UHF tuner into the circuit. The UHF tuner uses a local oscillator to convert the incoming UHF channel to an i-f of 44 mc. A capacitor which the 44 mc adapter places between the plate and grid of the VHF local oscillator prevents this circuit from oscillating. Instead, the VHF tuner acts as a 44 mc amplifier. More typical, however, of internal conversion systems is the channel strip shown in Fig. 12. Units of this type are generally available for most sets that use turret type tuners. They can be in-

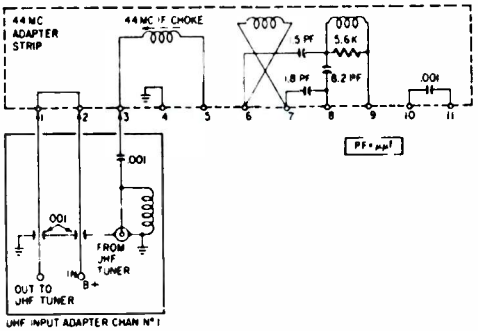


FIG. 11. 44 mc adapter with UHF input adapter converts Westinghouse TV sets to receive UHF channels.

FIG. 12. Typical UHF channel strip.

stalled in place of an unused VHF channel strip.

But external converters (see Fig. 13) are the easiest and most common means of adapting VHF TV receivers for UHF reception. Good converters have lower noise figures than internal UHF tuners. They are easy to install and do not require that the back of the TV set be removed.

There are two basic types of external converters presently available. The simpler type consists primarily of a local oscillator and a mixer. Output of such a unit is the incoming UHF signal, converted to an unused VHF channel (generally 5 or 6). Conversion loss is on the order of 10 db, as it is with internal UHF tuners.

To overcome this conversion loss, there are converters available with an amplifier stage after the mixer. This stage becomes the first i-f stage in the receiver on UHF reception. The i-f amplifier stage not only overcomes conversion loss, but supplies a gain of 6 to 14 db, depending on the frequencies involved.

A converter with a built-in amplifier is recommended especially for weak signal areas and with older TV receivers, where it can significantly improve picture contrast.

FIG. 13. External converters may be used to provide UHF reception on any VHF TV set.

CONVERTER SERVICING

Fig. 14 shows the schematic of a typical two-stage converter. If you're careful, converters aren't hard to service. Inspect tubes, line cords, diodes and poor contacts first. This will solve most converter troubleshooting problems.

Be very careful, though, not to disturb the physical layout of the converter. Because of the high frequencies involved, lead dress is very critical. An innocent looking wire may be used to inject signals into a mixer. And moving capacitors, silver strips, coils or tuner wiper contacts can cause misalignment.

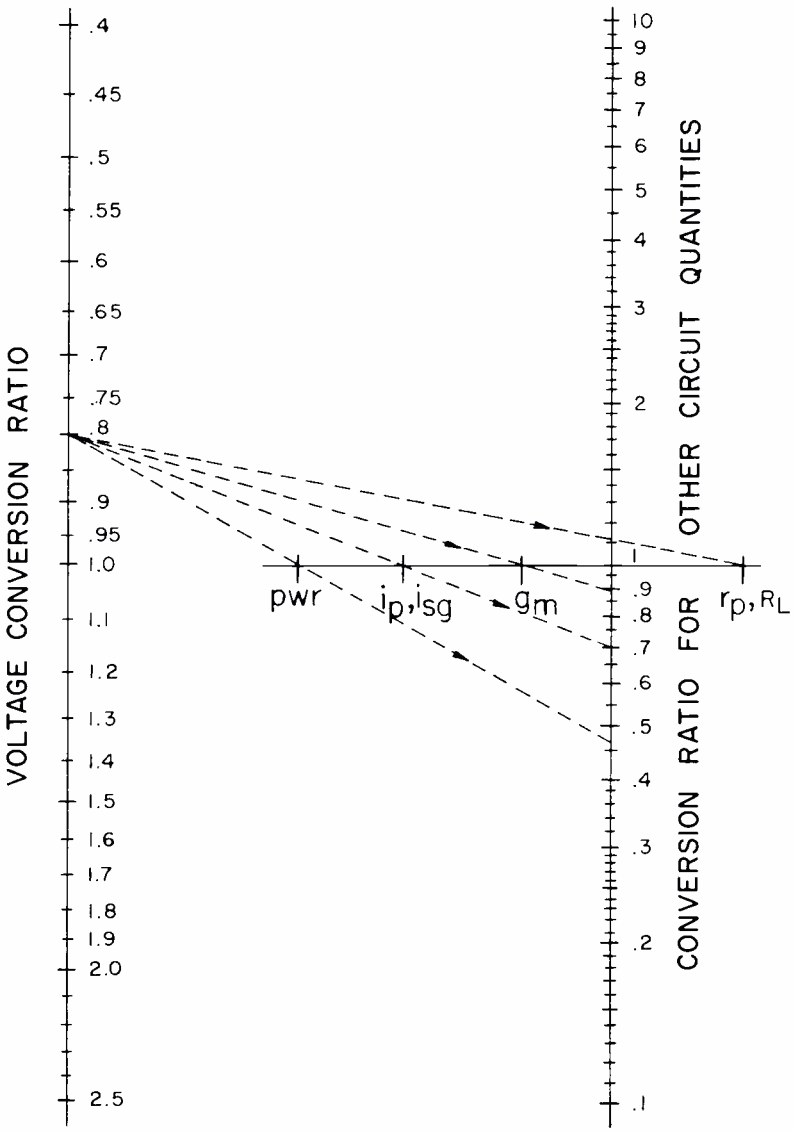
You probably don't have the equipment to properly align an UHF converter or tuner. Once a unit is out of alignment, the best thing to do is to send it back to the factory for service.

When tuner contacts get dirty, the result on the TV screen is often snow. This can usually be eliminated with a good tuner-cleaner-lubricant. Other possible causes of snow are poor selenium rectifiers, gassy tubes, and poor tube socket contacts.

If you find that the oscillator drifts, try substituting the oscillator tube. If this doesn't clear up the trouble, check B+ and filament voltages and clean the tuner contacts.

Get acquainted with UHF as soon as possible. It may not amount to much in your community now, but during the next few years UHF growth should be fantastic. -30-

OPERATING POINT CONVERSION NOMOGRAM



Data for the nomogram are from the Radiotron Designer's Handbook; typical 6L6 operating values from the Sylvania tube manual.

Operating Values For Various Plate Voltages

BY A. L. TEUBNER

When you change the plate voltage of a tube from that specified in the manuals for typical operating conditions to some other value, how do the other quantities in the circuit change? This nomogram solves that problem. As it happens, the circuit voltages, currents, and resistances do not change at the same ratio.

To use the nomogram at left, first decide by what factor you want to change the plate voltage. All voltages will be changed by this factor, and it should not be less than 0.4 or greater than 2.5. Then locate the number on the Voltage Conversion Ratio scale at the left side of the nomogram. Draw four lines from the four points on the horizontal scale. These lines will cut the right hand vertical scale at points which indicate the correct conversion factor. An example is worked out in the table. It represents a 6L6 Class A1 single tube power amplifier operating at 80% of the "typical" plate voltage of 250 volts.

QUANTITY	TYPICAL	CONV. FACTOR	NEW VALUE
Plate Voltage	250	0.8	200
Screen Voltage	250	0.8	200
Grid Bias	-14	0.8	-11.2
Peak AF Signal	14	0.8	11.2
Plate Current (0 signal)	72 ma.	0.71	51.1 ma.
Plate Current (max signal)	79 ma.	0.71	56.1 ma.
Screen Current (0 signal)	5.0 ma.	0.71	3.55 ma.
Screen Current (max signal)	7.3 ma.	0.71	5.18 ma.
Plate Resistance	6000	0.9	5400
Load Resistance	22500 ohm	1.1	24800 ohm
Power Output	2500 ohm	1.1	2750 ohm
	6.5 w.	0.47	3.05 w.

Straughn To Visit Alumni Chapters

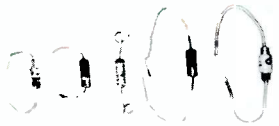
Members of the various NRI Alumni Association local chapters have come to look forward eagerly to the lectures and demonstrations conducted by J. B. Straughn, Chief of NRI Consultation Service, at their meetings. He has accompanied Executive Secretary Ted Rose on the latter's annual visits to the chapters for the past two years. We are pleased to announce he will do so again in the 1964 - 1965 season.

You do not have to be a graduate or a member of the NRI Alumni Association to attend the meetings of these local chapters. All NRI students and graduates are welcome. If there is a chapter in your area, make the most of this opportunity to visit it, meet Mr. Straughn and hear him lecture on Electronics. See "Directory of Local Chapters" on Page 32 for information on time and place of meetings.

Here is the schedule:

CHAPTER	DATE
Southeastern Mass.	September 30
Flint	October 8
Detroit	October 9
Philadelphia-Camden	October 26
Hagerstown	November 12
Springfield, Mass.	November 18
New York City	November 19
New Orleans	March 9
Hackensack	April 30
Pittsburgh	May 6

DEVICE OF THE MONTH



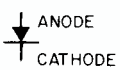
CRYSTAL DIODES

BY R. C. APPERSON, JR.

I wouldn't be surprised if your first real introduction to electronics was through the use of a crystal diode. Mine was. We called it a catswhisker and it was part of a marvel we knew as a crystal radio - got one station pretty good!

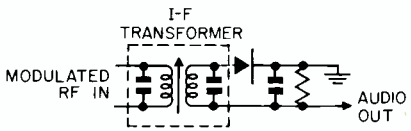
Since, as a kid, we didn't understand what was happening within this device, we stood in awe of the thing. Today we use a similar device many times daily and never give it the second thought which it deserves. That catswhisker has been improved upon, encapsulated, and is being used in almost every kind of circuit that comes out of the designer's bag of tricks. Let's examine the crystal diode more closely and decide when and where to use it to its best advantage and which one to choose for various operations.

Diode means two elements, and consists of the anode and cathode as is found in the thermionic diode, although it is drawn slightly differently.

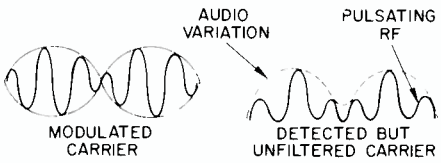


A crutch for remembering which is the anode, if you are like me and need a crutch occasionally - the shape of the schematic anode is the outline of an "A" - for anode. WILD, but it works for me!

We know that the diode rectifies, allowing current to flow in one direction and not the other. How do we use this in signal applications? One of the major uses is as a demodulator, or detector, and is found in almost all solid state (and a lot of vacuum tube) receivers.



Simply, the diode rectifies the carrier, throws away one half and retains the other half. The

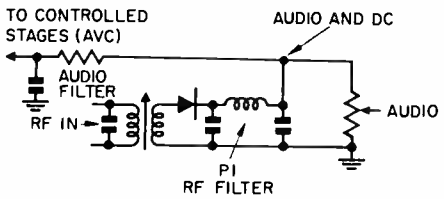


retained half is pulsations whose amplitudes are varying at an audio rate. The higher frequency component is filtered by a network and the result is a current which varies at an audio rate.

Which diode should you choose for this job? Most any signal diode will work, so don't waste money on a real good one, the cheaper the better for this application. A 1N34 will do as good a job as any.

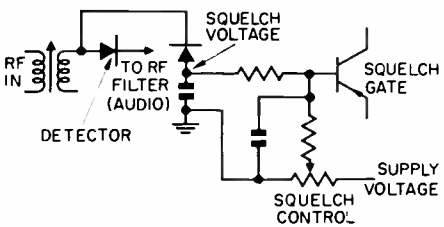
While we're in this section of the receiver, let's look at two other circuits in which diodes are used to improve receiver action. They are automatic volume control (AVC) and squelch. No person who has ever done any communications receiver listening hasn't, at one time or the other, thanked his

lucky stars for these two little improvements. The AVC holds the level fairly constant although fading does occur in the carrier. The squelch deadens some of that raucous atmospheric noise which can really get to you at times. They are both accomplished by diode action, rectifying the carrier and using the DC produced to control bias. The AVC diode is in a configuration like this (using the de-



tector diode in most cases), and causes a changing DC to be applied to the previous rf and i-f amplifiers in accordance with the carrier amplitude variation. This tends to hold the level constant. If the carrier level increases, the bias increases, decreasing the gain of the stages it is applied to, and vice versa.

Squelch works like this. The circuit is as appears here and the diode controls an audio

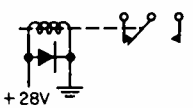


gate tube or transistor. When no carrier is present, the audio stage is cut off and none of the noise is allowed to pass. When a carrier pops on the air, the diode rectifies it, producing bias which overcomes the cutoff bias. The gate is open and sound emits.

Here again, selection of diodes is not very critical. You do not want to waste voltage, so a good conducting (low resistance) diode is best, but most any diode will work. Germanium is usually chosen because of the low voltage drop across it.

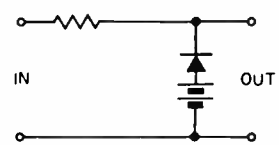
Diodes also find application in communications gear as modulators and mixers. Since they are non-linear devices, frequency components may be added across them and derive modulation. Also, as a mixer, the sum, difference and the two frequencies being beat together will appear across a diode. The diode is usually biased into the desired operating region by the local oscillator and the incoming signal mixes with it. Here, the frequency of operation determines the type of diode to use. The higher the frequency, the faster the diode must be, hence a silicon diode is preferred in the 50 MC region whereas a germanium type may be used satisfactorily in the A.M. broadcast band. The limiting factor, frequency-wise, is capacity. A diode with lower capacity is naturally faster, since the smaller capacity charges faster.

The drop across the average diode is approximately 0.7 volt before it starts conducting. This low voltage drop makes the diode ideal for surge spikes caused by collapsing electromagnetic fields associated with relay coils and such devices. The voltage is limited at 0.7 volt when it tries to generate a spike that could disturb other circuitry, as in programmed circuitry. The diode is connected like this so that it is back biased by the volt-

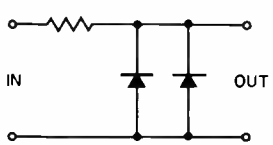


age applied to energize the relay, but absorbs the instantaneous voltage caused by the change of the collapsing field. Here, the speed of the changing voltage and the peak voltage rating of the diode, plus the peak voltage of the spike being generated must be considered. Choose the diode that will be fast enough to take out all frequency components necessary and will not break down under the peak voltage of the surge.

As voltage limiters, the diode controls amplitudes by clipping all voltage that rises above



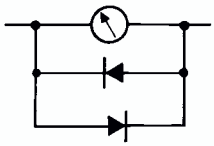
a predetermined point as set by the bias battery. This same arrangement may be used to square a sinusoidal waveshape by simply



adding another diode and the level may be controlled by inserting bias voltages (as in the limiter) to set the clipping level.

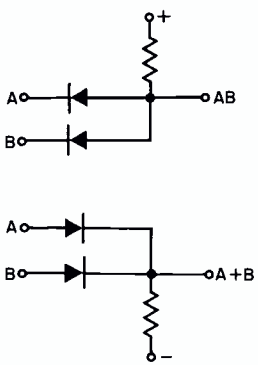
Another unique use of diodes is in meter pro-

tection circuitry. The drop across the average



meter at full scale does not exceed the conduction voltage of diodes. They are, for all practical purposes, out of the circuit. When the meter is pegged in either direction, one diode or the other will shunt the "damage" current and keep the meter from being burned out. Here, one will want to use rectifiers of higher current rating, but for microammeters in circuits where the currents are not possibly excessive for smaller diodes, there is no reason why the signal diode cannot be used. Remember, current and peak voltage are the criteria for selecting diodes for protection circuitry.

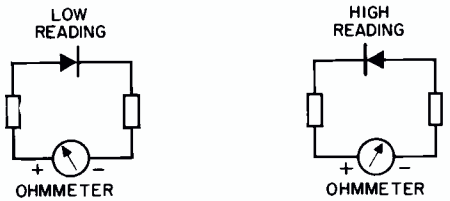
Now for the diode applications that have helped us advance into an automated society where our major mental efforts are greatly reduced by the computer. The computer is loaded with diodes and their main functions are as gates, or logic paths. The faster the computer, the better the diode must be, so here again, we have a slight choice. The gates are basically AND,



and operate like this. In the case of the AND gate, if an input appears at A and B, an output will be present. If A appears but B does not, no output. The OR gate gives an output for either A or B.

Diodes are also used to temperature compensate transistors. They are chosen to have an opposite temperature coefficient than the transistor and are connected with a resistor (as a variable voltage divider) between the base of the transistor and the bias source.

One very important thing a technician must know how to do is check a diode, a good habit to get into before placing one into a circuit even if it is a new one. The ohmmeter test



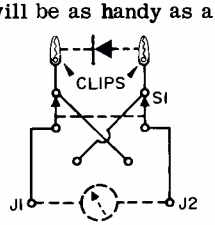
is the quickest method-simply measure the diode in one direction, then reverse the leads. The resistance should be at least 10 times greater in one direction than it is in the other. If the polarity of the ohmmeter leads is known, the cathode and anode may be determined. With the positive lead on the anode and the negative on the cathode, the lowest resistance reading will be obtained.

Visually, the cathode may be determined on most signal diodes by a band around the body

of the diode. Some are marked with the diode symbol, making it real easy to determine.

If three bands of color are on the diode body, these represent the diode number in color code. A 1N645 would have bands of blue-yellow-green and the band closest to the end of the diode body denotes cathode and first number (the 1N) is understood.

After many years of fumbling with ohmmeter leads and a diode, trying to measure the front to back ratio, I tacked together this simple device. It is convenient, yet so simple. All the device does is hold the diode and, by throwing a switch, reverses the ohmmeter so that the diode may be checked easily. Alligator clips hold the diode and any jacks that fit your ohmmeter probes will do the job on that end. The jacks and clips may be mounted right on the switch for a compact little test fixture. If you check many diodes this gadget will be as handy as a third hand!



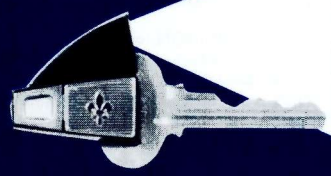
PARTS LIST:

2 - Alligator Clips
2 - Jacks (to fit ohmmeter probes)
1 - D.P.D.T. Switch

MINIATURE MIRACLE . . .

KEY BEAM LIFETIME OF LIGHT ON YOUR KEY.

(no batteries or bulbs to buy . . . ever.)



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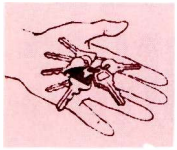

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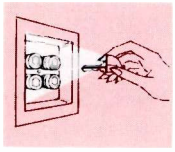

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City & State _____ How long at this address? _____

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City & State _____ How long at this address? _____

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Business Address _____ How Long Employed? _____

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Bank Account with _____ Savings ☐ Checking ☐

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Credit Acct. with _____ Highest Credit _____
(Name) (Address)

Credit Acct. with _____ Highest Credit _____
(Name) (Address)

ALUMNI ELECTION .....NEWS.....

Spitzer And Tate Nominated For Presidency

It was to be expected: Dave Spitzer of New York City and Howard Tate of Pittsburgh are way out in front as candidates for President of the Alumni Association for 1965.

This was a foregone conclusion, as pointed out in the last issue of the Journal, because they have both been equally outstanding in previous elections. This time no other members are within shouting distance of them as candidates for President.

Spitzer is a long-time member of the New York City Chapter, was its Secretary for two years and is currently serving his fifth term as Chairman. He is also nearing the end of his second term as a Vice-President of the NRIAA. Tate is a charter member of the Pittsburgh Chapter, has served it as a Vice-Chairman, as Secretary and as Chairman. He was a Vice-President of the NRIAA in 1963 and was re-elected to that office for this year.

It is apparent that the membership has a difficult choice between these two men. But one thing you can be sure of: they are both loyal and able men, fully deserving of the honor of the Presidency.

The two current Vice-Presidents who are eligible for re-election, Frank Zimmer of New York and Jules Cohen of Philadelphia, were both nominated with a strong vote. James Wheeler, Chairman of the Pittsburgh Chapter, was nominated for a Vice-Presidency, the first time he has run for national office. Two real old-timers have shown up as nominees in this election, F. Earl Oliver of Detroit and Joe Stocker of Los Angeles. Both are former chairmen of their chapters and also former National Officers. The remaining three nominees for a Vice Presidency are Charles E. Brack of Washington, D.C., Galen Price of Toledo, Ohio, and L. J. Heitman of Baltimore, Md. None of these three nominees have local chapter affiliations.

Please remember that only members of the Alumni Association are qualified to vote. Use the ballot on Page 29, and mail it promptly. It must be received in Washington by September 25. The winning candidates will be announced in the November-December Journal.

ALUMNI ELECTION BALLOT

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

FOR PRESIDENT (Vote for one man)

- ☐ David Spitzer, Brooklyn, N. Y.
- ☐ Howard Tate, Pittsburgh, Pa.

FOR VICE PRESIDENT (Vote for four men)

- ☐ Jules Cohen, Philadelphia, Pa.
- ☐ Joseph Stocker, Los Angeles, Calif.
- ☐ F. Earl Oliver, East Detroit, Mich.
- ☐ Frank Zimmer, Long Island City, N. Y.
- ☐ James L. Wheeler, Verona, Pa.
- ☐ Charles E. Brack, Washington, D. C.
- ☐ Galen Price, Toledo, Ohio
- ☐ L. J. Heitman, Baltimore, Md.

SIGN HERE:

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

Polls close September 25, 1964. Mail your complete Ballot to:

T. E. Rose, Executive Secretary

NRI ALUMNI ASSOCIATION

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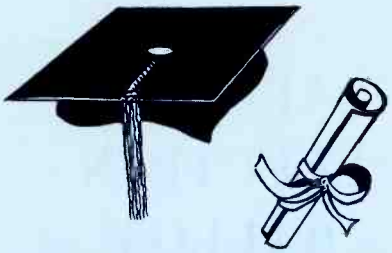


CHAPTER CHATTER

DETROIT CHAPTER members closed their 1963-1964 season with their customary annual stag party. There was too much tasty food and beverages, also customary, but the members did their best to consume them and made a pretty good job of it.

The following members were elected to serve for the 1964-1965 season: James Kelley, Chairman; John Nagy, Vice-Chairman; Roy W. Miller, Secretary; John Korpalski, Assistant Secretary; Leo Blevins and Asa Belton, Entertainment and Finance Committee; Asa Belton, Sergeant At Arms; and Prince Bray, Librarian.

The Detroit and Flint Chapters held a joint picnic at Kennington Metro Park, about midway between Flint and Detroit, on July 26. This enabled the members and their wives from the respective chapters to get acquainted. It was a new experience and a highly enjoyable one.

Having suspended meetings during July and August, the Chapter is scheduled to begin the new season with the September 11 meeting.

FLINT (SAGINAW VALLEY) CHAPTER thought highly of a color program conducted by Jim Windom, who used his own Zenith color Television to illustrate "the how" in adjusting the color purity in the home color set. Leroy Cockrell brought in a B and K Analyst and a bar and burst generator for this program on color Television.

At the final meeting of the last season Andy Jobbagy thought it appropriate to make some predictions about the immediate future in electronics. He gave it as his opinion that by 1970 many families will have a color console as well as a portable black and white TV; a transistor auto and home radio receivers, solar radios, and sound wave appliances. It will be interesting to see how accurate Andy's predictions turn out to be.

In the first meeting of the new season, in September, it has been planned to undertake

ALUMNI NEWS

J. Arthur Ragsdale	President
Howard Tate	Vice President
Frank Zimmer	Vice President
Eugene DeCaussin	Vice President
Jules Cohen	Vice President
Theodore E. Rose	Executive Sect.

T.E. ROSE, Executive Secretary

learning more about the repair of future common household items. This is a timely and practical objective.

NEW YORK CITY CHAPTER, since our last report of its activities, has been pleased to admit Cyril Hollingsworth to membership, also to welcome back several members who have not been seen for some time: Alvah Bonham, Pete Carter, and Charles Pearson.

Under Chairman Spitzer's guidance a faulty discriminator transformer was found in the Chapter's TV set, and Mr. Siracusa's set was found to be suffering only from poor tubes. Frank Szpiech gave us quite a detective story on locating an intermittent short in a coupling capacitor in a table radio. The moral of his tale is that you can't believe everything you are told -- mica capacitors do go bad.

Jim Eaddy talked at some length on the Audio stages in Transistor Radios, and gave a simple method of using the set's own B+ through a 15K resistor to give a click in the speaker of a dead set, whose individual stages operated.

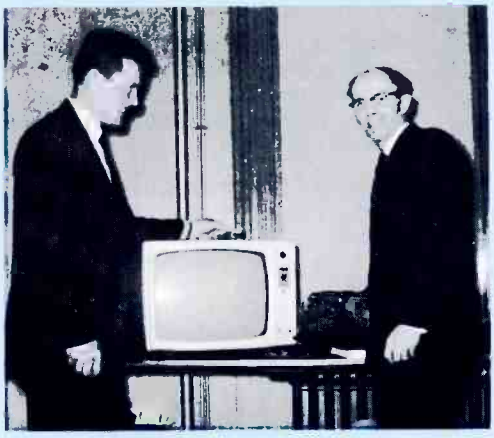
At the final meeting of last season, four films were shown on Chairman Spitzer's projector: Silverama (on Sylvania picture tube manufacture); Similarities in Wave Behaviour; Crystal Clear; and Voices under the Sea, the last three from the Telephone Company. Coffee and cookies were served with Mrs. Spitzer acting as our charming hostess.

As in the past, the Chapter suspended meet-

ings for the summer months. The first meeting of the new season was set for September 3.

PHILADELPHIA-CAMDEN CHAPTER eliminated its regular meetings during July and August -- held only its Service Night in each of those two months. It will resume its regular meetings in September.

Harvey Morris, the Chapter's very able and thoroughly experienced Electronics technician and service man, did his customary bang-up job with a program devoted to tuner troubles followed by a question-and-answer



Art Raucher and Bill Heath demonstrate a Westinghouse TV set at the Philadelphia-Camden chapter meeting.

forum, with all the members firing away with questions and Harvey throwing the answers right back to them.

The Chapter is trying to have its top-notch men at these meetings to help out the members who bring their dog sets in to fix. The Chapter has been doing very well at these meetings in the past but believes the new policy will be of still greater help to the members who are just starting out. As their sets are being repaired, every effort will be made to explain the procedure -- the proper way to go about troubleshooting and to make the final repair.

At another meeting, Bernie Bycer, design engineer for RCA and an Honorary Member of the Chapter, gave a fine talk about hum and its associated defects in TV receivers. He also talked about the design of low voltage power circuits and explained everything in detail. This was a very interesting program and the members enjoyed it very much. The Chapter feels fortunate to have a man of Bernie's caliber as a Honorary Member ever ready and willing to give freely of his knowledge and experience for the benefit of Chapter members.

SAN ANTONIO ALAMO CHAPTER held another of its "controlled bull sessions." These have proved useful and practical. The members like them and feel they get a great deal out of them. It is also good to have this type of program to fall back on, as in this case when Chairman Sam Dentler could not make it to the meeting and a controlled bull session was substituted. This one was devoted to TV dogs and specific remedies.

Last year the Chapter held a steak dinner for members and their wives. It was so successful that they held another one this year, which was even more of a success. The members and their wives met at a local restaurant at 7 P.M., enjoyed a few drinks, and "visited" until 8 o'clock, at which time they sat down to a delicious steak dinner.

At a subsequent meeting Chairman Sam Dentler devoted most of the program to a discussion on general TV servicing and service charges.

Plans were begun for the members to visit the local TV CRT tube manufacturer to see how the tubes are made. Most of the Chapters have made such visits to a tube manufacturer and in practically every case they have been impressed and fascinated.

SAN FRANCISCO CHAPTER'S Ed Persau demonstrated the blanking of a light by the action of a photoconductive cell. The control light was a 40 watt lamp. The light dimmer circuit was arranged with variable resistors controlling the resistance of the lamp circuit and affected the brightness of the 40 watt control lamp. Ed clearly showed the effect of light on the photocells: More light, less resistance; less light, more resistance. This was a fascinating demonstration, which was evident from the rapt attention of the audience.

At the next meeting Ed demonstrated a Heathkit VTVM which he built for the Chapter.

SPRINGFIELD (MASS.) CHAPTER'S Arnold Wilder, who is employed by the Gilbert-Barker Corporation, gave a lecture and demonstration on positive ground indicators as used in the petroleum industry. A model of the instrument was passed around for each member to inspect. Arnold also pointed out the need for Electronic Technicians to maintain this equipment.

The Chapter follows the practice of holding in June the election of officers to serve the Chapter for the next season beginning in

September. But the Chapter was forced to forego the June meeting so the election will be held in September instead. All members of the Chapter should make every effort to attend this meeting in order to have a voice in the selection of officers.

Directory of Local Chapters

Local chapters of the NRI Alumni Association cordially welcome visits from all NRI students and graduates as guests or prospective members. For more information contact the Chairman of the chapter you would like to visit or consider joining.

CHICAGO CHAPTER meets 8:00 P. M., 2nd and 4th Wednesday of each month, 666 Lake Shore Dr., West Entrance, 33rd Floor, Chicago. Chairman: Frank Dominski, 2646 W. Potomac, Chicago, Ill.

DETROIT CHAPTER meets 8:00 P. M., 2nd and 4th Friday of each month. St. Andrews Hall, 431 E. Congress ST., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Mic., VI-1-4972.

FLINT (SAGINAW VALLEY) CHAPTER meets 8:00 P. M., 2nd Wednesday of each month at Andrew Jobbagy's Shop, G-5507 S. Saginaw Rd., Flint. Chairman: Henry Hubbard, 5497 E. Hill Rd., Grand Blanc, Mich., 694-4535.

HACKENSACK CHAPTER meets 8:00 P. M., last Friday of each month, St. Francis Hall, Cor. Lodi and Holt St., Hackensack, N. J. Chairman: George Schalk, 471 Saddle River Rd., Ridgewood, N. J.

HAGERSTOWN (CUMBERLAND VALLEY) CHAPTER meets 7:30 P. M., 2nd Thursday of each month at the YMCA in Hagerstown, Md. Chairman: Francis Lyons, 2239 Beverly Dr., Hagerstown, Md. Reg 9-8280.

LOS ANGELES CHAPTER meets 8:00 P. M., 2nd and last Saturday of each month, 4912 DeCaussin, 5870 Franklin Ave., Apt. 203, Hollywood, Calif., NO 4-3455.

MINNEAPOLIS-ST PAUL (TWIN CITIES) CHAPTER meets 8:00 P. M., 2nd Thursday of each month, at the homes of its members. Chairman: Paul Donatell, 1645 Sherwood Ave., St. Paul, Minn., PR 4-6495.

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

NEW YORK CITY CHAPTER meets 8:30 P. M., 1st and 3rd Thursday of each month, St. Marks Community Center, 12 St. Marks Pl., New York City. Chairman: David Spitzer, 2052 81st St., Brooklyn, N. Y., CL 6-6564.

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

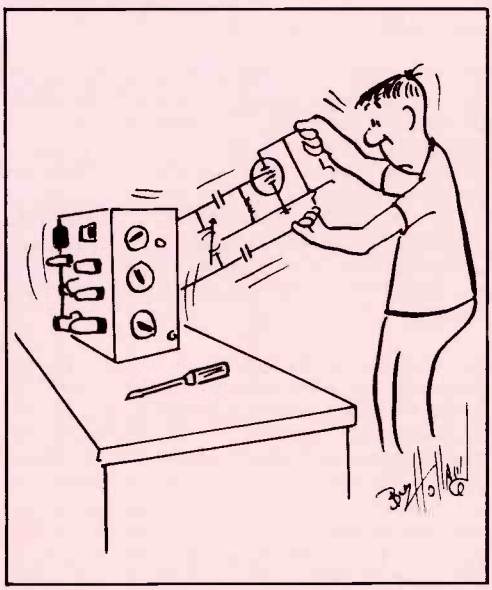
PITTSBURGH CHAPTER meets 8:00 P. M., 1st Thursday of each month, 436 Forbes Ave., Pittsburgh. Chairman: James L. Wheeler, 1436 Riverview Dr., Verona, Pa. 793-1298.

SAN ANTONIO ALAMO CHAPTER meets 7:30 P. M., 3rd Wednesday of each month, Beethoven Home, 422 Pereida, San Antonio. Chairman: Sam O. Dentler, 329 Southcross, San Antonio, Texas. WA 2-8682.

SAN FRANCISCO CHAPTER meets 8:00 P.M., 1st Wednesday of each month, 147 Albion St., San Francisco. Chairman: Peter Salvotti, 2543 Great Hwy., San Francisco, Calif.

SOUTHEASTERN MASSACHUSETTS CHAPTER meets 8:00 P. M., last Wednesday of each month, home of Chairman John Alves, 57 Allen Blvd., Swansea, Mass.

SPRINGFIELD (MASS.) CHAPTER meets 7:00 P. M., last Saturday of each month at shop of Norman Charest, 74 Redfern St., Springfield, Mass, Chairman Steven Chomyn, Powder Mill Rd., Southwich, Mass.



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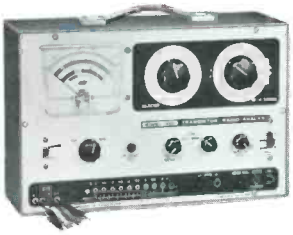

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