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SEPTEMBER-OCTOBER

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FOR BEGINNERS ONLY

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COURSE**

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TESTING

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One of our most successful students wrote this ad!

Harry Remmert decided he needed more electronics training to get ahead. He carefully "shopped around" for the best training he could find. His detailed report on why he chose CIE and how it worked out makes a better "ad" than anything we could tell you. Here's his story, as he wrote it to us in his own words.

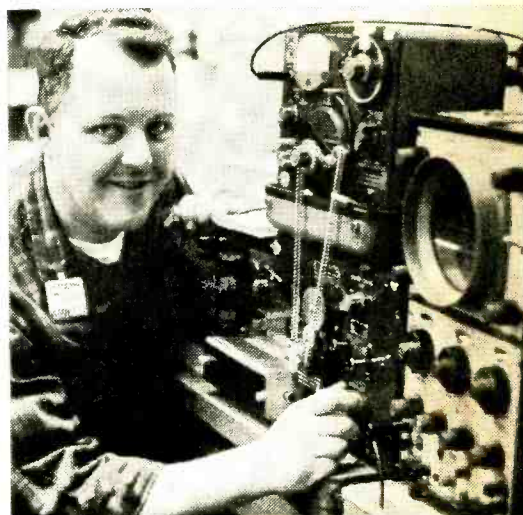
By Harry Remmert

AFTER SEVEN YEARS in my present position, I was made painfully aware of the fact that I had gotten just about all the on-the-job training available. When I asked my supervisor for an increase in pay, he said, "In what way are you a more valuable employee now than when you received your last raise?" Fortunately, I did receive the raise that time, but I realized that my pay was approaching the maximum for a person with my limited training.

"Education was the obvious answer, but I had enrolled in three different night school courses over the years and had not completed any of them. I'd be tired, or want to do something else on class night, and would miss so many classes that I'd fall behind, lose interest, and drop out.

The Advantages of Home Study

"Therefore, it was easy to decide that home study was the answer for someone like me, who doesn't want to be tied down. With home study there is no schedule. I am the boss and I set the pace. There is no cramming for exams because I decide when I am ready, and only then do I take the exam. I never miss a point in the lecture because it is right there in print for as many re-readings as I find



Harry Remmert gives his CIE Electronics course much of the credit for starting him on a rewarding career. He tells his own story on these pages.

necessary. If I feel tired, stay late at work, or just feel lazy, I can skip school for a night or two and never fall behind. The total absence of all pressure helps me to learn more than I'd be able to grasp if I were just cramming it in to meet an exam deadline schedule. For me, these points give home study courses an overwhelming advantage over scheduled classroom instruction.

"Having decided on home study, why did I choose CIE? I had catalogs from six different schools offering home study courses. The CIE catalog arrived in less than one week (four days before I received any of the other catalogs). This indicated (correctly) that from CIE I could expect fast service on grades, questions, etc. I eliminated those schools which were slow in sending catalogs.

FCC License Warranty Important

"The First Class FCC Warranty* was also an attractive point. I had seen "Q" and "A" manuals for the FCC exams, and the material had always seemed just a little beyond my grasp. Score another point for CIE.

*CIE backs its courses with this famous Money-Back Warranty: when you complete a CIE license preparation course, you'll be able to pass your FCC exam or be entitled to a full refund of all tuition paid. Warranty is valid during completion time allowed for your course.

"Another thing is that CIE offered a complete package: FCC License and technical school diploma. Completion time was reasonably short, and I could attain something definite without dragging it out over an interminable number of years. Here I eliminated those schools which gave college credits instead of graduation diplomas. I work in the R and D department of a large company and it's been my observation that technical school graduates generally hold better positions than men with a few college credits. A college degree is one thing, but I'm 32 years old, and 10 or 15 years of part-time college just isn't for me. No, I wanted to *graduate* in a year or two, not just *start*.

"When a school offers both resident and correspondence training, it's my feeling that the correspondence men are sort of on the outside of things. I wanted to be a full-fledged student instead of just a tag-a-long, so CIE's exclusive home-study program naturally attracted me.

"Then, too, it's the men who know their theory who are moving ahead where I work. They can read schematics and understand circuit operation. I want to be a good theory man.

"From the foregoing, you can see I did not select CIE in any haphazard fashion. I knew what I was looking for, and only CIE had all the things I wanted.

Two Pay Raises in Less Than a Year

"Only eleven months after I enrolled with CIE, I passed the FCC exams for First Class Radiotelephone License with Radar Endorsement. I had a pay increase even before I got my license and *another* only ten months later.

"These are the tangible results. But just as important are the things I've learned. I am smarter now than I had ever thought I would be. It feels good to know that I know what I know now. Schematics that used to confuse me completely are now easy for me to read and interpret. Yes, it is nice to be smarter, and that's probably the most satisfying result of my CIE experience.

Praise for Student Service

"In closing, I'd like to get in a compliment for my Correspondent Counselor who has faithfully seen to it that my supervisor knows I'm studying. I think the monthly reports to my supervisor and generally flattering commentary have been in large part responsible for my pay increases. My Counselor has given me much more student service than "the contract calls for," and I certainly owe him a sincere debt of gratitude.

"And finally, there is Mr. Tom Duffy, my instructor. I don't believe I've ever had the individual attention in any classroom that I've received from Mr. Duffy. He is clear, authoritative, and spared no time or effort to answer my every question. In Mr. Duffy, I've received everything I could have expected from a full-time private tutor.

"I'm very, very satisfied with the whole CIE experience. Every penny I spent for my course was returned many

times over, both in increased wages and in personal satisfaction."

Perhaps you too, like Harry Remmert, have realized that to get ahead in Electronics today, you need to know much more than the "screwdriver mechanics." They're limited to "thinking with their hands" . . . learning by taking things apart and putting them back together . . . soldering connections, testing circuits, and replacing components. Understandably, their pay is limited—and their future, too.

But for men like Harry Remmert, who have gotten the training they need in the fundamentals of Electronics, there are no such limitations. He was recently promoted, with a good increase in income, to the salaried position of Senior Engineering Assistant working in the design of systems to silence submarines. For trained technicians, the future is bright. Thousands of men will be needed in virtually every field of Electronics from two-way mobile radio to computer testing and troubleshooting.

Send for Complete Information — FREE

Many men who are advancing their Electronics career started by reading our illustrated school catalog, "Succeed in Electronics." It tells of the many electronics careers open to men with the proper training. And it tells which courses of study best prepare you for the work you want.

If you're "shopping around" for the training you need to move up in Electronics, this interesting book may have the answers you want. We'll send it to you FREE. With it, we'll also include our other helpful book, "How To Get A Commercial FCC License."

To get both FREE books, just fill out and mail the reply card. For your convenience, we will try to have a representative call. If card is missing, use coupon below.

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PROJECTS THAT IMPROVE

- ☆ 31 There's a TRF in that IC—a good experience project couples old-time radio and today's integrated circuit.
- 40 Disaster Alarm—shuffle an inexpensive alarm kit into protecting a full house
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- 35 So You Want To Design a Simple Transistor Amplifier Stage
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Cover photograph by Leonard Heicklen



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You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of Dunched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or electronics. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment. Many thousands of individuals of all

ages and backgrounds have successfully used the "Edu-Kit." In more than 79 countries of the world, the "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

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The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio. You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a Professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator, Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

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You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, dunched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

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Circle No. 30 On Reader Service Card

elementary Electronics

Sep./Oct. 1973

Vol. 13/No. 5

Dedicated to America's Electronics Hobbyists

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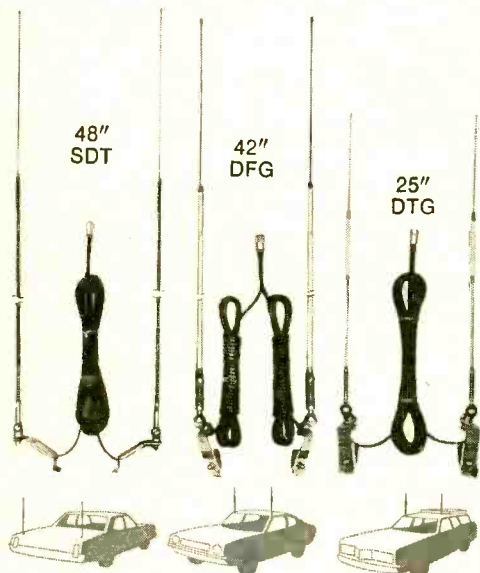
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Showcase of New Products

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and continuity—in many cases permits checking the entire ignition system on a small engine without tearing it down to get at the ignition points behind the flywheel. There's also a built-in tachometer with snap-on inductive pickup and 0 = 3000 plus 0 = 15,000 rpm ranges. Simply by connecting the leads, rpm can be read on any engine from one to 24 cylinders, without switching for the number of cylinders. Completely portable, the CM-1045 is powered by three low-cost 1.5 volt C batteries and is self-contained in a snap-lock oil-gas-water-resistant case. The kit goes together easily in a couple of evenings and is priced at \$39.95. Get all the facts by circling No. 1 on Reader Service page.

(Continued on page 12)

ELEMENTARY ELECTRONICS

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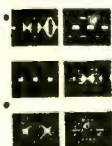
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Just one of these BF-5 devices produces sine, square, triangle, ramp and sawtooth waveforms without additional active components. By adding a second BF-5, you can create amplitude, frequency or phase modulated varieties of these waveforms. They are able to replace large discrete waveform generators costing from \$200.00 to \$1300.00. At the same time, they greatly reduce system layout, assembly, and hookup instructions included.

weight and power consumption. Full technical data, P.C. BF-5 WAVEFORM GENERATOR \$9.75

WIRE-WRAP COMPUTER WIRE

New surplus from a large computer company. Solid silver-plated OFHC copper conductor. Special high-temperature, thin-wall insulation of teflon, and other quality materials. Extremely rugged and flexible wire-wrap wire. In addition to usual applications, can be used for effective breadboarding, and wherever quick stripping of solid wire is desired. Different colors are now available. State first, second, and third choice of colors. Shipping weight per 500' is 1 lb.

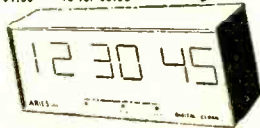
Conductor Size	Order No.	500'	1000'	10,000'
30	WWW30(f)	\$5.00	\$9.00	\$75.00
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24	WWW24(f)	\$6.50	\$12.00	\$100.00

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- Sockets are made by T.I. and Cinch.
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- 2 for \$1.50 8 for \$5.00
- 10 Pin to 5 gold Sockets (Cinch)
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GIANT 2 1/2" NUMERAL "NIXIE" CLOCK KIT

New! For factories, offices, and commercial establishments, and those people who like large displays, characters appear as a bright continuous line which can be read from distances as great as 150 feet. All drive circuits are solid state, and unit employs new custom LSI clock chip. Indicates hour, minutes, and seconds. May be wired for 24 hour or 12 hour operation with a simple jumper change. Kit offered complete with or without case for custom installations. Parts include P.C. board, sockets, solid state components, hardware, resistors, caps, viewing filter, etc.

Sh. Wt. 15 lbs.		
<input type="checkbox"/>	GNCC With Case	\$98.50
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<input type="checkbox"/>	GNCW Wired	\$139.50

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6 Amp 200 Volt	\$1.20
6 Amp 400 Volt	\$1.50
6 Amp 600 Volt	\$1.80



PHANUMERIC L.E.D. DISPLAY

This display consists of 35 L.E.D.'s (light emitting diodes) arranged in a 5 x 7 matrix. Numbers and letters of the alphabet can be formed by lighting the appropriate segments i.e. from our 2513 character generator Rom. One 2513 can be used to drive up to 64 displays by time sharing. In 14 Pin

Dia Package		
<input type="checkbox"/>	64 Character 5 x 7 LED Display	\$9.75

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That's right! A single chip TTL decade counter with latches, BCD outputs, a 7-segment decoder driver, AND a 7-segment LED display (with decimal) on top. Only 0.15" thick (not counting pins) the chip mounts in a standard 16-pin DIP socket. Digits are 0.270" high and can be latched in during the next count or blanked.

0.27 DLD \$15.00



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Aries/BF has sold over 12,000 digital clocks, to the best of our knowledge more than the combined output of all other manufacturers. Because of our huge purchasing power, and the engineering background gained, we can offer the features listed below. Compare with any other manufacturer and see if they can offer all these features:

- Decorator solid wood case. A striking addition to even the most luxurious living room. Our sketches just don't do it justice.
- Superb accuracy, seconds per month
- Choice of 50 or 60 Hz operation, 12 or 24 hour display in hours, minutes, seconds.
- BCD outputs, for auxiliary readouts etc.
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PRINTED CIRCUIT MATERIAL

- Low-cost Digital Clock Kit \$47.50
- Epoxy glass G10 material, Specify single or double copper clad. Thickness 1/16 inch.
- 4 x 12 Sheets \$1.00, 5 for \$3.50
- 12 x 12 Sheets \$2.50, 5 for \$10.00
- Assorted cut pieces at least 4" x 4" 2 square feet \$2.50



KEYBOARDS

B and F has accumulated a wide selection of surplus keyboards, which we are now offering at low prices. With this selection, you should be able to find something to fill your requirements, no matter how complex.

- 1) Figure "A", ASCII coded full alphanumeric, using solid state decoding. Manufactured for Tektronix by Honeywell or Controls Research. Complete with schematics, brand new. KB-1... \$55.00
- 2) Figure "B", similar to above, but slightly different key layout. KB-2... \$40.00
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- 4) Figure "D", calculator keyboard in calculator case, pressure sensitive elastomer contacts, manufactured for Aries. KB-4... \$9.50
- 5) Touch-tone keyboard, Figure "E", manufactured by Chromatics. No electronics included. KB-5... \$9.00
- 6) Desk calculator keyboard, Figure "F", manufactured by Controls Research. KB-6... \$15.75

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Circle No. 21 On Reader Service Card

TREAT YOURSELF TO A JOB WELL DONE... build Heathkit quality electronic products

**(A) Build your own Heathkit
25V Color TV...\$399.95*** less cabinet

The GR-900 is the most advanced TV you can build. Yet everything goes together with traditional Heathkit simplicity. And the built-in convergence board and test meter for at-home maintenance add further savings over the life of the set. You preset any 12 UHF channels for positive pushbutton power tuning, and you can scan both UHF and VHF channels in either direction. An ultra-rectangular black matrix tube, voltage controlled varactor UHF tuner, MOSFET VHF tuner and an exclusive angular tint control for better flesh tones combine to produce an absolutely brilliant color picture. Mailing weight, 125 lbs.

**(B) NEW Heathkit 19V B&W
Portable TV...\$179.95*** includes cabinet

The new GR-1900 is like no other B&W portable! With advanced solid-state "modular" design—most circuitry mounts on just 4 plug-in boards. Just 2 tubes; picture & high voltage. Total detent tuning on all 70 UHF channels as well as VHF. "Instant-on." Front panel controls of VHF/UHF fine tuning; brightness; contrast; master on/off; vert. hold; AGC & height. New ultrarectangular tube for a full 184 sq. in. view. Other "big" set features are Automatic Vertical Linearity; dual-controlled AGC; extra-wide Video Bandwidth;

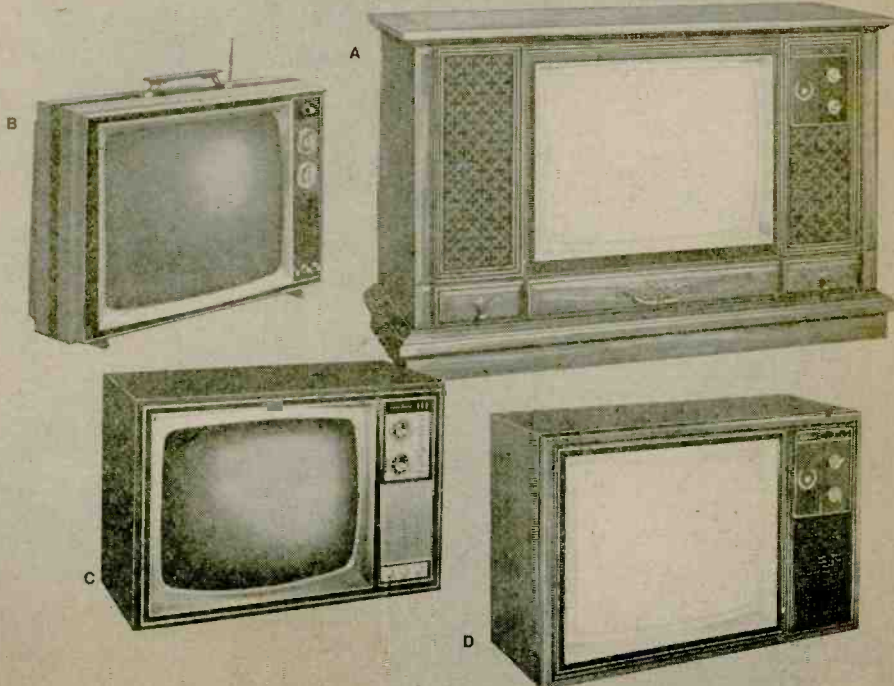
4-circuit grounded-base VHF tuner. A TV kit even the novice can build; both tuners come preassembled & aligned; transistors & ICs plug into sockets; and all chassis wiring is color coded. Mailing weight, 56 lbs.

(C) Heathkit 18V Color TV...\$499.95* less cabinet

Solid-state modular circuitry spells reliable operation and easy assembly. And the GR-269 comes with a full complement of alignment and self-service equipment—dot generator, convergence board, test meter and troubleshooting book. Factory assembled and aligned AFT module for perfect picture & sound at a touch. VHF tuner with MOSFET circuitry and UHF tuner with hot-carrier diode design for low noise, high sensitivity. Both tuners & IF assembly factory assembled & aligned "Instant-on", switch-controlled degaussing, hi-fi sound output; 75 & 300 ohm antenna inputs; exclusive Heath Magna-Shield, standard. Mailing weight, 100 lbs.

(D) Heathkit 21V Color TV...\$499.95* less cabinet

The new Heathkit GR-271 is the 21-in. (measured diagonally) version of our famous GR-900, the most advanced color TV we've ever offered. The GR-371 has the same state-of-the-art tuning convenience with power detent selection of all VHF and any 12 pre-selected UHF channels;



exclusive angular tint control for consistently better flesh tones, voltage controlled varactor UHF tuner & MOSFET VHF tuner for unmatched sensitivity; exclusive MTX-5 matrix tube with etched face plate for increased contrast, less glare. Plus, the GR-271 has built-in dot generator, convergence panel and volt-ohm meter - full remote control options, too. It's Heathkit TV at its finest in a space-saving size. Mailing weight, 121 lbs.

(E) Heathkit Pocket Calculator...92.50*

The new Heathkit IC-2009 is a fully portable calculator with rechargeable nickel-cadmium battery. Or you can leave it connected to the plug-in charger for permanent desk-top use. Weighs just 12 oz. And check over these features: 8-digit capacity. Four arithmetic function. Floating decimal. Constant key. Chain calculation capability. Clear-entry key. Entry & total overflow indicators. Low battery indicator. Battery-saver circuitry. And you can build it in four evenings. Mailing weight, 3 lbs.

(F) Heathkit Desk-top Calculator...79.95*

The Heathkit IC-2108 - a great looking full-function electronic calculator for home or office. You can assemble it in three spare evenings. Features include: Addition, subtraction, multiplication and division functions. Floating and fixed decimal. Constant key. Chain calculation capability. Clear display key. Entry and result overflow indicators. Negative answer indicator. 120 or 240 Volt operation. Mailing weight, 4 lbs.

(G) NEW Heathkit Telephone Amplifier...14.95*

An easy-to-assemble kit that even a beginner can get together in a couple of spare evenings. The Heathkit Telephone Amplifier lets you carry on a conversation without being tied to the phone. Amplifies the incoming voice and reproduces it at the separate speaker. Picks up your voice at the exposed telephone mouthpiece. The GD-1024 features a unique acoustic coupling so it can be used with all types of phones, including the Slim-line and Princess types. Has

all solid-state circuitry, powered by a low-cost 9-volt battery (not included). Great for hands-free communication wherever a business or household manager is busiest. Mailing weight, 2 lbs.

(H) NEW Heathkit Small-engine Tune-up Meter...39.95*

Kit CM-1045 - for all 2- and 4-cycle engines. 1 to 4 cylinders, with conventional, CD, or transistorized ignitions. Great for motorcycles, snowmobiles, outboard marine engines, etc. Clip-on leads let you check dwell, volts, ohms and continuously without tearing down the engine to get at systems buried beneath the flywheel. A built-in inductive-pickup tachometer works with any number of cylinders. Blue high-impact plastic case stores leads and three "C" batteries for ultimate portability. Mailing weight, 5 lbs.

(I) Heathkit AM Radio...14.95*

The Heathkit GR-1008 is a smartly styled, great sounding solid-state radio that makes a great introduction to Heathkit building. Eight-transistor circuitry mounts on one printed board, big 3 1/2" speaker mounts in high impact plastic case. If you've never built a kit before you can probably have this one together in one fun evening. Uses 9-volt battery (not supplied). Order the Heathkit GR-1008 for yourself or the kids. Mailing weight, 2 lbs.

(J) Heathkit AR-1214 50-Watt Stereo Receiver...169.95* includes cabinet

Produces 50 watts IHF, 25 watts per channel into 8 ohms with amazing fidelity. Two ICs and 2 ceramic filters in the IF offer greater than 60 dB selectivity, while phase lock multiplex demodulator gives 40 dB typical channel separation at less than 0.5% distortion. Preassembled FM tuner boasts 2 uV sensitivity and 2 dB capture ratio. Other features are phono preamp level controls, flywheel tuning, stereo indicator light, headphone jack, and complete tape monitor facilities. And the cabinet is included in this low price. Mailing weight, 18 lbs.



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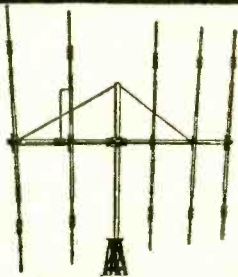


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These coils are built to take a powerful beating----in fact, the same coils are used in the construction of 10-meter amateur antennas. The GA-5D is lightweight. Erect on TV antenna mount and turn with an inexpensive TV rotor. Get all the facts: see your Dealer or write factory direct, Dept. 211-RTV

Mosley Electronics Inc.

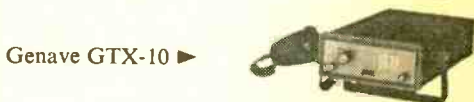
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Circle No. 6 On Reader Service Card

HEY, LOOK ME OVER

Ham Line

A complete new line of American-made 2-meter FM transceivers for the Amateur has been introduced by General Aviation Electronics, Inc. (GENAVE). The very fine offering of radios includes the GTX-10, the GTX-200, and the GTX-2. The GTX-10 is a full



10-channel, 10 watt output unit and retails for \$199.95. The GTX-200 features independent selection of 10 transmit and 10 receive frequencies, offers 30 watts nominal output power and retails for \$259.95. The GTX-2 provides 10 push-button channels with backlighting for night operation, 30 watts nominal output power and retails for \$249.95. Internally, all radios are equipped with netting trimmers for each transmit crystal. High selectivity 8-pole second IF filters are incorporated in the design of all three units, and RF output stages are VSWR protected. Don't wait—get all the facts today by circling No. 36 on Reader Service page.

Fix CB

Even if you don't know anything about electronics, you can learn how to repair CB radios if you study this course and can master the use of hand tools. Lessons, which can be learned in two hours or less, are mailed to you weekly. And, they're easy to study because they employ the step-by-step programmed-instruction technique! Before you start learning about CB radio circuits, you learn about the fundamentals of electronics as explained in simple easy-to-understand language—without pain and without having to know math except simple arithmetic and the most basic algebra. For more information from CB Radio Repair Course, Inc., circle No. 41 on Reader Service page.

The Beginner's Kit

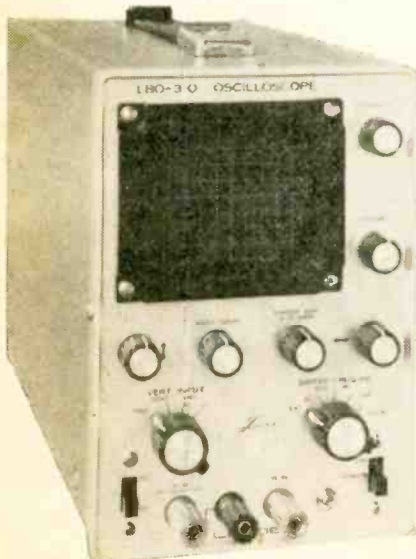
A kit-form portable solid-state AM radio, designed for easy assembly by the novice, has been introduced by Heath Company. The GR-1008 is an inexpensive receiver with all solid-state circuitry, 3½-in. speaker and high-



impact plastic case. Features include an RF amplifier stage for reception of distant or weak stations and an AGC circuit for uniform volume. The kit can be put together in one evening with a soldering iron and common household tools. All components except the speaker mount on a single printed circuit board, and the use of fixed ceramic filters in the IF section makes alignment amazingly simple. The step-by-step instructions leave nothing to chance and, should the builder want to learn more about what he is doing, the assembly manual contains sections explaining the GR-1008 circuitry and basic radio theory. The unit is powered by one 9-volt battery, not supplied. The Heath-kit GR-1008 is priced at \$14.95, mail order. For more information, circle No. 1 on Reader Service page.

3-in. Scope

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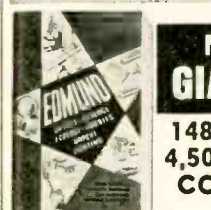
No. 71,835EK ... ECONOMY MODEL \$9.95 Ppd.

3-CHANNEL COLOR ORGAN KIT



Easy to build low-cost kit needs no technical knowledge. Completed unit has 3 bands of audio frequencies to modulate 3 independent strings of colored lamps (i.e. "lows"-reds, "middles"-greens, "highs"-blues. Just connect hi-fi, radio, power lamp, etc. & plug ea. lamp string into own channel (max. 300w ea.). Kit features 3 neon indicators, color intensity controls, controlled individ SCR circuits; isolation transformer; custom plastic housing; instr.

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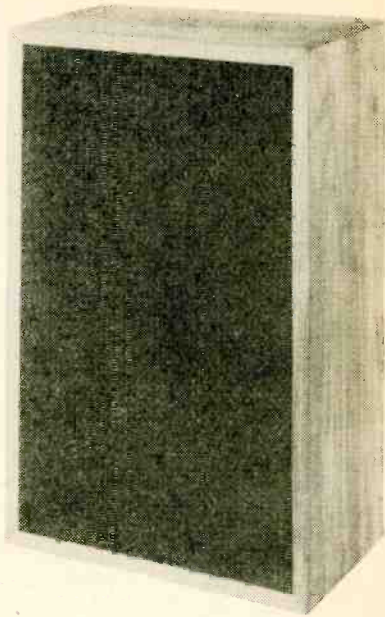
Circle No. 7 On Reader Service Card

HEY, LOOK ME OVER

features of the new Model LBO-310, 3-in. solid state, oscilloscope made by Leader Instruments. The compact, lightweight package also features a large, easy-to-read display area based on 8x10 divisions. It is said to have a number of applications for checking color TV, B&W and audio circuitry on both the service technician's and the hobbyist's bench. The LBO-310 measures 6-in. H X 4-in. W X 13¼-in. D and weighs approximately 10 lbs. It has a 115/230V; 50/60HZ; 12VA power supply and sells for \$199.95. For all the facts, circle No. 38 on Reader Service page.

Sound Kit

Hobbyists and do-it-yourselfers can now assemble their own high-fidelity speaker systems with the Archerkit 10-in. Speaker System kit from Radio Shack. The new kit is easily assembled using a screwdriver, pliers and soldering iron. The three-way system has a bass-reflex type enclosure constructed of ¾-in. hardwood with a 10-in. woofer, cone-type 6-in. midrange, 3-¼-in. tweeter, and electrical crossover. Impedance is 8 ohms. Response is 40—18,000 Hz; power capacity, 40 watts peak. Size, 14x22x9-in. Kit includes walnut finishing oil. The kit with step-by-step



assembly instructions sells for \$49.95. For further information, circle No. 45 on Reader Service page.

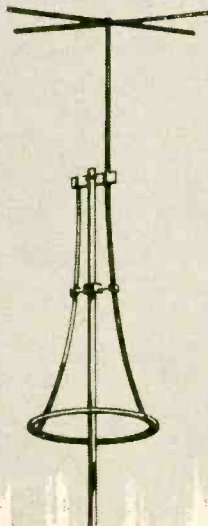
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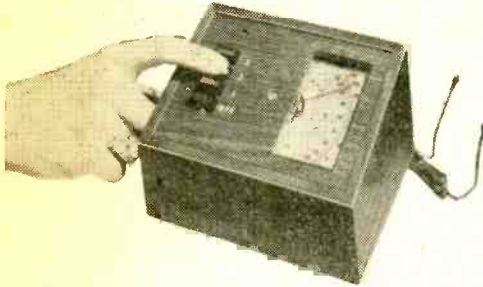
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Temp Sensor

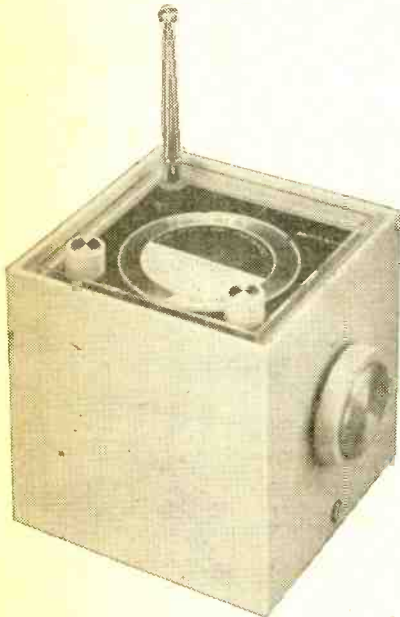
What's the temperature outside? In the garage? In the freezer? It's easy to find out by pressing one of three buttons. Olsen's deluxe Multi-Probe Electronic Thermometer F-201 is useful for other purposes, for exam-



ple: darkroom, aquarium, hot-house, scientific use and many others. Three sensor probes on 15-foot cords offer accuracies of 1/4-degree. Distances can be extended up to 1000 feet with ordinary lamp extension cord. And the price is right—\$49.95. For further information and the Olsen catalog, circle No. 29 on Reader Service page.

Tune in FM and TV Audio

The new "Eavesdropper" radio from Midland International receives standard VHF televi-

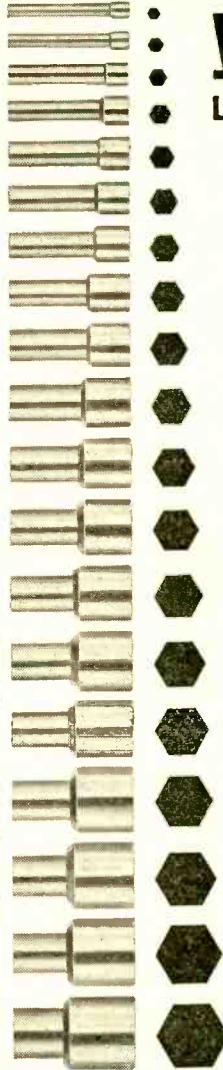


sion audio as well as FM broadcasts. Battery-powered, the compact radio permits the listener to enjoy the audio portion of TV shows. Radio is equipped with jack for earphone or pillow speaker—can be used with television

(Continued on page 98)

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Hank Scott, our Workshop Editor, wants to share his project tips with you. Got a question or a problem with a project you're building—ask Hank! Please remember that Hank's column is limited to answering specific electronic project questions that you send to him. Sorry, he isn't offering a circuit design service. Write to:

**Hank Scott, Workshop Editor
ELEMENTARY ELECTRONICS
229 Park Avenue South
New York NY 10003**

Needs a Schematic

I'd like to get a copy of the Panasonic CT95 TV chassis schematic diagram.

—L.T., Akron OH

Write to Tab Books, Blue Ridge Summit PA 17214 and ask them to send you a copy of *TV Schematic/Service Manual, Japanese Vol. 2* which covers the set you have. In fact, everyone, write to Tab and ask for their catalog. On the back page they list all the manuals they sell and the TV sets they cover.

Simple Problem

How can I electrify a guitar?

—R.T., San Diego CA

I once saw a nut with a night lamp attached to his guitar so he could see the frets while playing. I'm sure you want to do better than

that. Actually, it's quite easy. Many audio stores sell guitar mikes that attach to the guitar at the bridge or near the resonant cavity opening. They are usually hi-impedance devices that can plug into your hi-fi or public address system. That's your best bet. Electric guitars have steel strings and special magnetic heads that sense the travels of the string. The resonant cavity has no effect on the sound picked up. In fact, you can mount the neck of an old guitar to a plywood board, insert a bridge, strings and magnetic head, and you'll have an electric guitar. It may sound as good as an expensive rig.

What Next?

I replaced the high voltage transformer, high
(Continued on page 22)

THE ACTION FINDER

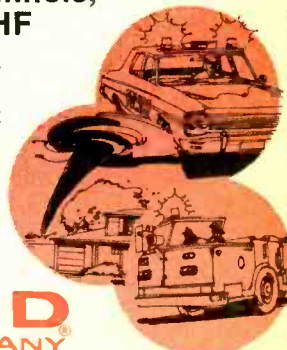


New Midland Dual-Band Scanner—8 Channels, AC/DC—Choose Hi/Lo-VHF or Hi-VHF/UHF

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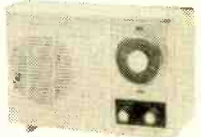


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*Transmit to any number
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Electronic Siren
Goofy-Lite Flasher

4⁹⁵ each
One-Tube AM Radio
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"OTL" Audio Amplifier
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Heads & Tails

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Electronic Metronome
Photoelectric Night Light

229

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So much better for learning TV servicing than any hobby kit, because NRI designed and created it as an educational tool.

Unlike hobby kits which are designed for creating a TV set as the end product, NRI built its exclusive 25" Diagonal Solid State Color TV kit as a real training kit. You can introduce and correct defects . . . for trouble-shooting and hands-on experience in circuitry and servicing. The kits include a wide-band oscilloscope, color bar crosshatch generator, transistorized volt-ohmmeter and other valuable equipment that can soon have you earning \$5 to \$7 an hour servicing color sets in your spare time.

Handsome woodgrain cabinet, at no extra cost. (Offered only by NRI)

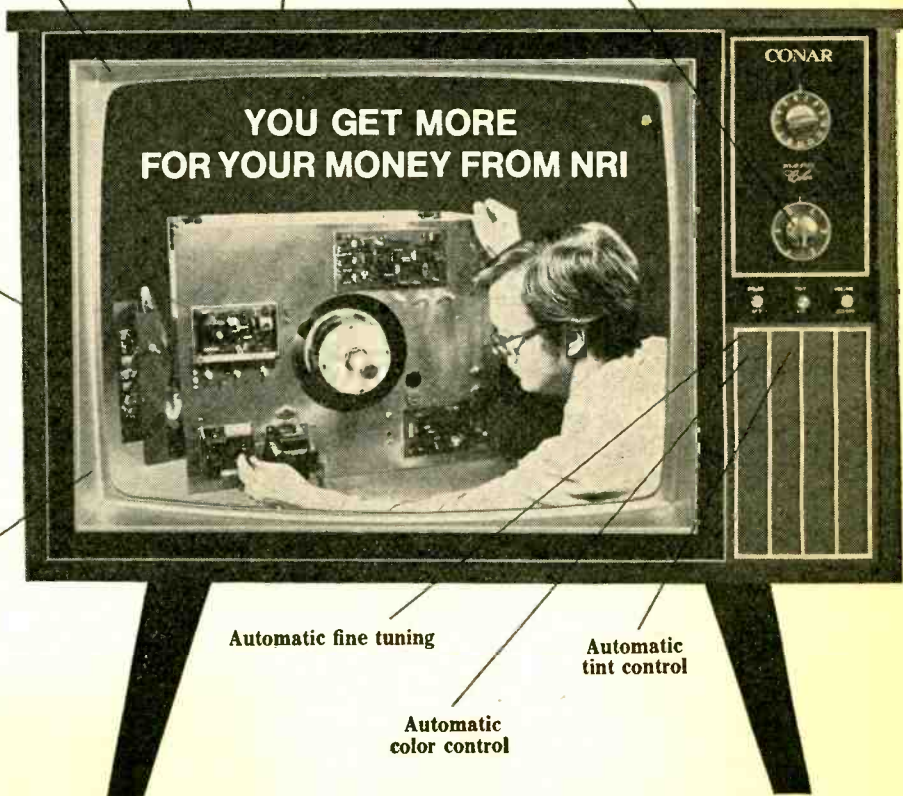
New square-cornered Sylvania picture tube

100% solid state chassis

6-position detented UHF channel selector



Modular construction with plug-in circuit boards



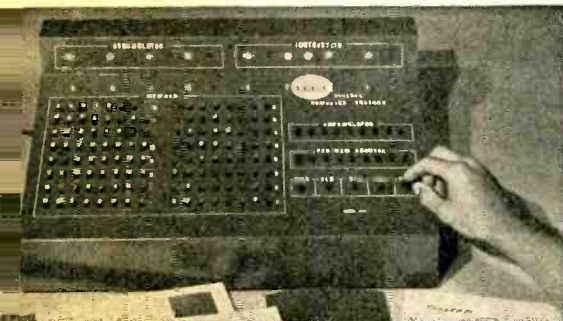
Automatic degaussing

Automatic fine tuning

Automatic tint control

Automatic color control

NRI FIRSTS make learning Electronics fast and fascinating—to give you priceless confidence



FIRST to give you a complete programmable digital computer, with memory, you build yourself . . . to learn organization, operation, trouble-shooting and programming. This remarkable computer is one of ten training kits you receive with the new NRI Complete Computer Electronics Course.



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FIRST to give you completely specialized training kits engineered for business, industrial and military Electronics Technology. Shown is your own training center in solid-state motor control and analog computer servo-mechanisms. Telemetering circuits, solid-state multivibrators and the latest types of integrated circuits are included in your course.

The NRI color TV and digital computer kits are the latest in a long line of "firsts" for NRI. For more than fifty years, NRI has been providing unique 3-dimensional home-study training that has helped hundreds of thousands of students reach their goals quickly and easily.

What NRI provides is a combination of kits and bite-size texts that give you hands-on experience while you are learning. The texts average only 40 pages each, and they are fully illustrated. You are taken step-by-step from the first stages into the more advanced theory and techniques . . . with an expert instructor ready at all times to provide valuable guidance and personal attention. (The level of personal attention provided is more than you would receive in many classrooms.) Once you've grasped the fundamentals, you move with confidence and enthusiasm into new discoveries in the fascinating world of electronics.

You start out with NRI's exclusive Achievement Kit, containing everything you need to get moving fast. Lessons have been specifically written so that experiments build upon one another like stepping stones. You can perform a hundred experiments, build hundreds of circuits . . . as you learn to use the professional test equipment provided, building radios and TV sets, transmitter or computer circuits. It's the priceless "third dimension" in NRI training . . . practical experience.

Train with the leader—NRI

Compare training kits, texts, techniques and overall training . . . and you'll find that you get more for your money from NRI. Whatever your reason for wanting more knowledge of Electronics, NRI has an instruction plan that will meet your needs. Choose from major programs in Advanced Color TV Servicing, Complete Computer Electronics, Industrial Electronics and the other special courses designed to meet specific needs. With NRI home training, you can learn new skills while you're still working at your present job . . . and turn yourself into the man in demand.

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Circle No. 2 On Reader Service Card

ASK HANK, HE KNOWS

(Continued from page 16)

voltage rectifier and horizontal drive tube in my black & white television set. Nothing works. It makes a lot of ozone and stinks like something burning. What do I do? I made exact replacements very carefully.

—B.P., Denver CO

First, never get into a repair job beyond your understanding. I replace tubes in my TV set, even parts like electrolytic capacitors, resistors, even a tuner. But the parts in the high-voltage cage never seem to work right for me, even if I only blow the dust off. Yep, your pal, Hank, calls the TV repair man when the high voltage goes and it's not the tubes. They got to make a buck, and, in the long run, it is the cheaper way out.

It Was a Bargain

I bought a second hand Quadrasizer. The price was right. Now my problem, what is it?

—N.K., Austin TX

Your letter described a four-channel matrix device. The trouble with too many products of this kind is that trademark names are used. But lately the 4-channel mess is becoming crystal clear. This fall will see the biggest audio explosion ever heard. Manufacturers will dump their stereo product lines in favor of 4-channel. Many of the audio magazines, who are very reluctant to cover 4-channel in depth, will suddenly discover this new audio medium. SQ will be SQ. CD-4 will be CD-4 and that's all you'll need to know. About time!

An Expensive Fuse

My receiver blows out tweeter windings faster than most sets pop fuses. I've checked the amplifier and nothing is wrong. The woofer and mid-range speakers work fine. I replaced the crossover circuit and still the tweeter goes. This happens in both the left and right channels. What is wrong?

—L.K., New York NY

Sounds like your receiver is passing the 19 kHz stereo pilot into the output stage. You have an old receiver that may be fritzed up. Check it out.

An Added Cost

I installed a low-pass filter on my CB set to kill the harmonics. Why didn't the manufacturer do this and save me money?

—P.M., St. Paul MN

It costs money and not everyone needs it. Your set, in the middle of Texas, may not interfere with your neighbor's TV, if he had a TV. Whereas, in your hometown, the house next door may be jammed by the TVI your rig puts out. If you need a low-pass filter, put one on, and they are not that expensive. By the way, did you fool with the final RF amp?

(Continued on page 94)

newscan

Electronics in the News!

Law West of the Pecos

For the New Mexico State Police, getting an answer to a teletypewriter message used to be a laborious process, with time-consuming delays built into an overworked and outmoded system. Now, using a new system developed by Teletype Corporation, a subsidiary of Western Electric, messages hum across the network almost instantly, with a monthly volume almost triple that of the old system.

The new, computer-directed network provides fast, efficient telecommunications over the varied terrain of America's sixth largest state. From the mountains of Taos to the desert of White Sands, the system can, in minutes, put a cruising patrol car in contact with FBI head-



A trooper radios the license plate number of an abandoned car to his local headquarters; from there a teletype query goes out to all relevant stations on the New Mexico State Police network. With the Teletype Corporation's new data terminal the trooper on the road gets the answer to his question, usually within minutes.

quarters in Washington, or the National Law Enforcement Teletype Service in Phoenix. The 150-word-a-minute teletypewriters that form the heart of the system have been specifically designed by Teletype Corporation to be adaptable to the diverse needs of police work; they are compatible with all other relevant networks, so messages need not be translated from one computer language to another, and each station can, in effect, act as its own "headquarters." A station in Carlsbad, for example,

SEPTEMBER-OCTOBER, 1973

The great new
Super Scanner
It scans 360° in milliseconds with 5.75 dB gain. Or beams an 8.75 dB gain signal where and when you want it—**instantaneously.** (Otherwise, it's just another beautiful  base antenna.)



MODEL MS-119 Super Scanner electronic beam, incl. control console—sugg. price, \$99⁹⁵

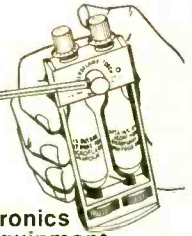


the antenna specialists co.

Division of ORION INDUSTRIES, INC.
12435 Euclid Ave., Cleveland, Ohio 44106
Export: 2200 Shames Dr.,
Westbury, L.I., New York 11590
Canada: A. C. Simmonds & Sons, Ltd.

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This handy torch is completely self-contained. Easy to use. Produces a 5000°F. pin point flame. Size and heat of flame is adjustable. Perfect for all types of electronic work. Will let you weld, solder or braze all types of metals. Get your miniature Microflame torch today at leading electronic shops everywhere. Microflame, Inc., 3724 Oregon Ave. So., Minneapolis, Minnesota 55426.

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NEWSCAN

can query the FBI directly, without tying up the main state police station at Sante Fe.

The new system has drawn the interest of other police departments throughout the country. Some have even requested to see the New Mexico operation first hand. "They're always amazed," says Communications Captain Richard deBaca, "at how calm everything is in our communications department. One man even suggested that he had come at a bad time, when traffic was slow. When I showed him the volume of traffic that our units were handling, he was impressed."

The Captain expects the call volume on the network to exceed 100,000 calls per month sometime in 1973. "As our troopers in the field become accustomed to efficient service, they are more likely to use the system," he says. "And even with that many calls, this system isn't breathing hard."

For Better Teacher-Student Communications

An \$80,000 electronic student response system, designed to increase the efficiency of student-teacher communication, is now in operation at the University of Southern California, School of Medicines. The system allows individual student participation and response which would otherwise be impossible in the large classroom environment of the 500-seat auditorium.

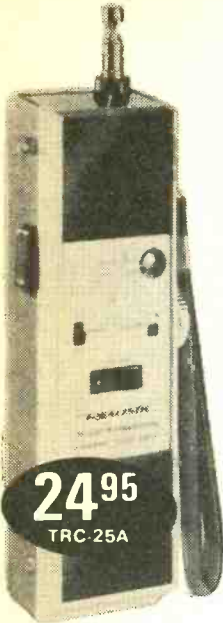
(Continued on page 97)



Push-button panel at each seat in new electronic classroom allows students to select right answer to questions. Flashing light on student's answer panel tells him if he's right. System feeds all student answers into analyzer for instant report to instructor on how class is doing.

ELEMENTARY ELECTRONICS

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24⁹⁵
TRC-25A



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TRC-35C

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These Realistic Walkie-Talkies put you in touch and *keep* you in touch, whether you're hunting, hiking, working, you name it! They're built to take it with really rugged cases, telescoping antennas that don't snap off at a touch, knobs and switches that have a really "professional" feel! All are solid-state, and all are solidly built, so you can walk and talk with confidence, no matter where you are!

TRC-25A Our best no-license model. 100 mW, 2-channels, "Beep" tone, Channel-11 crystals, battery, carry strap.

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Circle No. 10 On Reader Service Card



DX central reporting

A world of SWL info!

BY DON JENSEN

Your tape recorder can be a valuable piece of DXing equipment! Yet many SWL's apparently are still thinking of their tape and cassette recorders mainly in terms of music playback. They're great for that, of course, but if you haven't made your tape machine a full-fledged partner with your shortwave receiver in the DXing game, you're missing a real bet!

There are any number of ways that a recorder can help you with your listening hobby.

First, a tape recorder can be invaluable when it comes to identifying a puzzling station you've tuned. You know how easy it is to miss that all important announcement when the interference (QRM) and atmospheric noise (QRN) levels are high. When the station is broadcasting in an unfamiliar language, IDs are often hard to catch.

It is a big help to record the announcements. If you miss it the first time through, repeated playing of the identification often will do the trick.

A tape recording of each of your DX catches also can serve as something of a recordkeeping system. A few minutes of each station, including the identifying announcements, will give you a better idea, months and years hence, of how well the stations were received than any log book jottings.

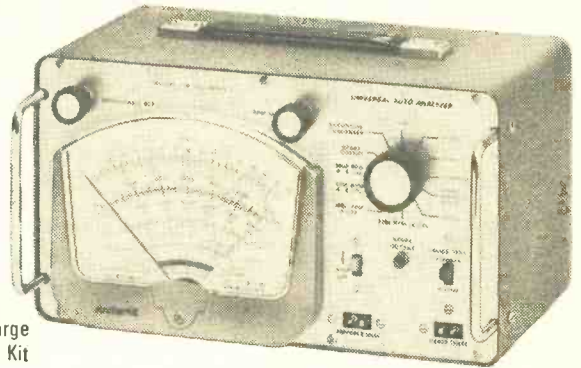
For some SWLs, the cost of collecting QSLs, verifications of their receptions, is a bit steep. After all, the postage to send reception reports to foreign stations adds up fast. So they don't try to get QSLs from all the stations they hear. Instead they record the station identifications and use these tapes or cassettes as proof that they received the various broadcasters. Any number of stations can be recorded on a single hour-long tape.

And, on the other hand, if the cost of writing for QSLs from the stations isn't a major problem, some DXers send a short, usually three-inch spool, tape to the station so that the engineers can get a firsthand idea of the exact reception conditions. Some stations encourage this practice and occasionally will return the tape with local m

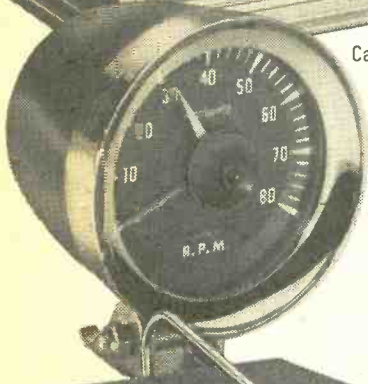
THESE RADIO SHACK ARCHERKITS ARE "SWELL" ON WHEELS!



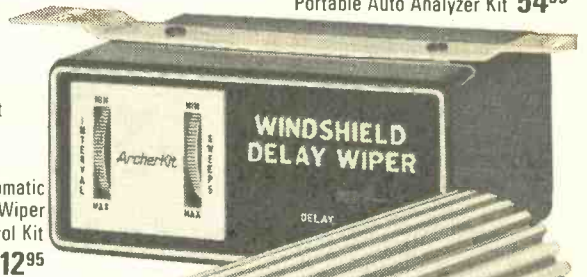
Deluxe Capacitive Discharge Ignition System Kit **39⁹⁵**



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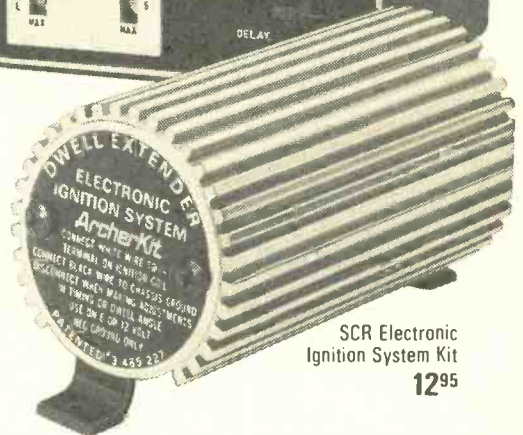
Auto/Marine Tachometer Kit **19⁹⁵**



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SCR Electronic Ignition System Kit **12⁹⁵**

Capacitive discharge ignition system puts more power in your car, cuts maintenance and boosts gas mileage!

Auto analyzer measures rpm, volts, amps, ohms, dwell angle, plus spark output and leakage.

Tachometer is designed for all 12-volt systems, reads 0-8000 rpm with $\pm 2\%$ accuracy. 240° deflection angle.

Wiper delay control is an essential aid for driving safety. Ends "dry wiper" action in light rain or mist!

Driver alert sentry gives an audible warning of radar within a 1/2-mile range. Promotes safer driving. Clips on visor.

SCR ignition system electronically fires spark, extends dwell angle for improved power.

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SEPTEMBER-OCTOBER, 1973



LITERATURE LIBRARY

101. Kit builder? Like weird products? EICO's 1973 catalog takes care of both breeds of buyers at prices you will like.

102. International Crystal has a free catalog for experimenters (crystals, PC boards, transistor RF mixers & amps, and other comm. products).

103. See brochures on Regency's 1973 lineup of CB transceivers & VHF/UHF receivers (public service/business bands—police, fire, etc.)

104. A pamphlet from Electra details the 6 models of the Bearcat III, a scanning monitor receiver.

105. Dynascan's new B&K catalog features test equipment for industrial labs, schools, and TV servicing.

106. Before you build from scratch, check the Fair Radio Sales latest catalog for surplus gear.

107. Get Antenna Specialists' cat. of latest CB and VHF/UHF innovations: base & mobile antennas, test equipment (wattmeters, etc.), accessories.

108. Want a deluxe CB base station? Then get the specs on Tram's super CB rigs.

109. You can get exactly what you need in nutdrivers from Xcelite. They have sizes and types for every hex head screw or nut, including metric sizes. Color-coded fixed handles or interchangeable shank sets are midget or super long.

110. Bomar claims to have C/B crystal for every transceiver... for every channel. The catalog gives list of crystal to set interchangeability.

111. A Turner amplified mike helps get the most from a CB rig. This free brochure describes line of base & mobile station models.

112. Midland has recently published a 4-color brochure illustrating and describing over 40 CB and scanner products.

113. EDI (Electronic Distributors) has a catalog with an index of manufacturers' items literally from A to Z (ADC to Xcelite). Whether you want to spend 29 cents for a pilot-light socket or \$699.95 for a stereo AM/FM receiver, you'll find it here.

114. Get all the facts on Progressive Edu-Kits Home Radio Course. Build 20 radios and electronic circuits; parts, tools, and instructions included.

115. Olson Electronics' 244-page fully-illustrated 1974 catalog carries leading national brand products in all electronics categories.

116. Trigger Electronics has a complete catalog of equipment for those in electronics. Included are kits, parts, ham gear, CB, hi fi and recording equipment.

117. Get the HUSTLER brochure illustrating their complete line of CB and monitor radio antennas.

118. Teaberry's new 6-page folder presents their 6 models of CB transceivers (base and mobile): 1 scanner for marine-use, and 2 scanner models (the innovative "Crime Fighter" receiver and a pocket-size scanner).

119. Burstein-Applebee's 1974 catalog has 276 pages of radio/TV electronics bargains. Selling for \$2, it is offered free to our readers.

120. For a colorful leaflet on the Golden Eagle Mark III SSB receiver and the Mark III SSB transmitter, write to Browning Laboratories.

121. Edmund Scientific's new catalog contains over 4000 products that embrace many sciences and fields.

122. For 1973's value-packed sale catalog, featuring TV & radio tubes, send for Cornell's. There is a special offer of 25¢ per tube on orders over \$10.

123. Radio Shack's 1974 catalog for electronics enthusiasts has 180 pages, colorfully illustrated—a complete range (kits & wired) of hi-fi, CB, SWL equipment and parts.

124. It's just off the press—Lafayette's all-new 1973 illustrated catalog packed with CB, hi-fi components, test equipment, tools, ham rigs, and more.

125. Mosley Electronics reports that by popular demand the Model A-311 3-element CB beam antenna is being reintroduced. Send for the brochure.

126. RCA Experimenter's Kits for hobbyists, hams, technicians and students are the answer for successful and enjoyable projects.

127. For "dynamic breadboards", elite 1 and 2; and for "basic breadboard", elite 3, send for EI Instruments' literature. Included is a catalog, "The Digital Design Line."

128. Avanti antennas (mobile and base for CB and VHF/UHF) are fully described and illustrated in new catalog.

129. A new free catalog is available from McGee Radio. It contains electronic product bargains.

130. Semiconductor Supermart is a new 1973 catalog listing project builders' parts, popular CB gear, and test equipment. It features semiconductors—all from Circuit Specialists.

131. Heath's new 1974 full-color catalog is a shopper's dream—chockful of gadgets and goodies everyone would want to own.

ELEMENTARY ELECTRONICS

Box 886

Ansonia Station

New York, N.Y. 10023

Please arrange to have this literature whose numbers I have circled at right sent to me as soon as possible. I am enclosing 25¢ to cover handling. (No stamps, please).



S/O-73

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DX CENTRAL REPORTING

Continued from page 26

gramming recorded. This, it must be noted, is a rarity, however. Generally the tapes are not returned.

SWLs who tune the ham bands and utility, non-broadcast stations sometimes have problems with the CW Morse code transmissions. One trick for the fellow who isn't too proficient at copying the code is to record the signal using a two-speed machine's fast speed. Play it back at the slower speed and it may be easier to "copy".

The recorder's microphone isn't the best way to tape record signals from your receiver, though many SWLs get satisfactory results this way. But the mike, placed near the receiver's speaker can also pick up extraneous sounds in the room, others talking, a squeaking chair, a sneeze.

A patch cord, with suitable plugs, works better for direct recording from the receiver's headphone jack or speaker terminals to the tape machine.

A final tape recorder use for the SWL is tape-swapping or tape-sponding, sending talking letters, short segments of your DXing sessions, selections of favorite music and the like to friends and fellow SWLs around the country and around the world.

Tip Topper. How can I hear Israel? That's one of the more frequent questions we get here at DX Central. And, until fairly recently, there wasn't an easy answer since little Israel, definitely an important power in its part of the world, was rather a second-class citizen in the area of shortwave broadcasting. While a number of Mid-East Arab nations, and especially the United Arab Republic's Radio Cairo, had booming, high powered shortwave signals, Israel's broad-

casts weren't received nearly as well in North America.

The state radio, the Israel Broadcasting Authority had its origins in two pre-independence shortwave operations. One was the Voice of Jerusalem, the official broadcasting station of the British mandate government of what then was called Palestine. The second root was the Voice of the Haganah, the underground broadcasting station of the Jewish Independence Movement shortly after World War II. When Israel achieved independence in 1948, these two stations were combined and went on the air as Kol Israel, the Voice of Israel. Later, when TV came to the country, both radio and television were placed under the Israel Broadcasting Authority, IBA.

IBA is headquartered in Jerusalem. The studios and most editorial offices, along with the news bureau, are in a complex of buildings originally built as a summer palace for an Abyssinian princess. Things just didn't work out the way the princess planned, though, and the palace became a girl's school. Later the buildings were taken over by the British mandate government for use as the Holy Land's first broadcasting station.

IBA broadcasts shortwave mostly to Europe and Africa in a number of languages, including Russian, French, Hebrew, Arabic and English. But, compared to the powerful shortwave transmitters in the rest of that corner of the world, IBA was woefully short on lungpower!

That problem has been rectified with the installation of 300 kilowatt shortwave transmitters. And, of special interest to Stateside and Canadian DXers, just this year, and very belatedly, the IBA has begun to experiment with shortwave programs beamed especially to North America. Whether or not these transmissions

(Continued on page 96)

LITERATURE LIBRARY has been expanded

Use Coupon on Left:

132. E. F. Johnson's 1974 full line of CB transceivers and accessories equipment is featured in a new 16-page brochure. A 4-color folder on monitor scanner line is also offered.

133. If you want courses in assembling your own TV kits, National Schools has 10 from which to choose. There is a plan for GIs.

134. Get the new free catalog from Howard W. Sams. It describes 100's of books for hobbyists and technicians—books on projects, basic electronics and many related subjects.

135. Sprague Products has L.E.D. readouts for those who want to build electronic clocks, calculators, etc. Parts lists and helpful schematics are included.

136. The 1972-73 edition of Tab Books' catalog has an extensive listing of TV, radio and general servicing manuals. Also listed are books on audio and hi-fi, basic technology, and test equipment.

137. The Drake Model SPR-4 Receiver is programmable to meet specific requirements: SWL, amateur, laboratory, broadcast, marine radio, etc. This leaflet gives complete information.

138. Leader's catalog features "Instruments to Believe In." They have a complete line for industry, education and service, featuring oscilloscopes/vectorscopes, many generators, accessories, etc.

139. B&F Enterprises has an interesting catalog you'd enjoy scanning. There are geiger counters, logic cards, kits, lenses, etc.

140. For a catalog on Pace Communications' CB transceivers, circle number 140.

141. Pearce-Simpson is offering new literature on their CB and SSB transceivers.

142. For the latest information on CB transceivers by Courier, send for their literature.

143. Siltronix has literature on CB transceivers that you just shouldn't miss.

144. Lee Electronics Labs has an inexpensive circuit analyzer, which is featured in this catalog.

2+2=QUAD

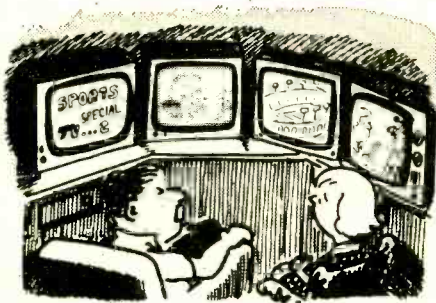
by Jack Schmidt



"No kidding. . . I got the idea one night in the stereo shop."



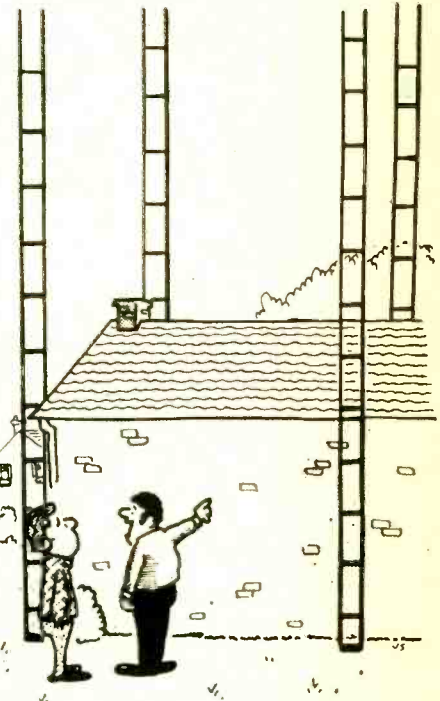
"Looks like you've got all four channels coming through one speaker."



"You enjoy your kind of Quad and I'll enjoy mine!"



"This is the first game of the year to be broadcast live in 4-channel. . ."



"... and that one picks up the sound for the left-front speaker . . . and the back one gets it for the left-rear, now these two pull in the. . ."

There's a TRF in that IC

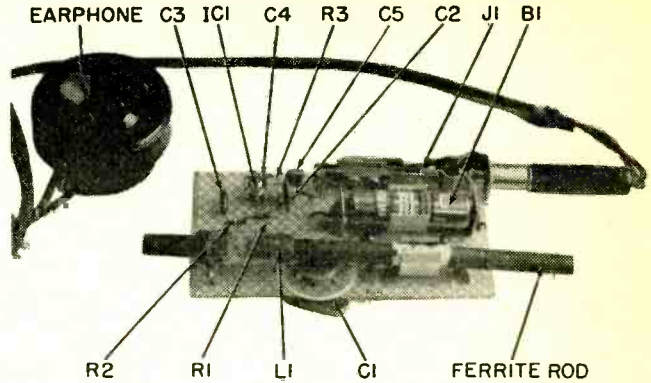
by C. R. Lewart

Building yesterdays radio with the excitement of today!

□ Back in the days when everyone who built electronic projects as a hobby used vacuum tube circuits, there was a project in the RCA Receiving Tube Manual for a wide range, low distortion receiver for the AM broadcast band that used what was called an "infinite impedance detector." This one-tube project gave hi-fi buffs a simple receiver that could detect the full response of local AM stations, some of which did broadcast wide frequency programming in spite of the usually quoted 5 kHz audio cutoff of AM stations. But, plagued with poor sensitivity and selectivity, it became more convenient to build one of the \$29.95 AM tuner kits of the day than to erect a 50-foot longwire antenna and deal with the bleedover of other local stations. With this project e/e shows you how to overcome those old time problems with an IC circuit that's simple, sensitive and selective.

e/e TERRIFIC TRF

This is the author's original model, built on a small perf board with a ferrite rod and coil L1 salvaged from an old transistor radio. You can do that or use one of the units suggested in the parts list.



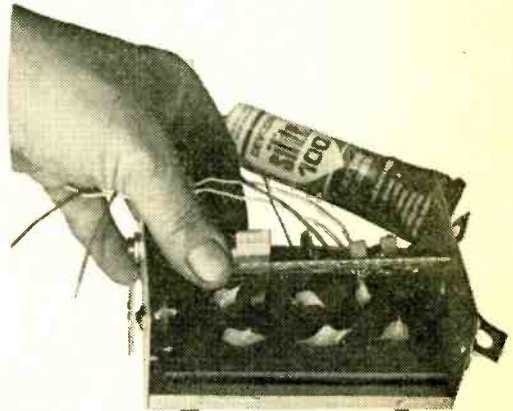
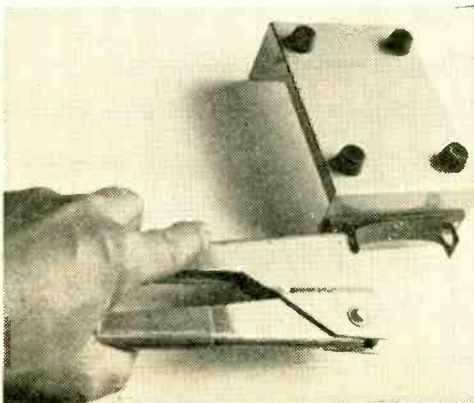
There is a way today for you to get a full measure of low-distortion sound from your local AM station, and at the same time gain experience in building one of the oldest circuits around—the TRF (tuned radio frequency) radio. As a bonus, you work with an integrated circuit, one of those amazing supersmall bits of etched silicon that do big jobs. Here the IC is a small three-lead unit that looks like a transistor but actually contains ten. Inside, an RF signal (the station you tune) is amplified and detected with enough output to directly drive high-impedance headphones. There is even an automatic volume control built in, so you don't have the problem of blasting and fading as you tune signals of different strengths.

That brings up the other fascinating thing about this receiver—its selectivity, or ability to separate stations crowded along the dial. With a high-Q ferrite antenna we could pick up eight separate stations in downtown NYC—a real feat for a TRF! A quick glance at *White's Radio Log* shows no less than seven

full-power 50,000-watt AM stations listed for New York City. An ordinary TRF circuit would be swamped by the high-power locals, allowing only one or two stations to be heard.

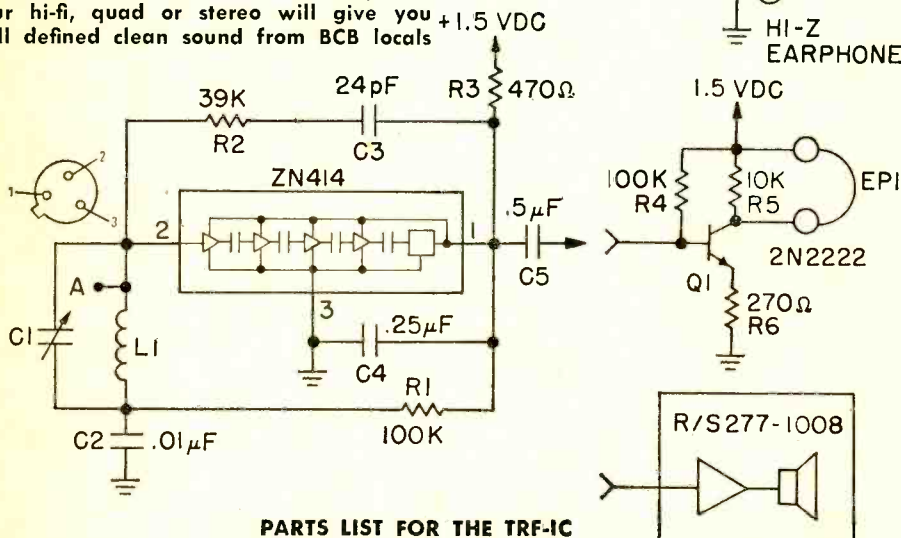
Actually, compared to an average superheterodyne-type pocket transistor radio, the audio quality of our receiver is considerably better, and its sensitivity and selectivity closely approach the superhet. The radio drives high-impedance earphones with sufficient volume for personal listening; with additional amplification it can of course be used to drive a loudspeaker.

The Circuit. The heart of this simple radio is a newly-developed integrated circuit, the ZN414, made and developed by Ferranti Limited of Great Britain. It amplifies the RF signal, demodulates it, and provides automatic gain control (AGC). Selectivity is the result of the input circuit—a high-Q (200 or more) ferrite antenna and tuning capacitor that work into the high input impedance of the IC.



Increasing the appearance of basic perfboard construction is simple with one of the good looking cases available to hobbyists. A well stocked workshop (left) can make a neat job easy as you attach the Miller coil holder. And dabs of adhesive hold perf-to-fiberboard.

Your three options for listening include a one-transistor earphone amplifier. Use it with less sensitive phones. Actually, even 8-ohm hi-fi phones work at reduced volume when connected directly to cap C5. Connecting C5 and ground to the input of your hi-fi, quad or stereo will give you well defined clean sound from BCB locals



PARTS LIST FOR THE TRF-IC

- B1—1½ volt AA cell
 BH1—Battery holder for single AA cell (Radio Shack 270-1432 or equiv.)
 C1—365 pF variable capacitor (Radio Shack 272-1341 or equiv.)
 C2—0.01 μF (10,000 pF) disc capacitor, 12 VDC or better (Radio Shack 272-131 or equiv.)
 C3—24 to 27 pF disc capacitor, 12 VDC or better
 C4—0.22 to 0.25 μF capacitor, 12 VDC or better (Radio Shack 272-1058 or equiv.)
 C5—0.5 μF capacitor, 12 VDC or better (Radio Shack 272-1054 or equiv.)
 EPI—2000-ohm impedance earphone (Radio Shack 33-180 or equiv.)
 IC1—Integrated Circuit ZN414 (Available from Circuit Specialists Co., P.O. Box 3047, Scottsdale AZ 85257 for \$4.95. Postage is included.)
 L1—Ferrite rod antenna coil for broadcast band, J. W. Miller type 2001 (Radio Shack 270-1430 ferrite antenna coil can be used with reduced sensitivity)
 *Optional parts required only if single-stage audio amp is to be constructed.

- PA1**—Optional amplifier and speaker (Radio Shack 277-1008)
 Q1*—Transistor, NPN, 2N2222 (Radio Shack 276-2009 or equiv.)
 R1—100,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
 R2—39,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
 R3—470-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
 R4*—100,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
 R5*—10,000-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)
 R6*—270-ohm, ¼-watt resistor (Radio Shack 271-1800 or equiv.)

Misc.—Battery holder, hookup wire, solder, epoxy glue, etc.

**Optional amplifier/speaker unit required only if earphones are not used.

Construction. Try to follow the parts layout as shown. Long connections may cause feedback whistles and poor reception. Of special note, C4 must be soldered as close as possible to the integrated circuit. Sensitivity with the ferrite antenna should be sufficient for most broadcast band stations. If you do want to pull in the weak ones, attach a couple of feet of free-hanging wire to point A shown on the schematic. The radio will operate with proper selection of a smaller tuning capacitor (C2) at frequencies between approximately 200 kHz and 4 MHz! This

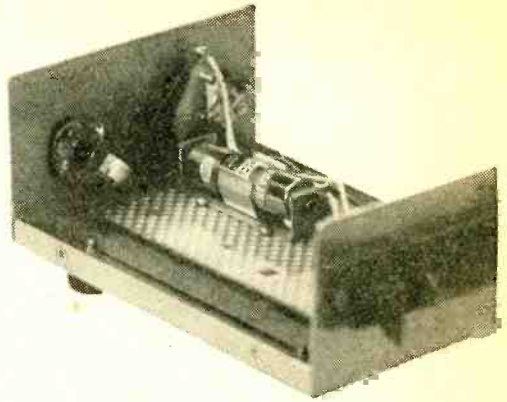
would include, in addition to the broadcast band, the weather band, the marine band, and the end of the 49 meter short-wave band. I was able to receive, using just a ferrite antenna, a German and a Canadian station in the 49 meter band, and I could hear the marine operator around 2.5 MHz.

The Editor's Modification. The original circuit board for the super-transistor radio was heywired on a perfboard with all connections made there. Phone jack, tuning capacitor, antenna coil—every part was mounted on the board without regard for

appearance. However, there comes a time when every project must be mounted in a box so that it can be used and be durable.

The super-transistor radio board is suitable for mounting inside an aluminum case. However, the antenna coil must be mounted on the outside of the case. The phone jack was mounted so that the phone plug could be inserted without any problem. The tuning capacitor was also mounted on the front panel for the purpose of having its dial accessible for tuning. The antenna coil (ferrite core) was mounted on the outside of the box simply because the box itself would shield the antenna from electromagnetic radiation. So, the easiest way for me to proceed was just to remove these parts from the perfboard and mount them on the front and back panels as the photos indicate. Leads were then connected to the perfboard, and the perfboard in turn was cemented to the bottom of the box. Since the bottom of the box is metallic, with metal screws jutting up because of the rubber feet mounting, a 1/4-in. masonite board was cut and inserted into the box so that the leads on the bottom of the perfboard would not touch the metal case.

There was one particularly important mounting problem. The tuning capacitor is isolated from ground as the schematic diagram indicates. However, the mounting shaft of the tuning capacitor connects to one of



Just a single 1½ volt cell powers this set for at least 90 days—even if you operate for 24 hours a day! What would a D cell do?

the plates of the capacitor. Therefore, mounting this tuning capacitor directly to the front panel would short out a part of the circuit and make the receiver totally inoperative. To avert this problem, two washers were cut from this magazine's cover. The holes were punched out with a paper punch. A piece of spaghetti tubing was cut about 1/16-in. long to make a large "rubber band" spacer that would fit over the shaft threads. This insures that the side of the shaft and the capacitor mounting threads would not touch the hole in the box. The two washers went on either side of the surface of the box so that the capacitor nut and rear mounting would not touch. Sound difficult? It's not, because it only took about five minutes to do. ■

Hook Up a Krunchometer Today

□ Your oscilloscope sits unused on the test bench during parties when it can provide yoman service as a Krunchometer to entertain your guests. Set-up is easy!

Set the vertical gain control of the oscilloscope for zero gain. Adjust the horizontal sweep control to about 20 Hz. Set the intensity and focus controls to give a nice clean, fairly bright trace. Now stand back about 15 feet from the face of the oscilloscope and crunch on a raw carrot or spaghetti (yuck!) while watching the trace on the oscilloscope. No connections are needed between the oscilloscope and the crunching observer. Note the wave that is generated on the oscilloscope trace and you will find the greater the crunch, the greater the amplitude of the wave.

Don't expect to see the wave on the oscilloscope unless you are the one doing the crunching. This seemingly "magical" property of the Krunchometer can be verified by everyone who takes part in the crunching.

How does it work? While you are watching the oscilloscope trace, your eyes see a flying spot which makes the oscilloscope trace. You do not see this trace as a flying spot, but as a solid line because of the eye's image persistence of 1/15th of a second or less. As you are crunching the eyes are being bounced up and down causing the flying spot to trace on the retina of the eye a wiggly line. This wiggly line you see is what I call a Krunchometer. The Krunchometer works best when carrots are in season.

—Glynn G. Gillette

SO YOU WANT TO DESIGN A SIMPLE TRANSISTOR AMPLIFIER STAGE!

by David J. Waters

Want a quick, easy method to determine what component values to use when you insert an additional transistor amplifier stage in your equipment? The common emitter arrangement shown in the diagram can be used with a reasonable amount of simplicity, stability, and dependability. It has both voltage and current gain.

Get Started. It is simple to select the correct values for the components in this circuit. Suppose we have the common variety of a silicon transistor with a beta of over 20 to be used as a small signal class A amplifier stage.

Under these conditions we want about 1 mA in the collector circuit. Let's use an emitter voltage somewhere between 1/2 and 2 volts, say 1 volt. The emitter resistor Re value will then be 1 volt/1 mA = 1000 ohms.

Since the base is automatically at 0.7 volt for a silicon transistor—close to 0.3 volt for germanium—the 1 volt emitter sets the base at 1.7 volts.

The current in the divider network of R1 and R2 should be 1/2 or more times as high as the collector current, which was selected at 1 mA. The divider current, then, is 0.5 mA. Use a 6-volt collector supply, for example. To obtain the resistance values of the divider network simply divide the 6 volt collector supply by the divider current of 0.5 mA. The answer, 12,000 ohms, is the total divider resistance value. Since R2 is at

1.7 volts/0.5 mA = 3400 ohms, it follows that R1 must be 12,000 minus 3400 or 8600 ohms.

This leaves only the collector resistor Rc to find. Any resistance should be used that gives the required collector voltage to drive the next stage. The collector voltage should be kept at least 1 volt over the emitter voltage; about 3 volts would be a logical output. The value of resistor Rc can then be easily calculated by 6 - 3 volts / 1 mA = 3000 ohms.

Lest You Forget. A few things worth remembering: A signal at the base affects the collector current. A positive voltage for an NPN transistor or a negative voltage for a PNP applied to the base raises the collector current. The common emitter configuration inverts the input signal 180° at the transistor output. The common emitter current gain, beta, is usually given in the manufacturer's data sheet but may quite easily be figured by the equation:

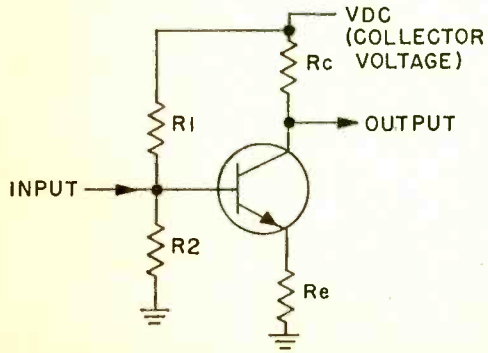
$$\text{Beta} = \frac{\text{alpha}}{\text{one minus alpha}}$$

Thus, if alpha is given at 0.98, beta would be:

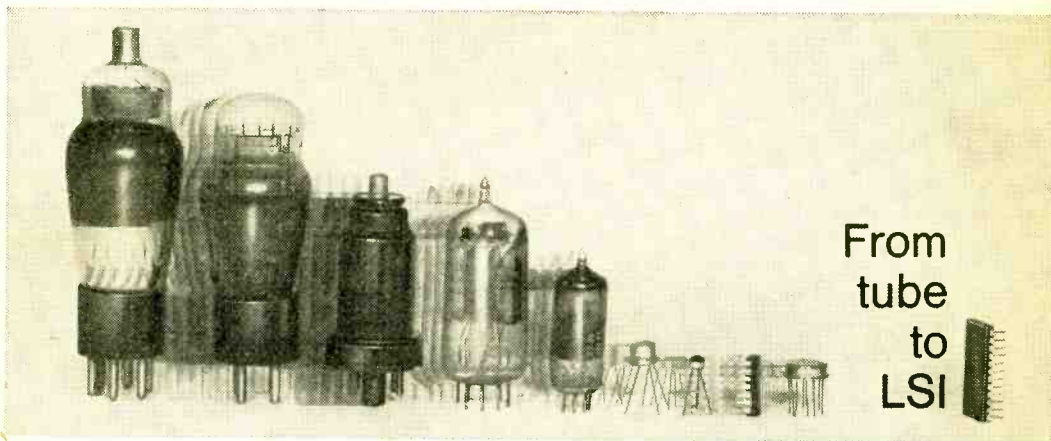
$$\text{Beta} = \frac{1 - .98}{.98} = \frac{.02}{.98} = .49$$

As a general rule alpha is approximately between .9 and .99; beta is usually between 10 and 1000. The negative number (minus sign) indicates signal phase inversion.

Final Tip. Now you have an inside track on designing simple, one-stage transistor amplifiers. If your computations call for an 8,600 ohms resistor, select the nearest standard resistance value. The two nearest values are 8,200 and 9,100 ohms. Either value is usable in the circuit (the 8,200 being the closer) since they are within 6% max. of the computed value. You'll find ±10% change in computed values to have little effect on the circuits operation. Start designing, today!



Changes come fast in electronics.



From
tube
to
LSI

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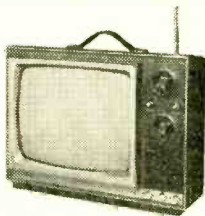
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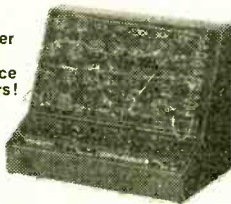
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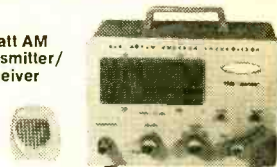
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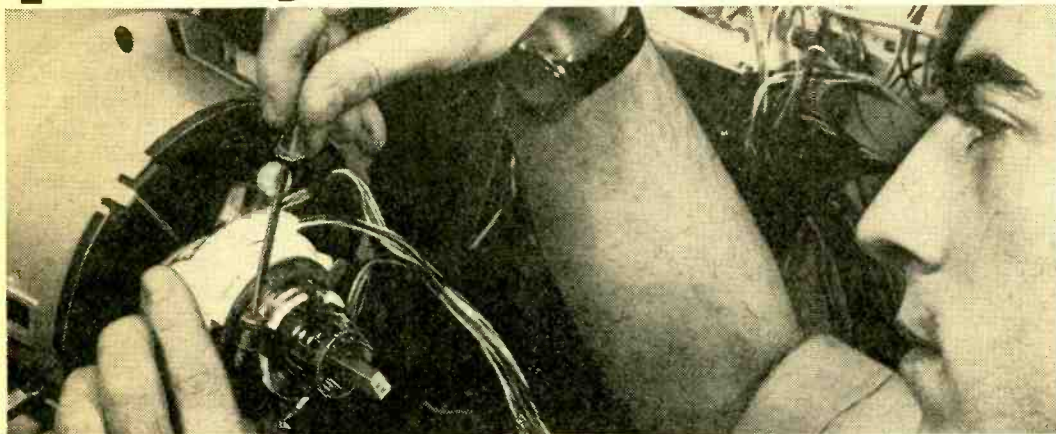
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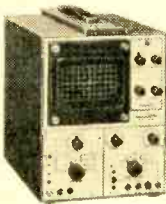


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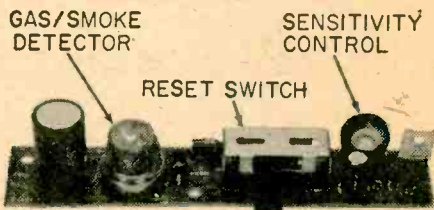
by Herb Friedman

It used to be that the average homeowner wanting early warning of impending fires through smoke detection either had to go the expensive commercial-equipment route or build a not-to-reliable homebrew device. In between the two extremes was nothing on which you'd stake your life. Fact is, in most instances "Joe Average" is still being sold expensive smoke detectors for home use he'd have to throw directly into a fire before it sounded an alarm.

But times change, particularly when it comes to solid state devices, and a small *ionization detector* designed to detect gas fumes and smoke is now available for little more than the cost of a transistor. Though the device is often termed a "smoke detector" it also sniffs out carbon monoxide, methane and Iso-Butane gases, in fact, any ionized gas. A small alarm system such as the Radio Shack Disaster Alarm Kit (#28-4006) which incorporates this detector can be used as a smoke detector in the home to warn of impending fires, as a carbon monoxide detector in the garage for those of you who insist on working on a running engine with the garage doors closed, or as a gas fume detector in closed areas.

The Disaster Alarm Kit has an approximate sensitivity to carbon monoxide of 500 PPM, and 2% to 4% smoke. Unfortunately, it does not incorporate heat detection—for there can be fire before smoke. However, we'll show you how, for just pennies and two extra wires, the Disaster Alarm can be converted to a *smoke, gas, heat and burglar alarm*.

Start With a Prefab. The basic Radio Shack Disaster Alarm Kit is AC powered and is housed in a small white plastic cabinet that is mounted high on a wall near the bedroom area (or inside a garage or closet). The alarm sound is produced by a loud, raucous buzzer, similar to the warning horns used as interior remote fire alarm horns in commercial equipment. Once triggered, the



Assemble the printed circuit board exactly as described in the manual. Modifications are added to a complete and tested board.

ELEMENTARY ELECTRONICS

alarm can be silenced only by operating a reset switch. Should the gas or smoke be temporarily blown away by wind the alarm will not be silenced: only the user can silence the alarm.

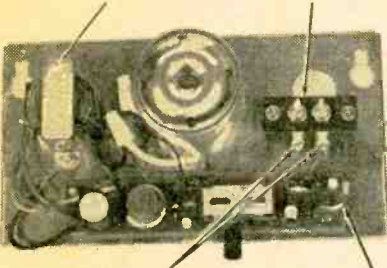
The kit consists of the plastic housing, power transformer, buzzer-horn, a small printed circuit board and much less than a handfull of components. Construction time takes about one hour.

On the PC board is a small wire jumper labled "J" that is used only for initial setting of a sensitivity control. After the sensitivity is adjusted the J-jumper is normally cut through. However, by bringing out the two J-jumper connections to a screw type terminal strip positioned near a hole pre-drilled on the alarm's back panel both fire and intruder detectors of the *open circuit type* can be connected into the Disaster alarm. Thus, the buzzer-horn sounds when there is gas, smoke, excessive heat or a forced entry through a door or window.

The alarm must be completed and tested before the fire/intruder modification is made. Only after you are *absolutely certain* the alarm is working properly should the following modifications be added to the alarm.

Fire-Intruder Modifications. The PC board is held to the cabinet by three plastic studs. Gently snap the board off the studs and flip it over. Unsolder the J-jumper which is now cut in two. In its place solder a 6 in. pair of insulated twisted wires. Then, re-install the board on the studs. Position a two terminal strip so it half covers the "extra" hole in the cabinet's rear cover, mark the mounting holes and drill for #4 or #6 screws. Bend the terminal strip's solder lugs outward so they will be horizontal to the cabinet and install the terminal strip using

POWER TRANSFORMER TERMINAL STRIP



J-JUMPER WIRES PRINTED CIRCUIT BOARD

Best location for alarm is high up in the bedroom area. Make certain resetting switch points down so that it is very convenient.



e/e DISASTER ALARM

a 1/2 in. spacer or stack of washers between the terminal strip and the cabinet. (You must be certain the terminal strip does not short to the metal cabinet cover.) Solder the two wires from the J-jumper connections to the terminal strip. That's the entire modification.

The Disaster Alarm will work normally with or without connections to the terminal strip. If you connect *open circuit* type heat and fire intruder detectors (such as magnetic switches) to the terminal strip the alarm will sound when ambient heat is excessive or when an intruder forces a door or window.

The heat and intruder detector switches are connected in parallel as shown in the schematic diagram. Because it's a parallel connection there is no practical limit to the number of protective devices you can use. You can place a heat detector in every room and a magnetic switch on every window. Heat detectors come in two standard values: 135°F which is used in the living areas and 190°F (or 195°F) used in furnace rooms and attics.

Take extreme care that you do not obtain *closed circuit* detectors for these cause the alarm to continuously sound. The magnetic detector usually sold in electronic parts stores is the closed circuit type. Do not let a salesman talk you into these devices. The heat and magnetic switch specified as *open circuit* has its contacts *open when safe* and *closed when activated*. If you or the salesman are in doubt as to whether you are getting the correct detector simply check it out with an ohmmeter. Open circuit detectors are usually available from security equipment distributors and many electrical supply houses.



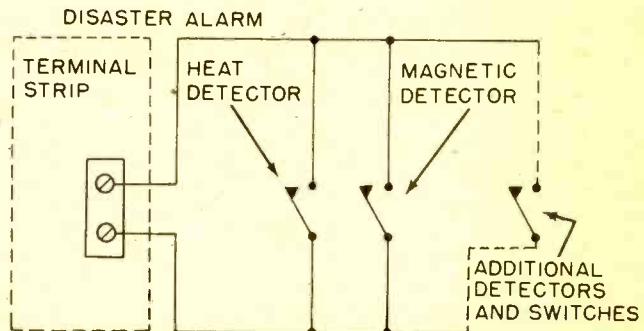
Standard open circuit heat/fire detectors can be installed in all living areas, above the furnace and in cellar and attic.

Final Set-up. After your complete security system is installed, check it out in the following manner. Blow some cigarette smoke at the alarm. If the alarm doesn't trip calibrate the unit as specified in the supplied instructions, but where the instructions call for a J-jumper simply connect a clip lead across the terminal strip. Similarly, where the instructions call for cutting the J-jumper just remove the clip lead.

Applying a match near the heat detector should sound the alarm. If it doesn't you have made a wiring error. (As soon as the detector cools off it automatically resets itself.)

Check a magnetic switch by opening the door or window. If the alarm doesn't sound, look for a wiring error.

It is a good idea to periodically check the system by deliberately tripping each detector—contacts do go bad. If you discover an inoperative detector replace it immediately. ■



The alarm system with modified circuits can have any number of additional detectors added to expand system to cover the entire house, even the garage. Terminal strip is added, after alarm is built, in place of jumper "J".



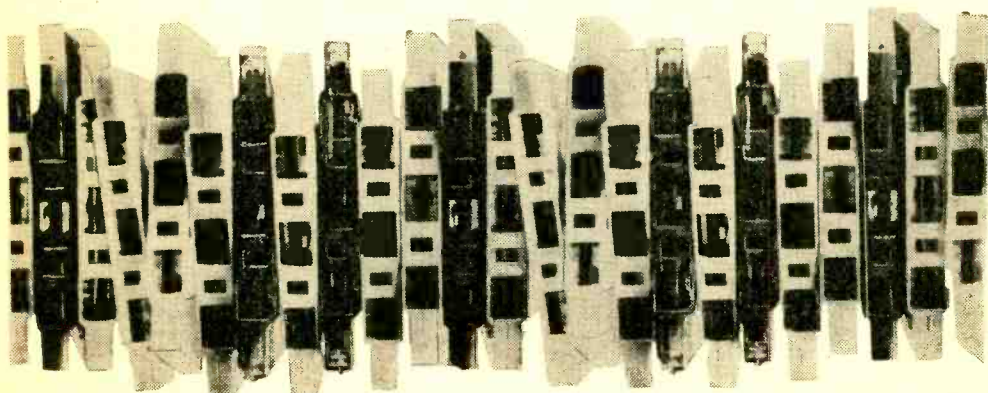
those little gadgets that keep tape machines going

by Jorma Hyypia

One man's gadget is another man's vital accessory. Accept this now, we shall both save time. I won't have to pass myself off as an expert about what you need or don't need, and you won't have to waste time writing a letter asking why I didn't mention the combination tape splicer, bulk eraser and fly swatter made especially for use in Boy Scout camps. Sure, I will express personal preferences on tape accessories, so this is no copout. But I also realize that you may have little use for what I need, and vice versa. So if you like a gadget I pass over lightly, or you can't dig the vital accessory I tactfully recommend, no one need feel slighted!

Now that all that is clear, let's see just what temptations are dangling from the pegboard at your local electronics shop. Don't take any mentioned prices as gospel because manufacturers, independent dealers and mail order supply houses invariably have differing ideas about the worth of each gadget. The prices are mentioned to provide a rough idea about how hard you will have to work to justify purchase of another gadget to whoever is in charge of the family budget.

Head Degaussers. If you have an uncomfortable feeling that some



e/e TAPE GADGETS

of your prized tapes don't sound quite as good as they did a year ago, the deterioration of sound quality may be real due to gradual magnetization of the playback head, capstan and guides; or it may also be partly due to actual deterioration of your recorded tape because of the magnetized head.

To ensure the best possible sound reproduction, and to safeguard your expensive and often irreplaceable tapes, demagnetize your tape player heads periodically. It only takes seconds, and well worth the slight effort. At the same time, pass the degausser over other metal parts that contact the moving tape, including the capstan and tape guides.

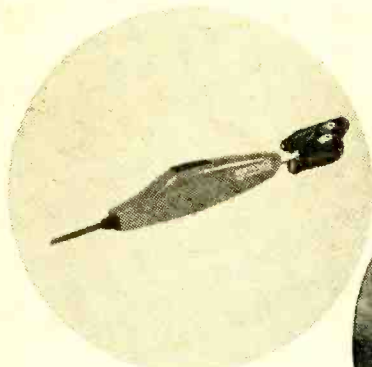
Head demagnetizers are available in many sizes and shapes. All work the same way, and probably all do a good job when used according to directions. The main thing to bear in mind when purchasing a demagnetizer is to choose one that can most easily reach the playback heads to be degaussed. For example, the job with the long snout (shown in one of the photos) is expressly designed to reach the heads in 4- or 8-track auto or home cartridge players; it can of course be used on the heads of other types of recorders as well. However the relatively thick probe of this demagnetizer would not be suitable for recorders or players having heads crammed close to other components. A thinner, more needle-nosed probe would be preferable.

Head demagnetizers range in price from around \$3 to \$12 or more depending on quality of construction, convenience of handling, and whether a push-for-on switch is built into the unit. If you tend to be forgetful, get one with a switch so that you won't leave your demagnetizer turned on accidentally and, thereby, ruin it.

Other Head Maintenance Needs. All tape heads build up deposits of iron oxide that is scraped off the moving tapes. If these build-ups are not cleaned off regularly, sound quality suffers because the tape can no longer make the required intimate contact with the heads, and because the tapes themselves can be damaged by the abrasive deposits.

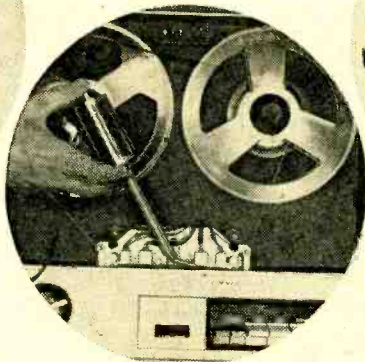
The safest and most thorough method of cleaning tape heads is to swab them with any of the specially formulated cleaning fluids made for that purpose. You can buy cotton swabs from your electronics shop, or save money by obtaining equally good cotton *Q-tips* from the local druggist. There are also spray-on head cleaners which are satisfactory provided that the sprayed fluids are completely volatile and will not leave residues on the head or other nearby components. If you are addicted to aerosol squirting, try them; I'll just keep on swabbing liquid because I *know* it won't get onto anything other than the head I am cleaning.

You can also dry-clean your tape machine heads by running a specially treated tape across the heads. The tape comes on a small reel for use on reel-to-reel machines; or you can obtain it in regular cassette or cartridge form to just pop into the machine and play as you would a regular tape. These do a good job where they actually contact



Nortronics head demagnetizer with thin probe reaches record and playback heads where bulkier units cannot reach.

Head demagnetizer is a must for continued hi-fi sound. This Audiotex model has an extra long tip for cartridge players.



Hand-held Nortronics QM-211 bulk eraser completely erases reels, cassettes, and 8-track cartridges of up to 1/2-inch tape width.

the heads, but you may see some residual debris left near the edges of the heads if the tape does not contact the entire head surfaces. Another objection to such tapes is that all the removed soil accumulates on the tape and so very soon you are cleaning dirt with dirt—abrasive oxide dirt at that. If you use such cleaning tapes, discard them when they begin to look soiled. They could be most convenient to keep portable recorders and players in top shape when you are travelling and don't want to carry along any more extra equipment than is necessary.

One other possible cause of sound deterioration is mis-alignment of playback heads. You can check head alignment by running through a Head Azimuth Alignment Tape (\$1.29 at Lafayette) that provides a 6 kHz steady tone in either direction. You just listen to the tone and reposition the head until you obtain the clearest sound reproduction. There's also a different tape loop that, it's claimed, will enable you to check speed timing, wow and flutter to within 1% accuracy.

If your eyes are better than your ears, and you have a feeling that your tape speed is off, a simple strobe device will tell you whether or not your fears are real or imagined. A "buck-fifty-nine" will buy a strobe disc on a handle that will measure speeds of 3¾, 7½ and 15 IPS (inches-per-second). You can also buy a similar disc mounted on a U-frame (see photo) for \$7.50. It does not measure the 15 IPS speed which most non-professional machines don't have anyway. The main justification for the much higher price—as far as I can figure it—is that the U-bracket is very easy to hold steady

against the tape recorder, and that the position of the wheel can be shifted on the shaft so that it will engage the tape properly.

Obviously, these strobes are for use only with reel-to-reel machines where there is enough room to position the wheel against the tape. To view the strobe pattern you need a light that flickers. This means that you would perhaps have to lug the tape recorder into the kitchen and put it under the fluorescent ceiling light unless you want to spring for the sometimes handier neon test light that sells for \$1.75.

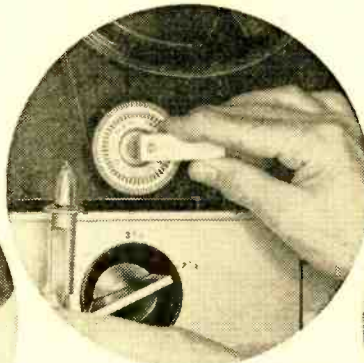
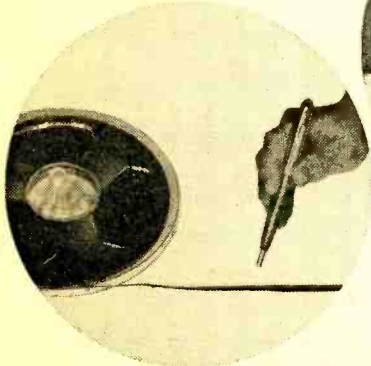
Tape Accessories. So far we have been talking mainly about accessories that can help keep your tape machine purring contentedly; now let's see what gadgets the manufacturers have dreamed up to keep your tapes in good shape.

Actually, you need only sharp scissors, a roll of splicing tape and your fingers to mend broken tapes and to add leader tapes to tapes that you prize and use often. But if you have arthritic digits, or more than your share of thumbs, or if you just want to do things easier and faster with your talented hands, buy a good tape splicer.

There are two basic types of splicer—the simple splicing block and a semi-automatic splicer. Both types, scaled for use with narrow cassette tapes, are shown in the photo; larger models, for use with ¼" tape, are of similar construction.

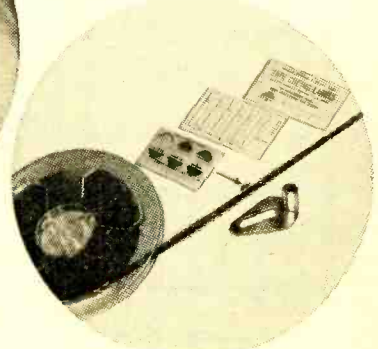
The splicing block is cheapest to buy because it consists of little more than a tape-wide groove running the length of a metal block into which you place the two tape ends to keep them aligned. You then cut both tapes at a 45-degree angle by running a razor

Magnetic editing pen by Robins removes isolated sounds and creates fade-outs on recorded tape. Great for home producers.



The Audiotex tape recorder strobe checks recorder's speed accuracy for both 7½ and 3¾ IPS speeds by holding against tape.

Self-adhesive cueing tabs by Radio Shack and Robins tape threader gadget make cueing possible and easy even for clumsy editors.



e/e TAPE GADGETS

blade through a guide slot. You then stick on the bit of splicing tape (*never* use ordinary household adhesive tapes) and trim off the excess. Some blocks have metal clamps to help hold the tape down in the groove, some do not. You are supposed to trim the extra splicing tape off by running the razor blade along the two edges of the groove. I have never made a decent splice that way; I have never made anything *but* a decent splice by trimming with a pair of sharp, curved cuticle scissors that friend wife has been looking for during these many past years. I demagnetize it before using.

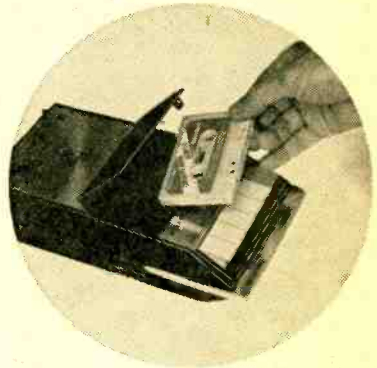
The semi-automatic splicer does a lot more than help align the two tape ends and hold them down with a couple of metal fingers. By pushing the plastic block atop the splicer into "cut" position and pressing it down like a stapler you get a nice, neat cut through both layers of tape. After carefully removing the top scrap piece so that the butted ends do not shift, you apply splicing tape, position the block to "trim" and bear down again. Like magic, both sides of the splice have been trimmed with that sexy little inward curve that is the surest sign of professional splicing. But be warned that too much of a good thing can be bad; if you have a 4-track tape system, look for a splicer that cuts a modest, skinny fashion-model waist line instead of a deeper Mae West curve that could damage a couple of sound tracks.

As with so many other tape recording gadgets, you can find splicers at many different prices depending on how well they are constructed and whether or not they include a splicing tape dispenser. If you do a *lot* of tape splicing because you are a nut on editing or because you are inordinately clumsy when handling tapes, it might be worth something like \$17 to get a complete rig that includes a splicer and two wind-up reel supports on the same base.

Speaking of editing, consider the possible merits of a magnetic editing pen (see photo) that can solve certain kinds of editing problems in pretty slick fashion. For example, suppose you record music off the air but run out of tape before a particular piece is finished. It's always a bit jarring to hear the abrupt ending on playback. With the magnetic editing pen you can easily fade out



Worn pressure pads must be replaced periodically if the best sound quality is to be achieved. Pads of any size can be cut from self-adhesive material (comes in two thicknesses) available at Radio Shack.



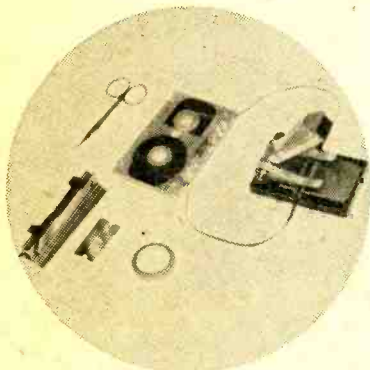
Easy way to clean the heads of a cassette tape recorder is to play the non-abrasive cleaning tape contained in this Realistic cassette sold by Radio Shack.

the music to create a far more pleasant effect. While the tape is being played, bring the pen tip closer and closer to the tape where it is about to enter the playback head section of the machine. You will hear the music fade off gradually and smoothly, as it will forever after because you progressively weaken the magnetic sound pattern on the tape. A couple of trials using a test tape of no permanent value will make you an instant expert in the technique of fade-ins and fade-outs.

There are other ways to use the editing pen. Suppose you have a tape copy of a record that had a dig in it and that loud thump or click always seems to call for an apology if guests are around. By locating the exact position of the thump on the tape, by rocking the tape back and forth while the recorder is in the play mode, you can mark



Lafayette bulk eraser removes old sound and reduces background noise. 12 plastic tape cans (also sold by Lafayette) and Radio Shack booklet detailing tape recorder techniques are valuable at home.



Two types of Realistic (Radio Shack) cassette tape splicers make the job easy. Unit on right is almost automatic, unit on left is cheaper and razor cuts tape.

the spot and after removing the tape from the machine delete the thump by bringing the pen tip straight down on the offending spot for just a moment. You will then notice a dead spot in the sound, but only if you listen for it intently and know when to expect it; it's much less disturbing than the original thump, click or whatever.

If you have a machine with a pause control, rocking the tape is easy. If there is no pause control, thread the tape across the heads in the normal way but then pass it *behind* the capstan so that the idler wheel can't touch the tape. You can now turn the machine on to "play" without the tape moving, and you can manually rock the tape to find the spot you want.

Bulk Erasers. If you intend to repeatedly record new material on the same tapes, and especially if the same reel-to-reel tapes are

TAPE ACCESSORIES SHOWN IN PHOTOS

Product	Model Number	Approx. Price
Radio Shack (Realistic) Reader Service No. 68		
EZE Cassette Tape Splicer	44-1021	\$1.99
Cassette Tape Splicer	44-771	2.95
Cassette Head Cleaner	44-1160	1.49
Tape Cueing Labels	44-1159	1.29
Tape Recorder Pressure Pads	44-1027	0.59
"Using Your Tape Recorder" (book)	—	0.95
Lafayette Reader Service No. 58		
Deluxe Bulk Tape Eraser	99P-15182	\$12.50
12 Twist-Lock Styrene Tape Cans	28P-65103W	4.75
Robins Reader Service No. 54		
Tape Threader	TT-1	\$0.98
Magnetic Tape Editing Pen	TM-2	1.65
G.C. Electronics (Audiotex) Reader Svc. No. 65		
Tape Cartridge-Player Head Demagnetizer	30-112-2	\$11.95
Tape Recorder Strobe	30-234	7.50
RPM Strobe Light (neon)	30-238	1.75
Nortronics Reader Service No. 61		
Hand-Held Bulk Eraser	QM-211	\$25.90
Head Demagnetizer	QM-202	15.90

likely to be used on different recorders having wholly different erase, record and playback head configurations, a good bulk eraser is a must for high-fidelity work. A bulk eraser does more than just erase the tape faster than it could be done on the recorder; it can do a much more thorough job than any recorder erase head, especially if you are cleaning up very old tapes on which the magnetic sound patterns have "hardened" or if you are erasing new-style chromium-dioxide tapes.

You can opt for a hand-held bulk eraser with which you "iron out" the magnetic signals by passing the eraser over the tape reel, cassette or cartridge. When using a larger bulk eraser, the reel is placed on top of the case while the coil is activated with a push button. The reel is rotated a couple of times and slowly removed while the coil is kept activated. The Lafayette deluxe model shown (99P 15182, \$12.50) does a good job provided you turn the reel over and repeat the erase process on the other side. A more powerful "professional" model sold by Lafayette for \$34.95 does not require revers-

TAPE GADGETS

ing of 1/4" tapes, and will erase magnetic tapes up to 1" wide. Also available is a battery-powered bulk eraser (\$8.95) that is most useful for field use where AC power is not available.

The erase efficiencies of different makes and models vary considerably, so buy an expensive model on trial basis, if possible, and test it on old tapes.

Better tape recorders and players generally have index counters that enable you to find the starting points of various selections on the tape. If you find that your counter isn't as accurate an indicator as you would like, or if your machine lacks any kind of indicator, try using small stick-on index tabs that you apply directly to the tape. Each tape cueing kit contains tabs of different colors in groups numbered from 1 to 6; also a set of self-adhesive labels to apply to the reel to identify the indexed compositions.

Have trouble getting your tape started around the take-up reel? A Robins tape threader could make this oft-repeated simple job simpler. There's also a special kind of take-up reel ("Autothread" \$1.19 for 7" reel at Radio Shack) that mysteriously grabs the tape when you drop it into the reel; but don't try to use this type of reel if you have plastic leader tapes on your tapes because the grabbing action seems to work only if the tape end is limp.

If you have especially valuable tapes that may be irreplaceable, they should be stored in plastic or metal cans, not so much to protect them from physical abuse as to minimize the deleterious effects of humidity changes. Metal cans are compact, and they stack neatly in minimum space, but some folk seem to have trouble getting the lids off.

If you have avoided metal cans for this reason, try the locking type of plastic cans that you can open much more easily just by rotating the lid so that it simultaneously unlocks and rises to an easy-to-open position. If you buy a dozen, you get a free cardboard rack for storage; it's handy enough, and will probably last a few years, but it won't look very chic on your teak cabinetry.

It seems that every time you visit your local hi-fi shop there's another gadget for tape maintenance on the peg board. Buy what you really need, because if you were to buy everything in sight you would almost surely discard half of the goodies. After all, who has the *time* to sit around and baby a tape machine for hours on end?

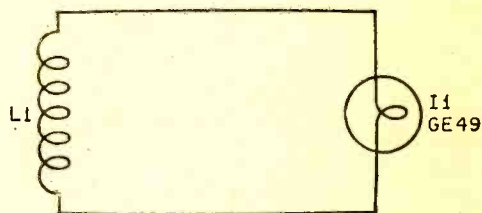
For example, you might figure that a silicone treated cloth that can be used to lubricate your tape will make musical passages sound smoother. Try it if you have tape squeal or chatter that you can't eliminate any other way—as by replacing those worn-down pressure pads. Avoid over use of anything that is supposed to add something to your tape because the added substance may do more harm by gunking your heads.

One of the least expensive accessories I would recommend are those small plastic clips that keep tape ends from spilling from the reels until you are ready to have them spill out. But if you don't mind dangling tape ends, don't let me pressure you into squandering another 49 cents for 18 clips down at the Radio Shack.

One thing I don't need, but you might, is a cassette rewriter that lets you keep the Rock and Roll blaring without pause for re-winding. Robins has a battery-operated rewriter, tagged at \$8.99 list, that will rewind a C-60 cassette in 20 seconds. And that just about winds up this tape accessory rundown, at least until next year when there will probably be scores more gadgets to talk about. ■

BUILD AN RF SNIFFER

The easiest way to start servicing low power ham transmitters is to first localize where the power gets lost. An R.F. Sniffer made from an ordinary #49 pilot lamp and a few turns of wire will instantly indicate if there's RF in a tank circuit. Carefully, so you don't get near the high voltage, bring the sniffer close to the tank coil. If RF is present, lamp I1 will glow—no glow, no RF. Coil L1 can be any diameter from

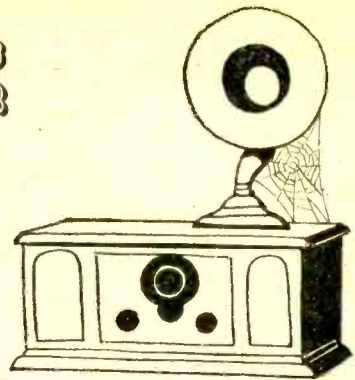


about one-half to one inch or greater. Use about 10 turns for 80 meters, 5 turns for 40 and 20 meters and 3 turns for 10 meters.



ANTIQUE RADIO CORNER

BY JAMES A. FRED

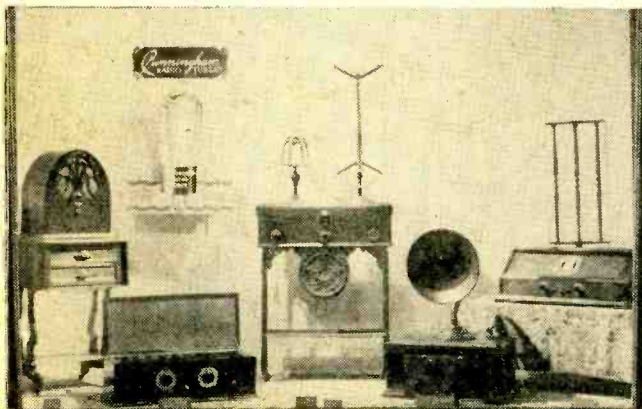


■ Hello! The Editor of ELEMENTARY ELECTRONICS magazine has urged me to use this magazine to communicate with the growing number of antique radio and wireless collectors. We are going to provide a common meeting place for collectors of antique radio and wireless equipment.

To start the column off on the right foot I would like to introduce myself. I became interested in radio in 1931 when I saw the diagram of a one tube radio in my high school science book. This was at the lowest point of the great depression, but I was able to scrounge enough parts to build a crystal set, then a one tube set. From there I progressed to multi-tube radios, shortwave receivers, and finally the crowning achievement, an eight-tube superhetrodyne. Upon graduation from high school I opened my own radio repair shop. During WWII I was a radio instructor and a radio inspector. Afterwards, I went into industry and was employed as a set designer, test equipment design engineer, and a reliability test technician. My spare time positions have included: broadcast station engineer, instructor in basic electronics, and a writer of magazine articles. I also did radio repairing

in my spare time. So, even though I am not the oldest radio collector around, I do remember the pre-1930 radios very well. I have a modest collection of radios dating from 1922 to 1960.

Now that you know who I am, lets get down to business. The hobby of collecting radio and wireless equipment has many facets. In this column we will explore different phases from time to time. For now, lets divide the last 70 years into some segments of time as it relates to our hobby. There was the pre-WWI area that saw the development of vacuum tubes, spark transmitters, crystal sets, and laid the ground work for commercial broadcasting. It would be fine if all collectors could have pre-1920 radio and wireless equipment, but by now most of it is in museums and in the hands of the older collectors. For these reasons most of the newer collectors are concentrating on the 1920 to 1930 period of commercial radio. There are several reasons for this: the main one being the availability of radio sets of this period. Personally I collect home and car radios up to 1950. Since I started in radio in 1931 I have a very close kinship with equipment of this period. (Turn page)



This collection of vintage radios is on display at the Indiana State Museum. Readers can have a free fact sheet of clubs, publications and museums dealing with antique wireless equipment. See the article for details.

e/e ANTIQUE RADIO CORNER

Who Are The Radio Collectors? There are no age limits to the hobby of collecting radios. The youngest collector I know of is 16 years old, while the oldest is in his 80's. You do not need to work in the radio industry or have a technical knowledge of radio to enjoy our hobby. I know collectors who are electrical engineers, electronic technicians, doctors, dentists, musicians, school teachers, retired persons, students, and from just about any other occupation you can think of. You don't need a lot of money to be a radio collector. I know of collectors who are probably millionaires, and I also know of collectors who live on fixed retirement incomes. To be a collector you don't need to live in any particular area. Most of the collectors seem to live in either the New England states or in California. New England is the oldest settled areas in the United States while California is one of the newer states.

To sum up the personality of radio collecting I would say the number one requirement is *desire*. If you want to be a

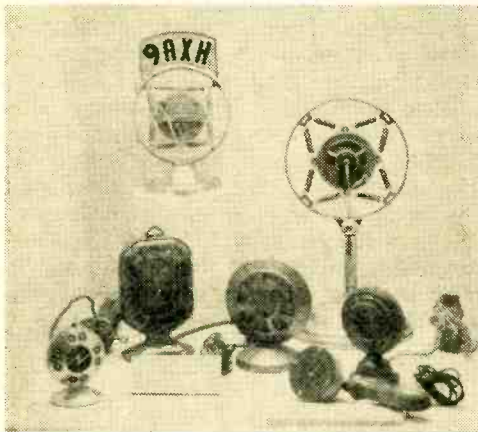
collector, start now!

How Does a Beginner Get Started? I would say that the best way to get started in radio collecting is to buy the oldest wood cabinet radio you can find. After you obtain a radio, clean and restore it, study it, try to make it play. You will soon find an older one and then you are on your way.

Where can you find old radios? Look in second-hand stores, Goodwill stores, Salvation Army stores, antique stores, old radio-TV shops, or advertise in the *Wanted* columns of newspapers. The best find I made, an Atwater Kent breadboard, laid in the upstairs rooms of an antique store in a very small town in Indiana. Your older relatives will often have the first radio they ever bought stored away in their attic. I have found radios in barns, in flea markets, in antique shows, and I might say, "Radios are where you find them."

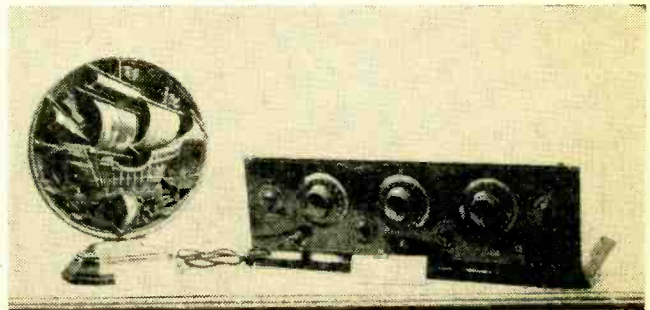
Suppose that you don't know a thing about radios, what do you do? There are publications that will help you learn about old radios. One of the best books available is *Vintage Radio* by Morgan McMahon. It shows many pictures of radios manufactured between 1922 and 1928. You can get a liberal education from this book. There are two monthly publications available for a modest subscription price. One is the *Horn Speaker*, a tabloid size paper with information on antique radios, wireless equipment, and phonographs. The other publication is "Antique Radio Topics". This is a newsletter featuring original material on old radios, plus technical tips and classified advertising.

A vital part of any hobby is organized clubs for collectors. Any hobby is more enjoyable when you can share the companionship of people with similar interests. There are several national groups for radio collectors. One is the Antique Wireless Association. They publish *The Old Timers Bulletin* quarterly. They have a national convention
(Continued on page 100)



Broadcast microphones from the early days of radio were virtually all carbon-type noted for their narrow 300-3000 Hz response. Today magnetic and condensers are doing the job.

Here is an A. C. Dayton type X-L-5 receiver dating from the early 20's. Speaker displays influence of the sailing ship models popular at that time,





by Kathi Martin KA10614

KATHI'S CB CAROUSEL

WELL, summer's nearly over and I'd like to extend a big kiss of thanks to all of you who made me feel so welcome when I popped into your CB jamborees. I really hadn't planned to attend any CB summer bashes, but how could I pass them by after I literally drove right up into the parking lots. And it was good to see how many brother and sister CB'ers keep up with the most modern trends in equipment; I had no idea there were so many sideband-squawkers in use. SSB is bigger than any of us here in the East believed. I guess people know what they're talking about when they say the real action is with those folks the TV comics call "hicks." Some hicks! *We* could all take lessons.

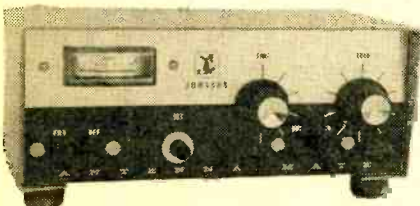
One thing that really threw me was the number of CB'ers who deluged me with questions about CB accessories. Seems as if no one has problems selecting the best *basic* hardware for his particular use (I mean transceivers and antennas), but there's a wide lack of knowledge about specialty items which resolve unusual problems. For example, up in the Sierras (one of the most magnificent parts of the U.S.) I ran across a jamboree operating a base station to guide in the mobiles trying to get around Yosem-

ite National Park. Did they have a problem! They were running an 8:1 SWR; the rig wouldn't load into that high an SWR, and they couldn't figure out how to repair the portable groundplane sky hook. Well, I have an SWR problem on my XKE, though not as bad, so I had the necessary equipment handy—a Johnson CB Antenna Mate. It's a device that presents a proper load to the rig even if the antenna system SWR is high. While it doesn't correct the SWR, it at least permits the transmitter to put all its RF into the transmission line. Anyway, I left them my matcher and picked up another when I hit Frisco.

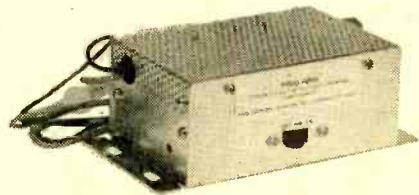
Trouble was, I was lending most of my accessories all over the west coast and wound up spending a good part of my vacation tracking down replacements.

So. . . Here are some of Kathi's tips on accessories, (maybe I won't have to spend my next vacation shopping for CB equipment!).

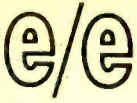
For those of you operating a channel 9 monitor net with separate rigs, you can save a bundle on price and effort by using the same antenna for both rigs. Just latch onto a Twin Rig Coupler that connects between two transceivers and one antenna. You can



E. F. Johnson Antenna Mate for lower SWR.
Circle No. 64 on the Reader Service Page.



Pace P5806 6 to 12 volt converter; to 4 A.
Circle No. 59 on the Reader Service Page.



transmit and receive from either rig without manual switching—the twin Rig Coupler does it automatically.

For those of you running more than two rigs—like the yacht club in L.A. that gave me two hours of water skiing behind 115 horses—just take an Antenna Specialists antenna switch and turn it around. The switch normally feeds one transceiver to three antennas; but there's no reason why you can't feed three transceivers to one antenna.

Another favorite accessory of mine is Radio Shack's short, loaded clip-on antenna for walkie talkies. I have never really appreciated that "hunting spear" sticking out of the top of full-5 walkie talkies. The Radio Shack clip-on antenna is about 15-in. long and fits right on top of a telescoped walkie talkie antenna. It has very little effect on overall performance and when I'm carrying the walkie-talkie on a shoulder strap I don't have a spear around my eye.

One way to resolve the 6 volt battery problem on older VWs is with a 6 VDC to 12 VDC solid state converter. Instead of plodding along with that old Sonar tube-type 6 volt rig, you can upgrade to one of those slick 12 volt transceivers without trading in the VW. The converter will jazz up the VWs 6 volt battery to a 12 VDC output.

Auto Setups. When there's no way anyone will talk you into cutting a hole in your "wheels" for an antenna, there's always a quick grip antenna, made by several of our top antenna outfits. These antennas, which deliver almost the same performance as a full length whip, and sometimes better performance, simply clip onto the rear deck without leaving a mark. And if you don't have a rear deck (or *boot* as my dealer calls it) to which a clip-on antenna can be affixed, there's always a gutter clamp antenna which mounts you-know-where. (Right! On the rain gutter.)

Another small accessory I dig is the solderless coaxial connector. The soldered connectors on the end of my portable antennas would often break—especially the center conductor of the coax. It would break *inside* the connector. With the solderless connectors, I now trim off a couple of inches of transmission line, give a twist with pliers and I'm back in operation in minutes.

Another cute accessory I get lots of mile-

age from is a center loaded portable whip that mounts on the back of a transceiver—it just screws into the rig's antenna jack. I'm often called upon to provide short range communications for local plays, outings, etc. Instead of looking for the nearest tree or column to which I can wire a standard whip antenna, I simply attach the small loaded whip to one of my small portable transceivers. While the antenna doesn't put out a whopping signal, it does give solid copy to walkie-talkies and other base-type transceivers within 1/4 mile—and that's enough to cover any auditorium, picnic area or parade ground.

Check This One. One accessory you've probably never heard of, but one which gets me a lot of free boat trips and water skiing, is my can of Mosley Weather-Guard Antenna Coat. Down at the local boat docks they say, "a marine CB antenna installed by Kathi lasts forever if she puts on that *magic glop* of hers." The "magic glop" is Mosley's antenna coat (with the label removed from the can). I watch while the boys do the whole installation and then I apply Kathi's Magic Glop And Snake Oil. Of course, the deal is I get paid off in a day on the water. A can of Antenna Coat cost about \$1.65 and adds about 5 years trouble-free life to the antenna.

My final accessory is a 50 ohm dummy load mounted in a coaxial connector; a device very few CB'ers have or appreciate. Anytime I think something's wrong with the antenna—if the SWR starts to rise or the forward power reading *kicks* when I'm not modulating—I simply disconnect the antenna system at the SWR meter output and install the dummy load. If everything settles down with the dummy load in place I know for certain the problem is in the antenna system. Similarly, if the SWR meter keeps showing the glitches even with the dummy load in place, I have eliminated the antenna system as the problem area. It's a lot easier to work on the transceiver than the antenna, and those inexpensive coaxial dummy loads have saved many hours of unnecessarily antenna work.

Well that's my story this issue. Check with ol' Kathi next time for more current info on the newest in transceivers or some other CB gear. Bet you'll find something you didn't know before. For example, our contacts claim some sort of FCC action on Class E CB before much longer. Could be a 40 channel FM service on the 224 MHz band. Keep in tune and I'll keep in touch! ■

HEY HERB

THE AUDIO ANSWER MAN

by Herb Friedman



Hey Herb: I'm really hooked on the performance of a JVC cassette deck with JVC's own ANRS noise reduction system, but I wonder how Dolby equalized tapes will play through the ANRS. Will I have any problems?

Some. ANRS and Dolby are only slightly compatible; acceptable for general use, but not for the hi-fi purist. But, how often do you think you'll be exchanging tapes? If you're a typical sound enthusiast, probably very little; and if you must have quality you can always dub off from a friend's recorder. I would say you should get the recorder that appeals to you most in terms of the features you want and its overall record/play characteristics.

Hey Herb: I've just gone through a summer with the local electric company playing at brownout for days on end. I don't mind them damaging the motors in my air conditioners (ha, ha) but the turntable wows away like the hand cranked victrola grandma used. Is there some way to regulate the voltage going to the turntable?

Yup. You could use a Colorvolt regulator, which is designed to regulate the line voltage to color TVs. A better idea is to use an electronically speed controlled turntable such as those from Panasonic and Thorens, among others. I never did believe we needed electronic control in this country but with the electric companies rapidly going downhill in their summertime performance—almost as bad as in Europe—electronic control is fast becoming a "must have" in certain parts of the U.S.

Hey Herb: My tape recorder produces a very annoying background hiss. I've tried several so-called low-noise and hi-output tapes but the hiss is always the same. How do reviewers and test labs get lower tape noise from these tapes?

They usually don't. They talk about lower noise, and they can test lower noise in terms of what it would be if they increased the output level, but rarely do they say they actually made a recording with lower noise. In most instances either the recorder's electronics is producing most of the noise or the bias adjustment is such the user can't realize the better performance of the LN/HO tapes. But when the recorder is specifically adjusted for the LN/HO tape, and when the electronics are really good, then and only



Tandberg 9000X

then do you get an outstanding difference when using LN/HO. For example, the Tandberg 9000X 4-track stereo recorder gets an honest-to-goodness *nonweighted* (no cheating) signal-to-noise ratio of 58 dB with their specified tape; and that's as good as many recorders can do with a Dolby. Unfortunately, it takes quality equipment to realize the true potential of LN/HO tapes, and very few recorders have that much quality.

Hey Herb: What's the difference between a logic and full-logic SQ decoder?

A lot! There are several types of logic SQ decoders. The basic type just increases the gain of the front when the signal is inherently front. Another type is a teeter-totter (see-saw) with the gain tilting to the center front and center rear depending on the program; this unit, however, also decreases side separation as a by-product. The *full logic decoder*, also known as the *wave-matching/full logic*, or *full logic-W*, senses the center front, center rear and the corner information; it gives the closest approximation to discrete surround-sound.

Hey Herb: What would cause the amplifier's output power to drop suddenly when the music gets loud, and then take several seconds to build back to normal?

Very poor overload recovery characteristics. I
(Continued on page 99)



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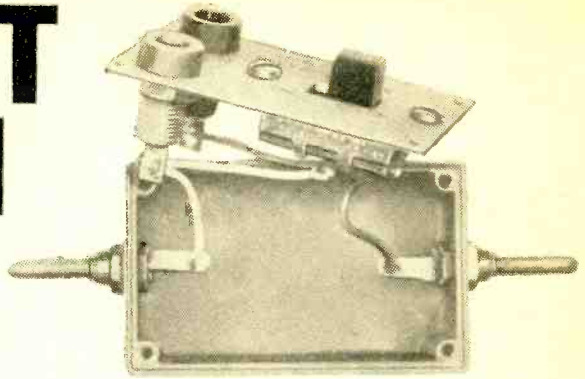
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ONE OF THE
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INSTANT PATCH BOX



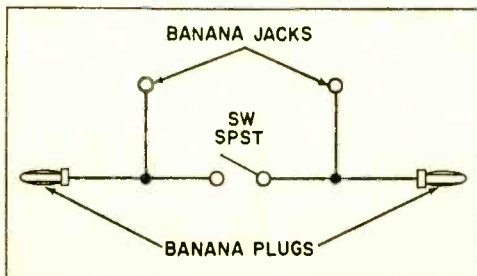
Speed up
substitutions with this builders aid

by James A. Fred

The INSTANT PATCH BOX is one of the little luxuries that simplifies electronic experimenting and makes it more enjoyable. Haywire lash-ups often get the job done, but feedback, oscillation, or inaccurate meter readings sometimes make the end results worthless. This little blue box provides a shielded, no-nonsense method of substituting resistance, capacitance, or inductance into a circuit with a minimum of problems.

Essentially, the INSTANT PATCH BOX consists of a small metal box with a cover in which are mounted a SPST slide switch, two banana jacks, and two banana plugs. The box is the smallest that will do the job and keep distributed capacitance and inductance to a minimum. The circuit is extremely simple as you can see from the schematic diagram. A voltage is fed into one banana plug and either through the switch or through the component plugged into the banana jacks. The switch allows conduction through the plugged-in component, or provides a shorted path across the banana jacks.

You will not find a parts list with this



article since you should select parts to fit your needs. Check your junk box for parts on hand, and pick up what you can't find at your local electronics shop.

When . . . you have built the instant patch box, what can you do with it? Let us suppose for a minute you have an experimental circuit you are working on. You are trying to determine the correct size bias resistor to use. Connect the box into the circuit with the banana jacks and alligator clips. You can now plug different size resistors into the banana jacks and short out the jacks if you wish. All this is possible without touching a soldering iron to the circuit. Once you get into the habit of using this builders aid, you may wonder how you got along without it!

Construction is simple. Secure the parts listed, make the proper size holes, and mount the parts. There is only one precaution to take and that is to be sure to use insulating washers when mounting the banana plugs. They must not short to the metal box.

Incidentally, you don't have to use the same combination of input plugs or component jacks that I did. You can use 5 way binding posts, BNC connectors, tip plugs and jacks, or other types of hardware. Just be sure and use connectors that are compatible with your other test equipment. ■

This almost too easy circuit gives you the option of (1) adding an extra component to your haywire circuit or (2) shorting across the component at the flip of a switch. You can vary the terminals to suit your needs.

Modern communicators use it...

SSB TODAY

Along a pipeline in the Middle East, aboard a liner in the Atlantic, from a 20-pound manpack to a multi-ton fixed base, people throughout the world use single sideband radio where reliability is a must. Long recognized and accepted as a reliable means of communication, SSB has properly moved full-force onto the Citizens Band where its interference-piercing signal is getting messages through. Here's your e/e roundup of single sideband transceivers for CB.

by Len Buckwalter

TODAY, SSB transceivers are top-of-the-line for more than a dozen CB manufacturers. The sets cost more because sideband circuits are considerably more complicated than regular CB equipment. What do you get for the extra money? About 8 times more talk power squeezed into a perfectly legal signal—a 5-watt transmitter sounds like 40! The technical trick is done by rearranging the AM signal, which consists of a carrier straddled by two sidebands. Since voice tones appear in upper *and* lower sidebands, one sideband is an unnecessary mirror image. The carrier also wastes power. A sideband transmitter solves it by killing one sideband and the carrier to compress all available watts into a hefty single sideband. The SSB receiver on the other end further helps matters by operating with tremendous selectivity (since it has to admit only a skinny sideband). This reduces much noise and interference.

The more than two dozen SSB rigs described here have controls which may be completely new to a conventional, AM-going CBer. Here's what the most important differences mean:

RF Gain. This control lets you reduce receiver sensitivity. Sideband signals may become *too* strong and overload the front end, causing mushy, distorted audio.

AM/LSB/USB. This is the mode selector

switch. In the first position, AM, the set operates like any regular AM transceiver and is compatible with everyone else. LSB is lower sideband; USB is upper sideband. You may select either sideband of any CB channel. Some manufacturers claim "69 channels"—meaning you can use, one at a time, all three models on each of CB's "23."

Clarifier. This control, as its name implies, clarifies speech in the receiver. Unless a sideband signal is tuned with fantastic accuracy, it sounds garbled or unnatural. Although channels are crystal-controlled, a clarifier allows delicate touch-up adjustments for best reception. Some sets call it *voice lock, delta, or fine tune.*

NB. This is the noise blanker, a circuit often found in sideband sets because of its excellent action on interference.

The power source for the rigs described below is quoted in slightly different figures by various manufacturers. In the following descriptions, we've simplified it by stating the popular "12 VDC" rating if a rig has a built-in DC supply for a car, or "117 VAC" for base-station operation on house current. Almost all manufacturers supply mikes, power cords and mounting hardware. Every set is solid-state, except where tubes are mentioned. Prices, especially in view of international currency revaluations, are subject to change.

**BROWNING GOLDEN EAGLE MARK III
BASE STATION**

\$650 (Browning Laboratories)



General Description: A 23-channel base station consisting of transmitter and receiver in separate but interconnected cabinets. Power supply is 117 VAC. Overall dimensions of receiver and transmitter (each) are 7-in. h x 15½-in. w x 10-in. d. Receiver front panel controls, switches and jacks include Speaker/Ext-Int-All, Channel Selector, Mode/AM-LSB-USB, Bandsread, Volume, Squelch, Power, Manual/XTL 1/XTL 2, RF Gain, AGC. Transmitter controls include VFO, Power, Meter-MOD/FWD/REF/MA, SWR Calibrate, Mode/AM-LSB-USB, Spot. Standard accessories are microphone and connecting cables.

Editorial Remarks: The Golden Eagle Mark III receiver has a combined RF-IF gain control, On-Air indicator, Nuvisitor RF amplifier, large S-meter, 2 crystal positions for monitoring AM stations. The transmitter has a large meter which reads Modulation, Forward and Reflected Power (SWR) and plate current, automatic level control, front panel VFO, crystal spotting for both AM and SSB operation, and mode indicator lights for AM, LSB and USB.

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BROWNING LTD

\$359.95 (Browning Laboratories)



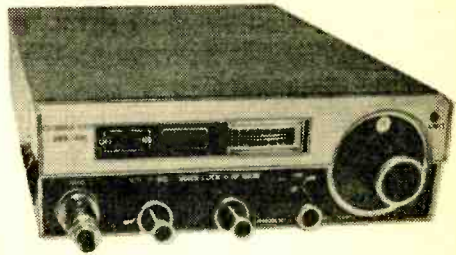
General Description: A 23-channel transceiver for mobile operation. Power supply is 12 VDC. Overall dimensions are 2¾-in. h x 6½-in. w x 8¼-in. d. Front panel controls, switches and jacks include Volume, RF Gain, AM/LSB/USB, Delta, Squelch, Noise Blanker, PA/CB, Channel Selector. Standard accessories include microphone, mounting bracket with tamper-proof hardware.

Editorial Remarks: The LTD is one of the smallest SSB mobile sets, has an S/Rf meter, transmit indicator, and PA function.

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COBRA 132

\$339.95 (Dynascan Corp.)



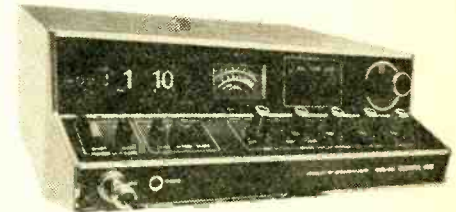
General Description: A 23-channel transceiver for mobile operation. Power supply is 12 VDC. Front panel controls, switches and jacks include Microphone, Volume, Squelch, Voice Lock, RF Gain, AM/USB/LSB, Channel Selector, Noise Blanker, CB/PA.

Editorial Remarks: The 132 has an illuminated S/Rf meter, transmit indicator, voice lock with range of 600 Hz and a PA function.

Circle No. 40 on Reader Service Page.

COBRA 135

\$449.95 (Dynascan Corp.)



General Description: A 23-channel base station transceiver. Power supply is 117 VAC or 12 VDC. Front panel control, switches and jacks include Power, CB/PA, Meter Function, Volume, Squelch, RF Gain, Voice Lock, AM/USB/LSB, Channel Selector, Clock Controls, Microphone, Phone.

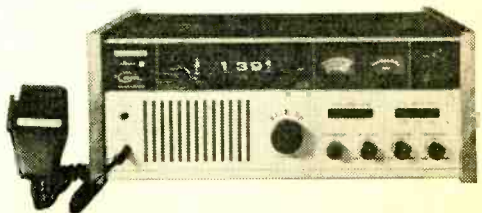
Editorial Remarks: The 135 has console-type cabinet, digital clock with automatic control, S/Rf/SWR meter, headphone output, PA function.

Circle No. 40 on Reader Service Page.

COURIER CENTURION

\$549.95 (Fanon/Courier Corp.)

General Description: A 23-channel SSB rig for base or mobile operation. Power supply operates on 117 VAC or 12 VDC. Overall dimensions are 7¼-in. h x 15¼-in. w x 16¼-in. d. Front



panel controls, switches and jacks include On the Air indicator, Receiving mode indicator, Blanker On-Off, PA/CB, Volume, RF Gain, Clarifier, Squelch, Digital clock, Timer and Alarm, Channel Selector and indicator, AM/USB/LSB, Power on-off.

Editorial Remarks: The Centurion has a dual-conversion receiver, built-in digital clock with timer and alarm functions, external speaker jack, separate meters for S-RF power and SWR measurements. ■

Circle No. 34 on Reader Service Page.

COURIER GLADIATOR

\$129.95 (Fanon/Courier Corp.)

General Description: A 23-channel sideband transceiver for mobile operation on positive or negative ground. Power supply is 12 VDC. Overall dimensions are 3-in. h x 10 $\frac{1}{16}$ -in. w x 11 $\frac{3}{4}$ -in. d. Standard accessories include power cord and mobile mounting hardware. Front panel controls, switches and jacks include RF Power meter and control, Calibration control for SWR meter, Channel Selector, Clarifier, RF Gain, Power On-Off, Blanker On-Off, PA/CB, Squelch, Volume, Receiving Mode indicator, On the Air indicator. Power cord and mounting hardware are standard accessories.

Editorial Remarks: The Gladiator features a low-noise receiver front end and built-in SWR



meter for measuring antenna efficiency. Meter also reads S-units and RF power. Channel frequencies are derived through frequency synthesis, microphone is a noise-cancelling type. ■

Circle No. 34 on Reader Service Page.

HY-GAIN 623

\$495.00 (Hy-Gain Electronics Corp.)



General Description: A 23-channel transceiver for base or mobile operation. Power supply is 117 VAC or 12 VDC. Overall dimensions are 5 $\frac{1}{8}$ -in. h x 11 $\frac{7}{8}$ -in. w x 10 $\frac{1}{2}$ -in. d. Front panel controls, switches and jacks include Microphone,

Channel Selector, Volume, Fine Tune, AM/USB/LSB, Meter-PWR/CAL/SWR, Squelch, Noise Blanker, Calibrate, Microphone Gain, RF Gain. Standard accessories include AC and DC power cords. Accepts high or low impedance microphone.

Editorial Remarks: The Model 623 has tube output in the transmitter section, five-turn Fine Tune control, S/RF/SWR meter, manually adjustable microphone preamp. ■

Circle No. 31 on Reader Service Page.

HY-GAIN 674 (HY-RANGE V)

\$319.95 (Hy-Gain Electronics Corp.)

General Description: A 23-channel mobile transceiver. Power supply is 12 VDC for positive or negative ground. Overall dimensions are 2 $\frac{3}{4}$ -in. h x 8 $\frac{5}{8}$ -in. w x 10 $\frac{3}{8}$ -in. d. Front panel controls, switches and jacks include Channel Selector, RF Gain, Volume, Squelch, Fine Tune, LSB/USB/AM, Power, ANL/Noise Silencer. Standard accessories include microphone, power cord.

Editorial Remarks: The Model has an illumi-



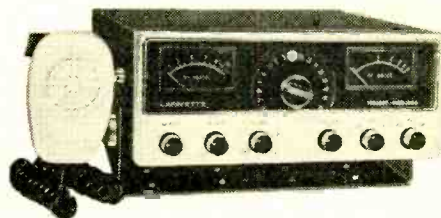
nated S/RF meter, antenna tune and load controls, bridge detector, provision for PA and external speaker. ■

Circle No. 31 on Reader Service Page.

LAFAYETTE TELSAT SSB-25A

\$249.95 (Lafayette Radio Electronics)

General Description: A solid-state 23-channel transceiver for mobile or base-station use. Power supply is 117 VAC or 12 VDC (positive or negative ground). Overall dimensions are 3 $\frac{1}{4}$ -in. h x 9 $\frac{1}{2}$ -in. w x 11 $\frac{1}{4}$ -in. d. Front panel controls,



switches and jacks include Squelch, RF Gain, Volume, Channel Selector, Fine Tune, LSB/USB/AM, Noise Silencer/ANL/PA. Standard accessories include microphone with coil cord, AC and DC power cables, mounting bracket.

Editorial Remarks: The Telsat SSB-25A has a built-in burglar alarm control, separate S and RF output meters, crystal lattice filter, external speaker jack, and a tape recording output. ■

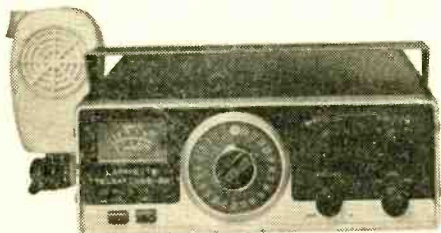
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e/e SSB TODAY

LAFAYETTE TELSAT SSB-50

\$289.95 (Lafayette Radio Electronics)

General Description: A 23-channel transceiver for mobile operation. Power supply accepts 12 VDC negative ground, with provision for changing to



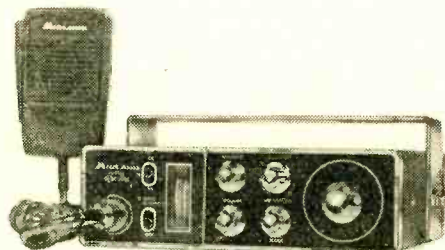
positive ground. Overall dimensions are 2 $\frac{7}{8}$ -in. h x 7 $\frac{3}{4}$ -in. w x 9 $\frac{13}{16}$ -in. d. Front panel controls, switches and jacks include ANL/Noise Silencer, CB/PA, Channel Selector, Squelch, Volume, Fine Tune LSB/USB/AM. Standard accessories include microphone, power cable and mounting bracket.

Editorial Remarks: The Telsat SSB-50 has a built-in burglar alarm system, 4-section crystal lattice filter, provision for external speaker, tape recording jack, and S/RF output meter. ■

Circle No. 42 on Reader Service Page.

MIDLAND 13-894

\$369.95 (Midland Electronics Co.)



General Description: A mobile transceiver with 23 channels. Power supply is 12 VDC. Overall dimensions are 2 $\frac{1}{4}$ -in. h x 7-in. w x 9 in. d. Front panel controls, switches and jacks include Microphone, CB/PA, Noise Blanker, Squelch, Clarifier, Volume, AM/USB/LSB, Channel Selector. Standard accessories include microphone, mounting bracket, DC power cord.

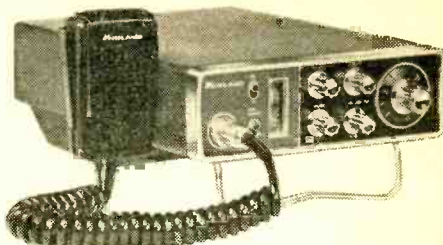
Editorial Remarks: The Midland 13-894 is a compact, 5 $\frac{1}{2}$ -lb. set with vertical S meter, ± 600 Hz clarifier range, external speaker and PA jack. ■

Circle No. 44 on Reader Service Page.

MIDLAND 13-896

\$389.95 (Midland Electronics Co.)

General Description: A 23-channel solid-state transceiver for mobile or base-station operation.



Power supply is for 117 VAC or 12 VDC. Overall dimensions are 2 $\frac{1}{4}$ -in. h x 7-in. w x 10 $\frac{1}{2}$ -in. d. Front panel controls, switches and jacks include PA/CB, Noise Blanker, Microphone, Squelch, Volume, Clarifier, AM/USB/LSB, Channel Selector. Standard accessories include microphone mounting bracket, power cords.

Editorial Remarks: The Midland 13-896 will drive an external or PA speaker, has a built-in stand for tabletop use, electronic switching. ■

Circle No. 44 on Reader Service Page.

MIDLAND 13-898

\$419.95 (Midland Electronics Corp.)

General Description: A solid-state base station with 23 channels. Power supply is 117 VAC or 12 VDC. Overall dimensions are 5 $\frac{1}{4}$ -in. h x 15-in. w x 10-in. d. Front panel controls, switches and jacks include Microphone, RF Gain, Volume, Squelch, LSB/USB/CB, Fine Tune, Phone, PA/CB, Channel Selector, SWR Calibrate, ANL/Blanker, Clock controls. Standard accessories in-



clude AC and DC power cords, microphone.

Editorial Remarks: The Model 13-898 has an illuminated digital clock, walnut-finished hardwood sides, twin meters for indicating S-units and SWR, digital clock with alarm and automatic turn-on. ■

Circle No. 44 on Reader Service Page.

PAGE CB-1023

\$329.95 (Pathcom, Inc.)

General Description: A 23-channel transceiver for mobile operation. Power supply is 12 VDC. Overall dimensions are 1 $\frac{7}{8}$ -in. h x 7 $\frac{1}{2}$ -in. w x 9 $\frac{1}{2}$ -in. d. Front panel controls, switches and jacks include Volume, Squelch, Clarifier, RF Gain, AM/USB/LSB, PA/CB, Noise Blanker, and Channel Selector. Standard accessories in-



clude microphone, mounting bracket and DC power cord.

Editorial Remarks: The CB-1023 is the smallest AM/SSB mobile set with a full 15-watt PEP input, has an S/R/F meter, PA function, and a locking connector on the microphone to prevent unauthorized use. ■

Circle No. 50 on Reader Service Page.

PALOMAR SKIPPER 73

\$395.00 (Palomar Electronics Corp.)

General Description: A 23-channel base station of tube and transistor design. Power supply is 117 VAC. Front panel controls, switches and jacks include AM/ANL/SSB, Squelch, AF Gain, RF Gain, LSB/AM/USB, Clarifier, Microphone, Channel Selector.

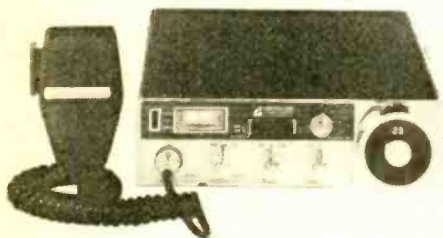


Editorial Remarks: The Skipper 73 has a ceramic mike, external speaker jack, S meter, 8-pole ladder filter. ■

Circle No. 46 on Reader Service Page.

PEARCE-SIMPSON CHEETAH SSB

\$379.95 (Pearce-Simpson)



General Description: A 23-channel transceiver for mobile operation. Power supply is 12 VDC. Overall dimensions are 2½-in. h x 8¾-in. w x 10½-in. d. Front panel controls, switches and jacks include S/R/F/CAL, Blanker, PA/CB, Clarifier, Mike, AM/USBL/SB, Squelch, Calibrate, Volume, RF Gain, Channel Selector. Standard accessories include microphone, mobile mount, power cable.

Editorial Remarks: The Cheetah SSB has illuminated S/R/F/SWR/ meter, crystal lattice filter. ■

Circle No. 48 on Reader Service Page.

PEARCE-SIMPSON PANTHER SSB

\$299.95 (Pearce-Simpson)

General Description: A 23-channel transceiver for mobile operation. Overall dimensions are 2¼-in.



h x 7½-in. w x 9¾-in. d. Power supply is 12 VDC. Standard accessories include microphone, mounting bracket, power cord, FCC application form. Front panel controls, switches and jacks include Mike, Volume, Squelch, AM/USB/LSB, Clarifier, PA/CB, Noise Blanker, DX/Local, Channel Selector.

Editorial Remarks: The Panther is a compact rig, with crystal lattice filter, external speaker jack, PA function, FET front end, ±600 Hz fine tuning. ■

Circle No. 48 on Reader Service Page.

PEARCE-SIMPSON SIMBA SSB

\$489.95 (Pearce-Simpson)

General Description: A 23-channel transceiver for base or mobile operation. Power supply is 117 VAC or 12 VDC. Overall dimensions are 7¾-in. h x 15-in. w x 12-in. d. Front Panel controls, switches and jacks include Headphone, Mike, Mike Gain, Volume, Calibrate, AM/USB/LSB, Squelch, RF Gain, Clarifier, Clock controls, Blanker, CB/PA, Calibrate (SWR), S/R/F-Modulation, Channel Selector. Standard accessories include desk mike, power cords.



Editorial Remarks: The SIMBA SSB has a lighted digital clock that sounds an alarm or turns on the set, microphone gain control and modulation meter, separate meters for SWR and S/R/F indication, external speaker and PA jacks, and lighted mode indicators for USB, LSB and AM. ■

Circle No. 48 on Reader Service Page.

REALISTIC TRC-46

\$329.95 (Radio Shack)

General Description: A 23-channel solid-state transceiver for base or mobile operation. Power supply is 117 VAC or 12 VDC. Overall dimensions are 2¾-in. h x 8¾-in. w x 10½-in. d. Front panel controls, switches and jacks include AM/LSB/USB, Clarifier, Volume, Channel Selector, Squelch, RF Gain, Microphone, Power, Remote

e/e SSB TODAY

Volume, PA, Silencer. Standard accessories include microphone, power cord and mounting bracket.



Editorial Remarks: The TRC-46 has an illuminated S/RF meter which glows red on transmit, white on receive; a remote microphone-mounted volume control for adjusting receiver speaker volume (a convenience during mobile operation).

Circle No. 43 on Reader Service Page.

ROBYN SS-747

\$439.00 (Robyn International)

General Description: A 23-channel transceiver for operation in base or mobile service. Power source may be 117 VAC or 12 VDC. Overall dimensions are 31 $\frac{3}{16}$ -in. h x 11 $\frac{13}{16}$ -in. d x 9 $\frac{1}{16}$ -in. d. Front panel controls, switches and jacks include AF Gain, RF Gain, AM/USB/LSB selector, Squelch, Noise Blanker, PA, SWR Calibrate, Meter selector, Channel Selector, Clarifier, microphone jack. Microphone and power cables are standard accessories.



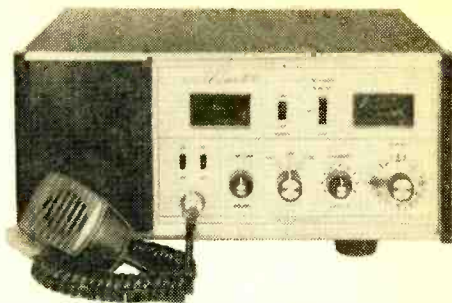
Editorial Remarks: The 747 has a push-pull speech clarifier, wood grain cabinet (top and sides), separate SWR and S/RF meters, individual mode lamps, 3-watt PA system, external speaker and PA jacks, noise blanker and series gate noise limiter, net weight is 13.2 pounds.

Circle No. 51 on Reader Service Page.

SBE CONSOLE II (SBE-16CB)

\$399.95 (Linear Systems, Inc.)

General Description: A 23-channel base station transceiver, with provision for emergency operation during power failure. Power source is 117 VAC, but internal circuitry can automatically switch to external 12-volt battery for emergency service. Overall dimensions are 5-in. h x 12-in. w x 10 $\frac{1}{4}$ -in. d. Front panel controls, switches and



jacks include RF Gain, Volume, Clarifier, Squelch, Power RF Power-S/SWR, Channel Selector, CB/PA, Noise Blanker/Off, AM/USB/LSB. Dynamic mike with coil cord supplied, voice-operated relay and desk-type mike available as optional accessories.

Editorial Remarks: The Console II has automatic modulation limiting and load control, gold panel with simulated ebony end pieces. On the Air annunciator light, meter to monitor transmission power and S-units during receive.

Circle No. 47 on Reader Service Page.

SBE SIDEBANDER II (SBE-12CB)

\$359.95 (Linear Systems, Inc.)

General Description: A 23-channel transceiver for mobile operation. Power source is 12 VDC, with optional 117 VAC supply available for base operation. Overall dimensions are 2 $\frac{1}{4}$ -in. h x 7 $\frac{1}{4}$ -in. w x 9 $\frac{1}{4}$ -in. d. Front panel controls, switches and jacks include RF Gain, Volume, Clarifier, Squelch, AM/USB/LSB, Noise Blanker/Off, CB/PA, Channel Selector. Dynamic mike with coil cord supplied.



Editorial Remarks: The Sidebander II has a speech-operated "logo-gradient" load control for maintaining output RF power, solid-state switching for antenna changeover, provision for PA with an external speaker. Meter on panel reads output power and modulation and is calibrated 6 dB per S-unit on receive.

Circle No. 47 on Reader Service Page.

SILTRONIX SSB-23

\$529 (Cubic Corp.)

General Description: A 23-channel mobile transceiver operating on a power supply of 12 VDC. Overall dimensions are 2 $\frac{1}{2}$ -in. h x 8-in. w x 11-in. d. Front panel controls, switches and jacks include Squelch, Volume, Fine Tune, LSB/AM/USB, PA Volume, RF Gain, Noise Blanker,



PA/CB, Channel Selector.

Editorial Remarks: High-frequency crystal filter, variable fine-tuning, RF attenuator for reducing overload from strong local signals. ■

Circle No. 53 on Reader Service Page.

TEABERRY TWIN "T"

\$129.00 (Teaberry Electronics Corp.)



General Description: A 23-channel transceiver for either mobile or fixed station operation. Power supply operates from 12 VDC (positive or negative ground) or 117 VAC. Overall dimensions are 5¼-in. h x 13-in. w x 9¾-in. d. Standard accessories include microphone and two power cords. Front panel controls, switches and jacks include Power, RF Gain, Volume, Squelch, Clarifier, Channel Selector, Calibrate, Meter function, Blanking On-Off, PA/CB, Phone, Microphone.

Editorial Remarks: The Twin "T" has lights for indicating transmit and receive, an integrated S/Power/SWR meter, and provision feeding audio to a tape recorder. ■

Circle No. 49 on Reader Service Page.

TRAM CORSAIR

\$395 (Tram Corp.)



General Description: A 23-channel transceiver for mobile operation. Power supply is 12 VDC. Overall dimensions are 3½-in. h x 8¼-in. w x 9½-in. d. Front panel controls, switches and jacks include Squelch, Channel selector, Fine Tune, Volume, LSB/USB/AM, Limiter/PA, Microphone. Fine tuning adjusts over range of ±1.2 kHz each

channel. Standard accessories include microphone, mobile mounting bracket, and power cable.

Editorial Remarks: The Corsair has a built-in PA function, mechanical filter, solid-state design, 4-in. x 6-in. speaker and S/RF meter. ■

Circle No. 55 on Reader Service Page.

TRAM DIAMOND 60

\$389 (Tram Corp.)



General Description: A mobile transceiver with 23-channel capability. Power supply is for 12 VDC. Overall dimensions are 2½-in. h x 6½-in. w x 9¾-in. d. Front panel controls, switches and jacks include Volume, RF Gain, SWR, TTC (Transmitter Tone Control), Clarifier, Squelch, AM/USB/LSB, Channel Selector, Noise Blanking, PA/CB, SWR/Cal. Standard accessories include microphone, power cord, mounting bracket with theft-resistant hardware.

Editorial Remarks: The Diamond 60 has an S/HF/SWR meter, external speaker jack, PA function, vinyl-covered steel cabinet, transmitter tone control to adjust voice bass and treble, transmit indicator. ■

Circle No. 55 on Reader Service Page.

TRAM TITAN IV

\$627 (Tram Corp.)



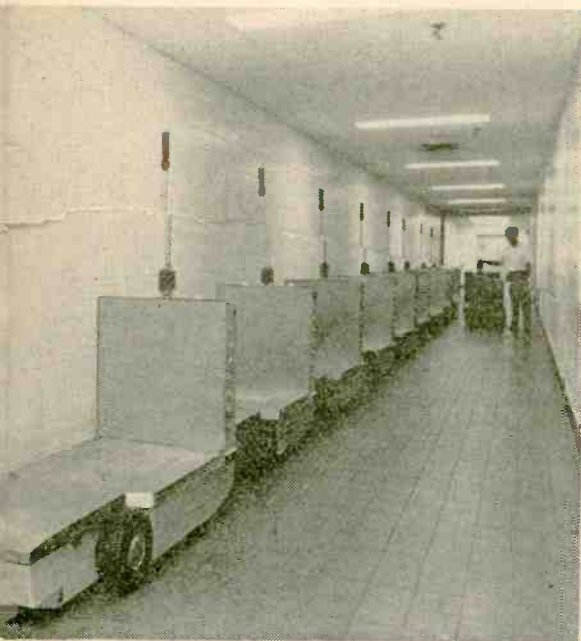
General Description: A 23-channel base-station transceiver, with variable receiver tuning for monitoring radio-control and Business Radio channels between CB channels. Power supply is 117 VAC. Overall dimensions are 8½-in. h x 18¾-in. w x 11¼-in. d. Front panel controls, switches and jacks include RF Gain, Transmit Channel selector, Squelch, Main Receiver tuning, Meter switch, Receiver fine-tune, Transmitter fine-tune, Microphone Gain, Multi-Function meter, Volume/On-Off, Limiter, Spot Switch, SWR Calibrate, SSB indicator, Transmit On/

(Continued on page 104)



THESE TROLLIES DON'T

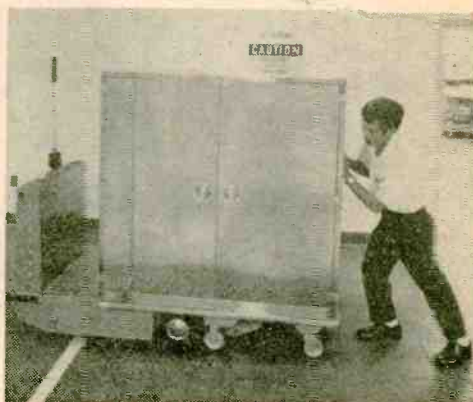
Hospital robots ride the corridors



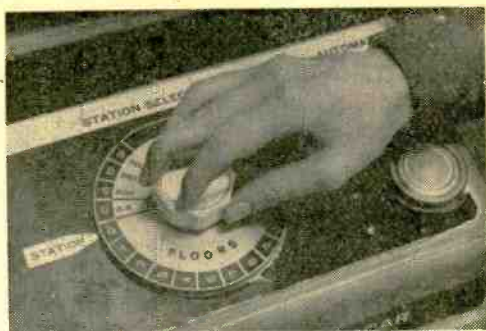
Eight trolleys stand at ease (above) waiting to go to work like the unit on the right. Attendant loads general purpose module on trolley for general hauling.

Robots are the new hospital orderlies in Fairfax Hospital in Virginia. These robots are trolleys which can carry anything from a wards-lunch to the dirty laundry. The robots are programmed to travel along set routes on command with never a human hand helping them on their way.

The hospital scene is almost out of science fiction. Stainless-steel robot trolleys, roughly the size of large filing cabinets, slide noiselessly down corridors, board elevators, get off at another floor and proceed to a pre-



ELEMENTARY ELECTRONICS



With the flick of a switch on the computer control dial (see top), which is part of every trolley, the unit is programmed on its way. Photo at far left shows a trolley with general purpose module on board being loaded for laundry purposes. Photo near left shows meals being stowed on a food module in the kitchen for distribution to patients anywhere in the hospital complex.

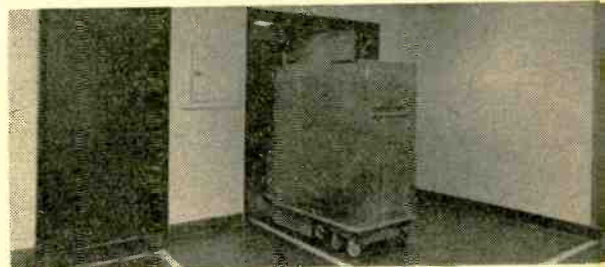
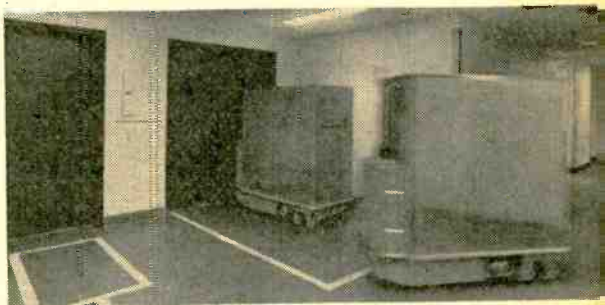
GO 'DING, DING, DING'

serving as silent, hard-working teamsters

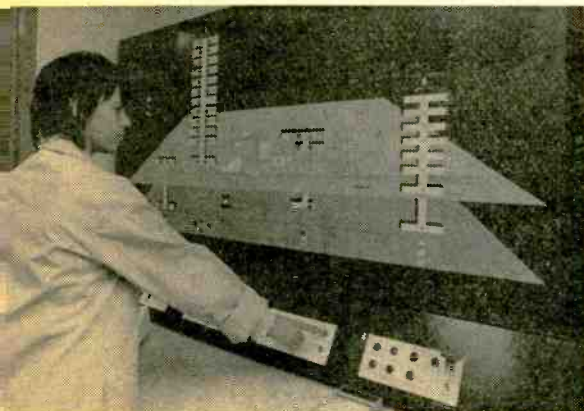
determined destination. For most of their journey there is not a human hand to guide them. Named "Amstars" by their distributor, The American Sterilizer Co., these unmanned trollies are powered by three 12-volt batteries and carry two types of detachable service units for delivering supplies.

When the trolley is loaded, a course is set on a control panel and the automatic vehicle takes off, running along an invisible path (a series of wires embedded in the

(Continued on page 99)

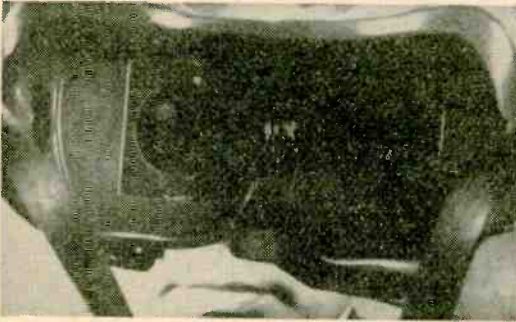
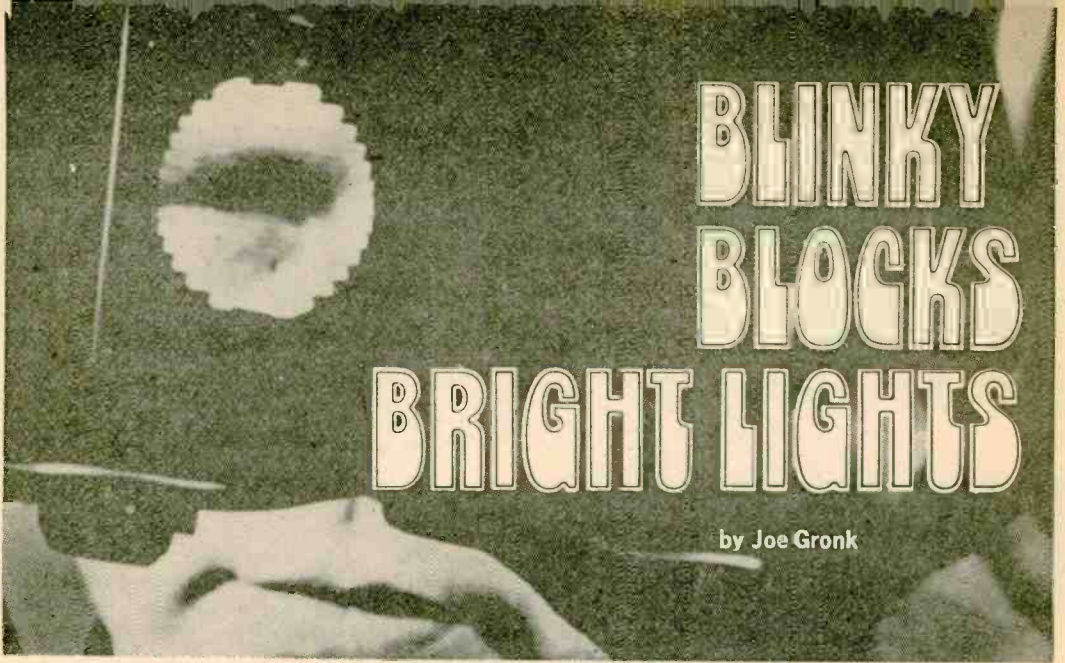


Like patient commuters, one trolley waits at an elevator (two photos up) as another pulls up. The trollies silently signal for an elevator and board when one comes to the floor (one photo up). Dispatch clerk (left) monitors electronic chart that pinpoints trollies in the hospital.



BLINKY BLOCKS BRIGHT LIGHTS

by Joe Gronk



Co-inventors J. T. Cutchen (left) and J. O. Harris (right) examine their device which is shown in top photo with eyepiece "open." Photo was taken without a photoflash unit. Photo below it shows effect of an electronic flash. Eyepiece is darkened, allowing no light to pass through to the wearer's eyes.

Every year industrial accidents occur which result in permanent blinding. The reason is usually that the worker, wearing normal protective goggles, could not close his eyes fast enough when a sudden ultra-bright, destructive light build-up occurred. To avert these tragedies a new type of industrial goggle has been developed which has built into it a "blinking lens."

The blinking goggles contain a special electro-optic ceramic which becomes transparent when electrical voltage is applied, and darkens—within a 50-millionth of a second—when the voltage is interrupted. This means that a person wearing the goggles can look at an electric lightning storm

and yet never actually see a flash! Even better, the brilliant flash of a high-current utility circuit breaker will not blind the man who happened to look at it.

Inside the Goggles. Five tiny light-sensitive cells between the goggle lenses see when the light reaches danger levels and switch the goggles "off." When the light level is safe again the cells switch the goggles "on" and the wearer can see again. The "blink" of the goggles is so fast that it is quite possible that the wearer is totally unaware that the goggles have switched off and on again. This is because the human eye needs a 1/4-second reaction time.

(Continued on page 99)

Antiquing an Old Tube into Antiquity

by Art Traufer

Many antique radio collectors have one or more early battery radios in their collections which have bayonet shell-type sockets made for O1A type tubes. The O1A tubes require 5 volts on the filament and draw a hefty .25 amps each. Since these tubes were out of production many years ago and are becoming hard to find, it is desirable to use more modern tubes having lower filament voltages and less "A" battery drain. One such tube is the type 30 tube, which requires only 2 volts on the filament at only .060 amps!

Type 30 tubes have the same four pin arrangement as the old O1A tubes. However, the 30's base is smaller in diameter than the O1A's base and it also does not have the metal pin for use in bayonet sockets. The 30 tubes were made for use in "push-in" type sockets.

To use a 30 in an O1A bayonet socket it isn't necessary to make an adapter or to "re-tube" an O1A base with a 30 glass envelope. All you have to do is build up the diameter of the 30 base so that it fits the bayonet socket and then put small metal

pins in the base.

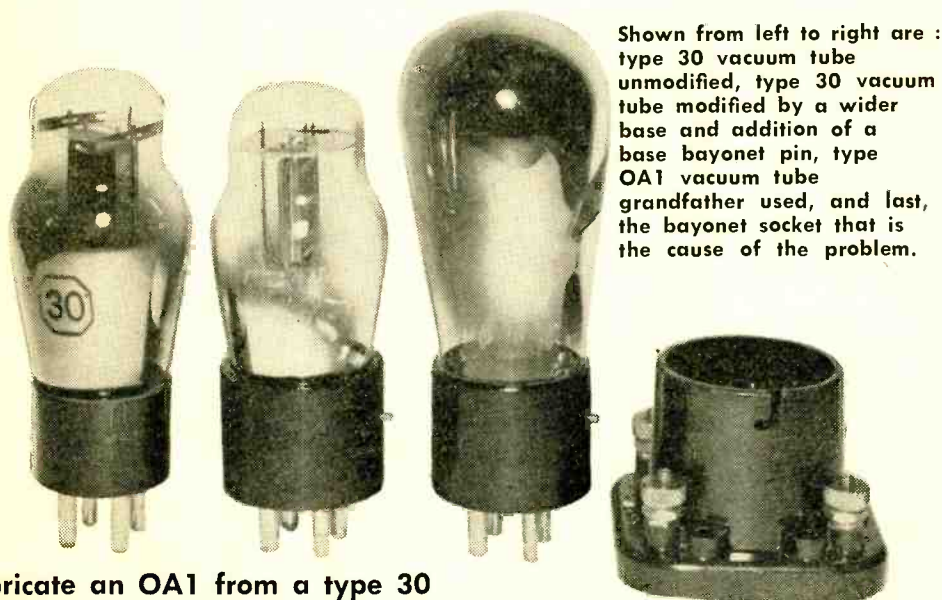
How To Do It. Buy a 12" length of Crown Line PCV-1120 1" white plastic pipe at a plumbing supply house, or buy any other plastic pipe having an inside diameter the same (or slightly larger) than the diameter of the 30 tube base. Be sure the outside diameter is the same (or slightly smaller) than the opening in the O1A bayonet tube socket.

Saw off a 1" piece from the plastic pipe, then file the tough sawed edges smooth and glue the 1" piece on the base of the 30 tube. If the plastic fits a little too loose on the tube base simply wrap a turn or two of *Mystik* cloth tape around the tube base before you apply the glue. Let the glue harden.

If the modified 30 base now fits a little too loose in the O1A bayonet socket wrap a turn or two of the cloth tape around the base.

To complete the job fasten a small metal pin in the base. To do this drill an undersize hole through the plastic and into the tube base and then twist in a machine screw

(Continued on page 102)



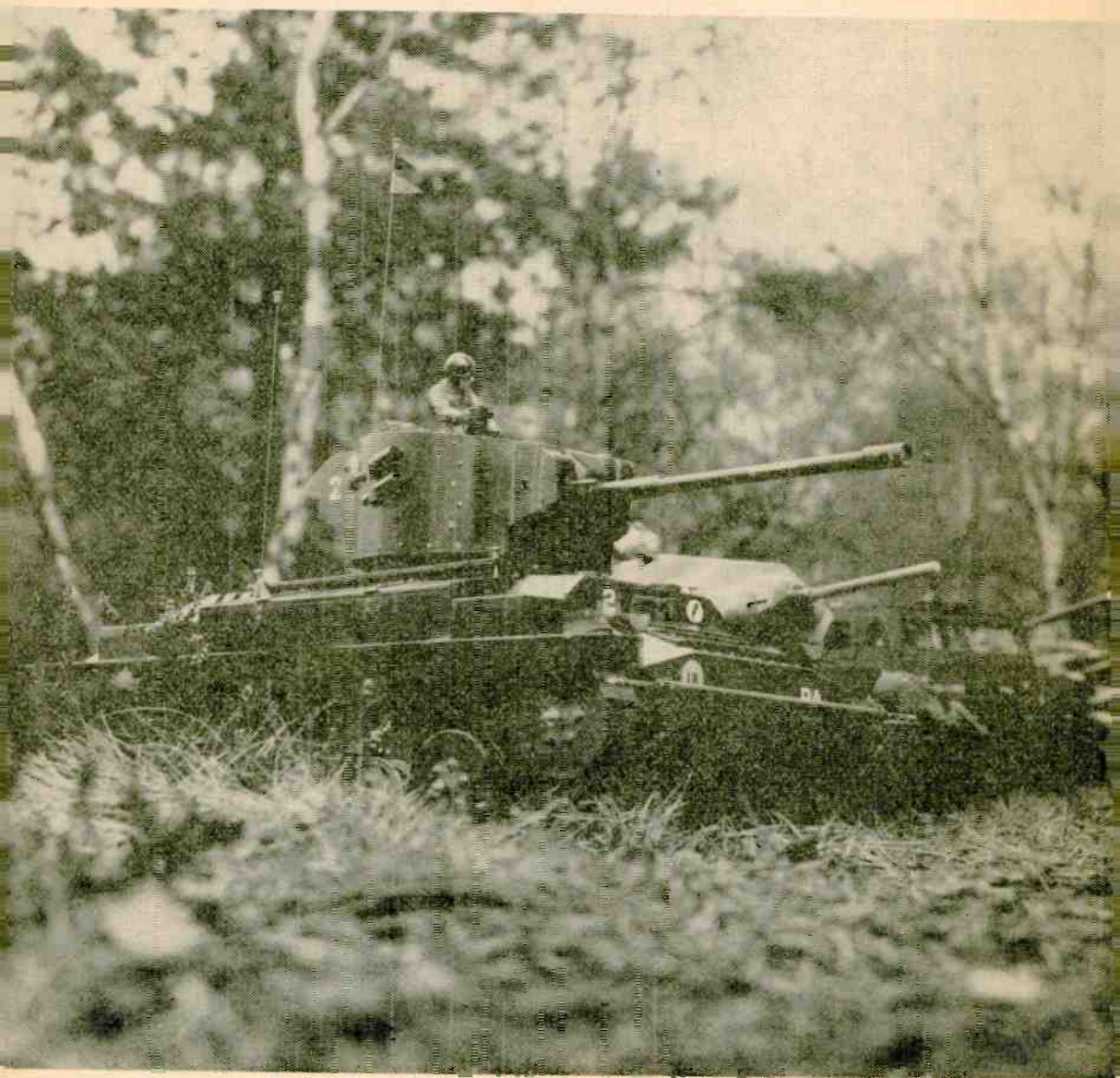
Shown from left to right are : type 30 vacuum tube unmodified, type 30 vacuum tube modified by a wider base and addition of a base bayonet pin, type O1A vacuum tube grandfather used, and last, the bayonet socket that is the cause of the problem.

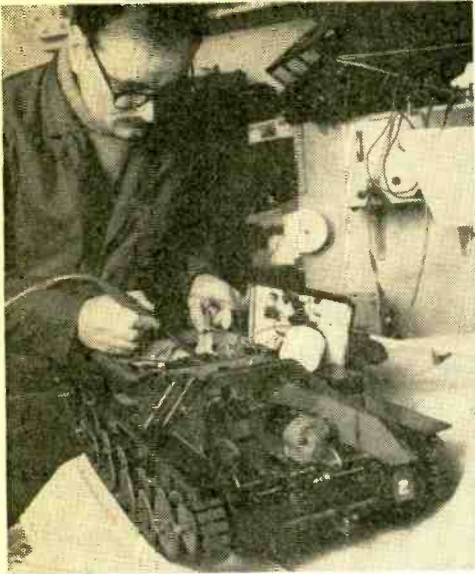
Fabricate an O1A from a type 30 tube and keep your ancient rig on the air!

TANKS TO RADIO CONTROL

by Joe Gronk

Robert Earwicker (right) works on R/C servo in the British Artillery Carrier, a radio-control model lifelike in practically every respect. Far right is the WW II German Valentine tank matching every detail in the German War Office catalog. Below, an American Crusader tank waits its call to action from Earwicker's multichannel R/C transmitter.





Every Sunday a big tank battle takes place in the woods of Keston Ponds, Bromley in Kent, England. The men and women involved form the Bromley Tank Corps. The Corps consists of some 30 tanks and troop carriers, lovingly built by a number of modelers scattered over a wide area of southeastern England. Every Sunday a number of these people get together at Bromley to exchange reports and work their beautifully scaled models.

"Most of us at one time had radio-controlled aircraft or boats," said Robert Earwicker, the group's unofficial leader and spokesman. "With those models there are big problems, namely, restriction of air

space, and the almost impossible task of finding a suitable uncluttered stretch of water to use. One of my old flying-club members was a tank commander, and seeing the flying problem increase he suggested controlling models in another dimension—tanks. From that it grew till today, you see, there are some thirty models all about one-ninth scale."

What's Inside. The models are made of plywood and metal, using German drive motors and English gearing. The models take about 30 hours to build, which means three months working evenings, and they cost about \$300 each, fully equipped. This doesn't include the multi-channel transmit-



Jean and Robert Earwicker swing a convoy of radio-controlled tanks into action. The tanks, models from several nations, look like the real things when size is overlooked.

TANKS TO R/C

ting control box, which can cost anything from \$50 to \$400 depending on the range and sensitivity the controller wishes to have.

The ages of the "Bromley Tank Commanders" vary between 18 and 70. There is even one female commander. The group usually gets about ten tanks together at every Sunday gathering. They hold war games, making the scene more realistic with the aid

of smoke canisters and controlled mini-explosions. A few of the tanks fire pellets worked by compressed air. One member once built a flame-throwing tank which was so dangerous that he had to scrap it after several close singes!

The group's tanks cover models from WW II to the present. The models are scaled from plans, when available, or from plastic models if no plans can be found. There are British, German, American, French and Russian tanks and tractors in the "Corps." ■

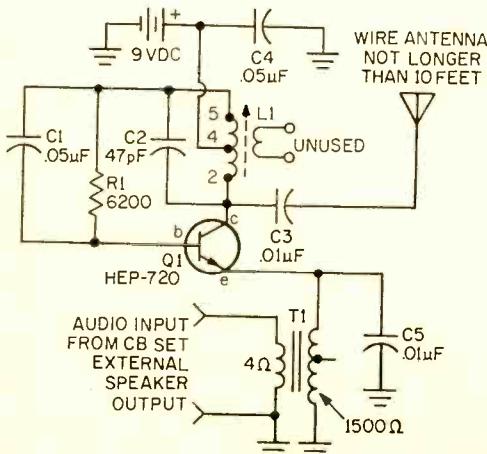
Rebroadcast Your CB and VHF/UHF Receptions

□ One way to keep an ear on the Amateur or Citizens band, or even newscasts from your favorite FM station, while working around the house or searing steaks out on the patio, is to install a lot of remote speakers. An easier way is to feed the audio signal from your CB or amateur receiver into a broadcast band Rebroadcaster and radiate the signals throughout the house and yard. A small AM transistor pocket radio tuned to the rebroadcaster frequency will alert you instantly if a call is received on your communications gear. Best of all, since the radio travels with you, you're never away from your receiver.

Build the rebroadcaster in a metal cabinet. The power supply can be a transistor radio type 9 volt battery, though a line supply is preferred for more dependable continuous operation. The unit draws about 10 mA. Power input and antenna length are limited

by FCC regulations. If the input current exceeds 10 mA, increase the value of R1 in 20% increments until the current is below 10 mA. The antenna wire cannot exceed 10 feet. Adjust slug L1 so the rebroadcaster operates on an unused AM frequency. The audio input connects to the speaker or headphone output of your communications equipment. Adjust the volume on the receiver for a high, undistorted transmission by the rebroadcaster.

After the unit is operational, tune the AM band and the marine band above it (if you have a shortwave receiver) and check for spurious radiations. Also, check for harmonics. If you are splattering the band with signal and noise, reduce power. Best way to do this is to cut off sections of the antenna a few inches at a time. Also, after your tests are completed, check with your neighbors to determine whether or not you are interfering with their receivers. ■



PARTS LIST FOR REBROADCASTER

- C1, C4—0.05 μ F disc capacitor, 25 VDC or better (Radio Shack 272-1068 or equiv.)
- C2—30 or 47 pF disc capacitor, 100 VDC or better (Radio Shack 272-121 or equiv.)
- C3, C5—0.01 μ F disc capacitor, 25 VDC or better (Radio Shack 272-131 or equiv.)
- L1—Oscillator coil, Miller 2022 (Circuit Specialists Co.—see Ad.)
- Q1—NPN transistor, HEP-720 (Radio Shack 276-2015)
- R1—6200-ohm, 1/2-watt resistor, see text (Radio Shack 271-000 or equiv.)
- T1—Output transformer, 4-16 ohms to 2500 ohms (Allied Radio 928-005, Lafayette 33-85218, or equiv.)



BOOKMARK BY BOOKWORM

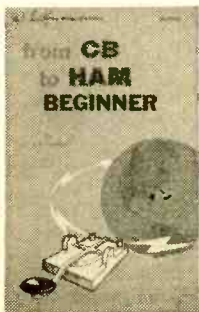
Security Project Book. With auto theft and home burglary incidence on the increase, Motorola HEP Semiconductors has published a timely project book entitled *Build Your Own Home & Car Security* (HEP-409). HEP markets a broad line of semiconductors, their hardware and accessories, as well as semiconductor kits and projects brochures. Compiled and written for the hobbyist-experimenter, the book is devoted entirely to the topics of sensors, alarms and detectors primarily for home and auto use.



Soft cover
106 pages
\$1.25

Beginning with basic alarm theory, the manual contains illustrated construction and installation techniques for 11 safety systems. Each project includes a brief description of the systems function, a schematic diagram, suggested applications and a complete parts list. Also included are assembly hints and a photograph of the finished product. The manual is available from franchised HEP suppliers throughout the country. For more information, circle No. 62 on Reader Service page.

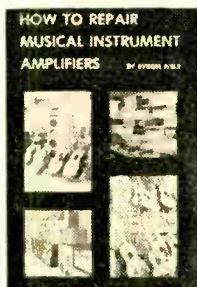
Time to Switch. Are you tired of listening to the same type of traffic on the CB band? Have you heard "skip" stations roll in from across



Soft cover
144 pages
\$4.25

the country and wished it were legal to contact them? Now you can do all of this and more by entering the world of ham radio. Whether you are a CBER or an SWL—or anyone who wants to get started in amateur radio—*From CB to Ham Beginner* by J. A. Stanley answers your questions. It explains how to: select and tune a communications receiver, listen in on the ham bands, acquire technical knowledge by building and experimenting, learn to send and receive code, build or buy an amateur transmitter, erect an effective antenna, and put a ham station on the air. Published by Howard W. Sams & Co., Inc. For more information circle No. 66 on Reader Service page.

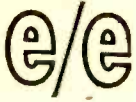
Fixing Musical Amps. Here's a volume that covers the repair and maintenance of amplifying systems used with guitars, pianos and organs, as well as repairing the instruments themselves. It's *How To Repair Electronic Musical Instrument Amplifiers* by Byron Wels. A very lucrative business awaits the technician who can service and repair electronic musical instrument amplifiers and associated equipment. Electronics is involved in a variety of guitar systems, organs, and even electronic pianos. Countless thousands of such systems and instruments need service right now, and every year



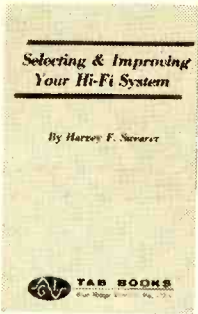
Soft cover
288 pages
50 illustrations
\$5.95

vast numbers are added to those already in use. This book provides the knowledge required to troubleshoot and repair such equipment—not only the electronics, but also the mechanical repair of guitars and other fretted instruments. It is a complete book, covering all phases of electronic musical instrument repair. Published by Tab Books. For more information, circle No. 69 on Reader Service page.

For Big Sound. *Selecting & Improving Your Hi-Fi System* by Harvey Swearer is a handy guide to the latest information on home audio equipment. It tells what to look for, what to expect, and what to avoid when considering starting or expanding any part of a hi-fi system. All pertinent characteristics of the equipment are defined to advise the reader exactly why listening pleasure increases with better quality, more elaborate layouts. Four-channel sound is described in its present phases of development, with the emphasis on complete compatibility with an existing system. Speaker-selection criteria are described, along with a few im-



BOOKMARK



Hard cover
224 pages
122 illustrations
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portant trade-off considerations. Finally, there are hints concerning placement of components, listener's tests, room acoustics, shortcuts, and adjustments. For information and catalog of other Tab books, circle No. 69 on Reader Service page.

Reference Data. Whether you are in radio, telephony or telegraphy, you will agree that the new Fifth Edition of *Reference Data for Radio Engineers* is an invaluable tool: a reference library in one fact-laden volume published

REFERENCE DATA FOR RADIO ENGINEERS
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ITT

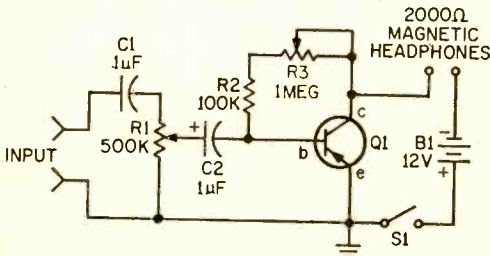
by Howard W. Sams & Co., Inc. This new compilation with its comprehensive index and cross-index was made by an extremely qualified group of practicing engineers, professors, and industry and government experts under the direction of the International Telephone and Telegraph Corporation staff. It is skillfully written, greatly enlarged, and meticulously revised and edited. In 45 chapters of a brand new format, 50% of the text is new material, including seven subject areas not covered by the fourth edition. In addition to the basic phases of electronics, there is new material on microminiature electronics, space communications, navigation aids, quantum electronics and many other current topics. For more information, circle No. 66 on Reader Service page.

HEAD-AMP FOR THOSE MINI-SOUND PROJECTS

□ Quite often the audio output from small projects is just barely sufficient to produce a recognizable signal in standard experimenter magnetic earphones. Yet a handful of surplus components will provide enough gain to turn that whisper sound into a roar. Specifically intended for use with magnetic earphones of from 1000 to 5000 ohms impedance, the Head-Amp can do double-duty as an audio signal tracer when troubleshooting.

Transistor Q1 can be any PNP of the

2N2613 variety. Even the 10-for-a-buck kind will work. Volume control R1 should have an audio taper. Distortion control R3 can have any taper. Make certain C2's polarity is correct; the positive terminal connects to volume control R1 (wiper terminal). Adjust distortion control R3 for best sound quality. If you use a jack and plug to connect your headphones to this amp, you can eliminate on-off switch S1 because power is removed whenever the headphones are disconnected.

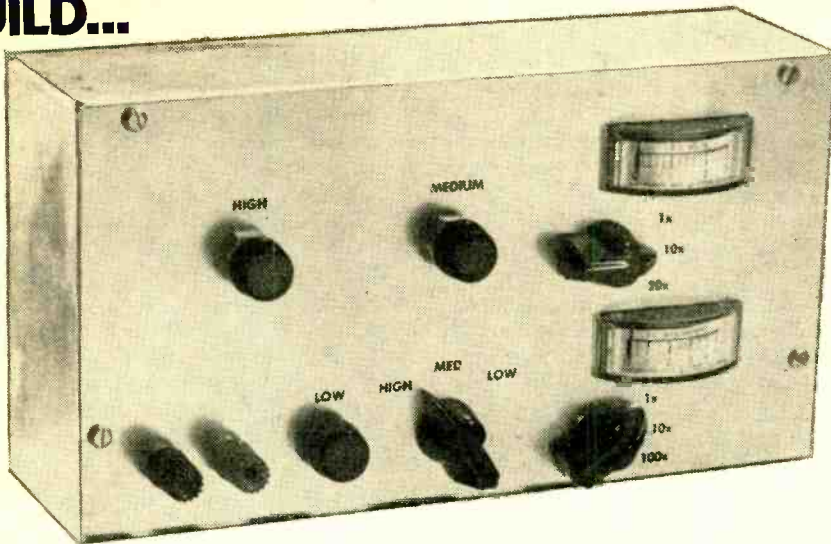


It takes two to stereo, and four to quadeo. Construction is easy, just use one battery and combine all ground connections in one chassis.

PARTS LIST FOR HEAD-AMP

- B1—Battery, 12 volts (two Radio Shack 23-066, Eveready 5105, in series or equiv.)
- C1—0.1 µF capacitor, 15 VDC or better (Radio Shack 272-1069 or equiv.)
- C2—1 µF capacitor, 15 VDC or better (Radio Shack 272-1055 or equiv.)
- Q1—PNP transistor, 2N2613 (Radio Shack 276-2003 or equiv.)
- R1—500,000-ohm audio taper potentiometer (Radio Shack 271-1723 or equiv.)
- R2—100,000-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)
- R3—1 megohm potentiometer, any taper (Radio Shack 271-211 or equiv.)

BUILD...



A BETTER BATTERY TESTER

by Marshall Lincoln

EACH OF US today uses a surprising number of batteries in daily living—more of them than we realize until we sit down to count all the battery-operated devices we have in home and shop. But how many of us have a good way to test all the various sizes and kinds of batteries we use, to learn when each should be replaced (or in some cases, recharged)?

Mostly, we must rely on the old method of using a battery until it seems to be getting weak, and then replace it. If we want to be cautious, we may replace it sooner than necessary “just to be sure,” and never really know if the old battery was really worn out.

Sometimes we may keep a couple extra batteries on hand for the most important devices in the household. These may go dead on the shelf before we get around to using them. So, the next time, we put off buying a replacement until we need one and then find the store is out of the size we need. Any way you look at it, we wind up with a feeling that “there must be a better way.”

Naturally, There Is. It's through use of a battery tester that will check all the many types of batteries we have in the house. And to do the job right, it must do more than just measure the voltage—it must also put the correct load on the battery while measuring the voltage.

The little testers you find on the counter at an electronics parts store do this in a limited fashion. It's easy enough to build a similar tester to check just one or two types of batteries this way for yourself. But with so many different types of batteries in common use today, these simple testers still don't do the complete job. What you need is a battery tester with a built-in load which can be adjusted to suit any common type of battery which you are likely to have. The better battery tester illustrated here does just that, and yet is not much more complex than a simple tester which may work with only a few selected types of batteries.

Using commonly-available components and inexpensive, yet suitably accurate meters, this battery tester enables you to test just about any household or workshop battery you're likely to encounter, from the little button cells used in hearing aids and photographic exposure meters, up through medium-voltage radio “B” batteries.

A Terminal Voltage? This tester has both a voltmeter and a milliammeter, and so it enables you to check the battery voltage while at the same time observing the amount of current being drawn from the battery. By adjusting the tester so it draws the amount of current for which the battery is rated by the manufacturer, you can quickly see if its

e/e BETTER BATTERY TESTER

terminal voltage drops significantly under this load.

Three rheostats, of different resistance values, are used in the tester to give you continuously-variable control of the load placed on the battery. This is the key to use of this better battery tester—it gives you the ability to easily impose the proper load on the battery so you can observe the effect this load has on the battery's terminal voltage.

Each of the tester's two meters has three ranges, selected with a rotary switch just below the meter. Voltage ranges are 0-3, 0-30, and 0-60 volts. Current ranges are 0-5, 0-50, and 0-500 mA.

Three rheostats give you a selection of load resistance from zero to 20,000-ohms. Only one rheostat is used at a time, with S1 used to select the rheostat in use. By covering the load resistance range with three rheostats whose resistance values overlap, this tester allows you to select a medium or low resistance setting with greater precision than if a single rheostat were used for the load.

Overrated Rheostats. When you look at the parts list, you may be surprised at the power ratings of these rheostats—they range from 12½ watts up to 50 watts. Why such a high power dissipation rating for the load resistors to be used on household batteries, which don't produce nearly that much power?

These high power ratings are needed to give you the flexibility to test a wide range of batteries. The power rating on a rheostat applies only to the full resistance of the rheostat. When you turn the slider to a lower resistance point, as you will do when

using this tester, the power rating of the portion of the rheostat which is being used is reduced accordingly.

You certainly won't be sucking 50 watts of power out of the batteries you test, but you need rheostats heavy enough to safely dissipate lesser amounts of power when set for less than their full resistance.

In using the tester, you'll adjust a rheostat used as a load on the battery being tested until the milliammeter shows you this load is drawing from the battery the amount of current for which it is rated. To determine this "load current," refer to the accompanying battery table, which covers many of the commonly-used batteries you're likely to encounter, or refer to a battery manual from the manufacturer of the batteries you use.

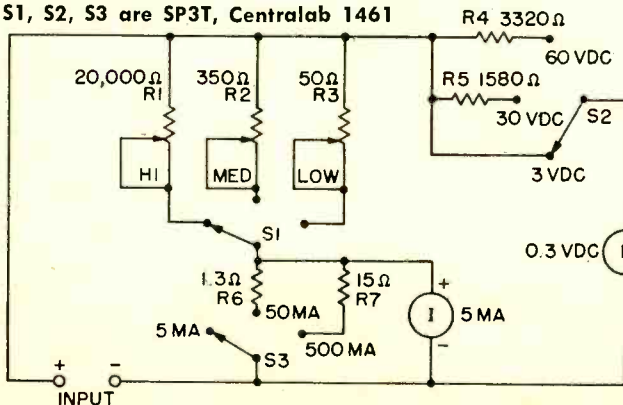
For example, the normal full rated load current for a 1.5-volt size "D" flashlight cell is shown as 150 milliamperes. To test such a cell on this better battery tester, follow this procedure.

1. Plug a pair of test prods into the two banana jacks at the lower left corner of the tester. Set the voltmeter range switch to "1x" (for the 0.3 volt range) and the milliammeter range switch to "100x" (for the 0-500 mA. range).

2. Set the load range switch to "low." This will select load resistor R3.

3. Touch the positive test prod to the positive battery terminal and the negative test prod to the negative battery terminal. Turn the "low" rheostat control (R3) until the milliammeter shows you are drawing 150 milliamperes from the battery, and as you do this, also watch the voltmeter. If it continues to indicate nearly 1.5 volts as the current flow is adjusted upwards until it reaches 150 milliamperes, the cell is in good condition, since you can see it is supplying

S1, S2, S3 are SP3T, Centralab 1461



- E—0-3 volt DC meter, edge reading or round (Allied 701-5102 or equiv.)
- I—0-5 mA DC meter, edge reading or round (Allied 701-5302 or equiv.)
- R1—20,000-ohm, 50-watt rheostat (Ohmite 4211 or equiv.)
- R2—350-ohm, 25-watt rheostat (Ohmite 0155 or equiv.)
- R3—50-ohm, 12½-watt rheostat (Ohmite 0110 or equiv.)
- R4—3320-ohm, ½-watt resistor (IRC type CEC-T-O or equiv.)
- R5—1580-ohm, ½-watt resistor (IRC type CEC-T-O or equiv.)
- R6—1.3-ohm, ½-watt resistor (Ohmite type RC20GF or equiv.)
- R7—15-ohm, ½-watt resistor (Radio Shack 271-000 or equiv.)

BATTERY TEST REFERENCE CHART

Maximum Current (mA)	Manufacturer Type Number					Type and Application
	RCA	Burgess	Eveready	Ray-O-Vac	NEDA	
1.5 Volts						
25	VS034A	Z	915	7R	15E	AA flashlight cell
80	VS035A	1	935	1C	14F	C flashlight cell
150	VS036	2	950	2D	13F	D flashlight cell
20	VS073	NE	904	716	910	Key chain lights & novelties
20	VS074	7	912	4D0	24F	AAA flashlight cell
25	VS334	930	1015	15	15	Transistor radios AA size
80	VS335	130	1035	14	14	Portable radios C size
150	VS336	2R	1050	2LP	13	Portable radios D size
25	VS734	920	815BP			Photoflash AA size
80	VS735	120	835BP			Photoflash C size
150	VS736	220	850			Photoflash D size
200	VS1074	AL-7	E92	MN-2400	24F	Alkaline AAA size
300	VS1334	AL-9	E91	MN-1500	15A	Alkaline AA size
500	VS1335	AL-1	E93	MN-1400	14A	Alkaline C size
500	VS1336	AL-2	E95	MN-1300	13A	Alkaline D size
4.5 Volts						
250	VS067	F3	736	A3	3	Portable "A"
6 Volts						
250	VS040C	F4M	509	941		Lantern service spring terminals
25	VS068	Z4	724	A2	2	Portable "A"
500	VS317	TW1	731	918	918	Lantern service binding posts
7.5 Volts						
70	VS065	C5	717	9	9	Portable radio "A"
50	VS129	B5	713	8	8	Portable radio "A"
80	VS315	D5	707	26	26	Portable radio "A"
9 Volts						
9	VS300A	P6	226	1600	1600	Transistor radios
150	VS301	D6PI	2506	1601	1601	Transistor radios
15	VS305	2N6	246	1602	1602	Transistor radios
30	VS306	D6	276	1603	1603	Transistor radios
20	VS322	M6	266	1605	1605	Transistor radios
8	VS323	2U6	216	1604	1604	Transistor radios
7	VS327	L6	206		1611	Transistor radios
80	VS330	C6X	2356N		1612	Transistor radios
12 Volts						
250	VS342	TW1S	732			Lantern service
13.5 Volts						
10	VS304	XX9	239	1900	1900	Transistor service
15 Volts						
1.5	VS704	Y10	504		220	Photoflash BC units
22.5 Volts						
2.5	VS084	U15	412	215	215	Photoflash BC units, transistor service
30 Volts						
2.5	VS085	U20	413	A210	210	Transistor radios
45 Volts						
40	VS014	A30	W359	206	206	Portable radio "B"
25	VS015	Z30	738	205	205	Portable radio "B"
4	VS086	U30	415	213	213	Portable radio "B"
50	VS112	5308	762S	709	709	Portable radio "B"
70	VS344	B30	484	207	207	Portable radio "B"

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its rated load current without a significant drop in voltage. However, if the voltmeter shows you the voltage dropped excessively as the current was adjusted upward to the value that's normal for this particular cell, then you know the cell is weak.

Incidentally, if you compare battery ratings published by different manufacturers of similar battery types, you may find a few variations in ratings. However, the versatility of this battery tester permits you to operate it to fit virtually any ratings to be found for low and medium voltage batteries.

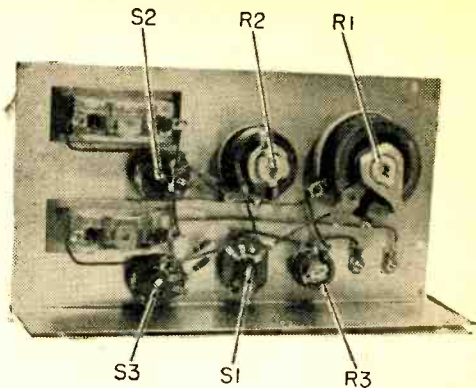
Some batteries that have just a little life left will produce their rated load current for a short time before their terminal voltage begins to drop off. So, even if the cell tests good at first, hold the test prods in place for a minute or so and watch the voltmeter closely. If the voltage begins to drop off, you know the cell may be all right for short periods of operation, but that it is nearing the end of its useful life.

For Unknown Loads. In describing the test procedure for a size "D" flashlight cell, it was said to use the *low* resistance rheostat load. That's because the author, who designed this tester, knew from his calculations which load to use. Many times though, you may not be sure which rheostat to use, so just follow this simple rule. Start a test using the *high* rheostat (R1) set for its highest resistance, and work down from there. This is easy to do if you wire the unit so each rheostat will be set for maximum resistance when it is turned fully counter-clockwise as viewed from the front of the panel.)

In making a test, turn the resistance knob to the right, which will reduce the resistance, as you seek a setting that will produce on the milliammeter an indication of the current for which the battery is rated.

If you find you must turn the rheostat nearly fully clockwise to obtain the amount of current you want to draw from the battery being tested, you will find it's very hard to set the rheostat precisely enough to hold the milliammeter steady. This will happen because you will be attempting to work with a very tiny portion of the rheostat's full resistance range.

When this happens, the thing to do is set



Once parts are assembled mechanically, it's a fast and simple matter to wire a tester. Choose a panel meter that fits your design.

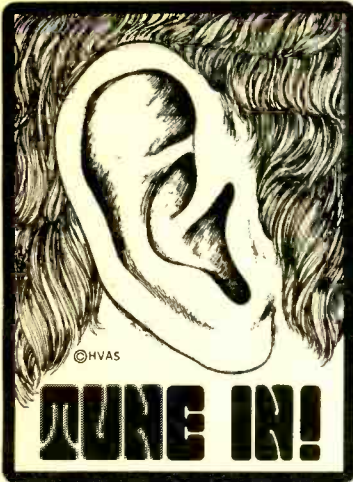
the load selector switch (S1) to *medium* and try again, using the medium rheostat (R2). If the same thing occurs with R2, then set S1 to *low* and use the low rheostat (R3).

As a general rule, you'll find the high rheostat will be used on tests requiring fairly low amounts of current from low voltage batteries, and the low rheostat will be used for high amounts of current from low and medium voltage batteries. The medium rheostat will be used to conveniently bridge the gap between these two general categories. However, because of the wide variety of voltage and current combinations now available in the many battery types, it's not practical to set an iron-clad rule to determine which rheostat to use in every case. So, just follow the procedure of starting with a high resistance and working down until you reach the proper load for the battery you're testing.

Construction. Building the battery tester is very simple and straightforward, as you can see from the photos. Any type of metal or plastic utility box may be used. The one shown here is a 5 x 9½ x 2¼-in. steel convert-a-box, which is a little easier to work with than the more common mini-box.

Drill ⅜-in. holes for the switches and rheostats. Drill large enough holes for the two binding posts to accommodate fiber shoulder washers so the binding post mounting screws will be insulated from the metal panel, and cut rectangular holes for the meters.

One or two evenings should be sufficient to complete the unit, and then you'll have a battery tester that we think you'll be proud to own and wise to use. ■



PROGRAMS FOR DXers

□ One way you can now keep yourself current on what's going on in the world of SWBC DXing is to listen regularly to the special DXers broadcasts from a number of stations around the world. Some of these have been around for many years; Radio Sweden's "Sweden Calling DXers" has recently celebrated its 25th birthday; and a similar program from Radio Australia is even older.

Some feature DX tips extensively or exclusively; others have some tips and also incorporate a mailbag feature, reading listeners letters and playing requested records.

There are many of these DXers programs on the air. Let's run through the week to report on some of them you can hear. Remember, though, that stations do change their frequencies and they move from the spots mentioned. But chances are that the time schedule will remain fairly constant. If you don't find these programs where we note, tune around a bit and you'll probably locate them on a different frequency in the same bands.

Mondays Radio Japan has its weekly English language DX program directed to North America scheduled for 0015 and again at 0200 (as in all of cases, the times are quoted in Greenwich Mean Time (GMT). So don't forget that 0015 GMT, Monday, is really 7:15 p.m. EST; 6:15 p.m. CST; 5:15 p.m. MST and 4:15 p.m. PST, *Sunday*, in North America). (11,800, 15,445 kHz) Other DX programs on Mondays are Radio Portugal at 0215 GMT, (6,025 kHz) Radio Norway at 0220, but on the Monday after the first Sunday of the month only, (9,610 kHz); and Radio Bucharest, Roumania, at 1930 (7,195, 9,570 kHz)

Tuesdays As we mentioned, Radio Sweden's DX program is the second oldest of its type in the world. It can be heard each Tuesday at 1100 (9,630 kHz) and 1600 (11,930 kHz). Tuesday in the U.S. and Canada, but actually Wednesday by GMT, the same program can be heard directed toward us at



Headquarters of Nippon Hoso Kyokai, the Japanese Broadcasting Corporation widely heard as Radio Japan by SWL's here.

e/e PROGRAMS FOR DXers

0030 (11,955 kHz) and 0330 (11,705 kHz). Additional DX program fare Tuesdays includes Radio Budapest (Hungary) (9,833 kHz at 2245 GMT, and HCJB, Quito, Ecuador, 1930 GMT (11,780 kHz)

Wednesdays The powerful transmitters of Radio RSA, the international service of South Africa, beam a DX program to North American DXers at 2330 GMT (9,695 kHz), and to other parts of the world, in English, at 0800, 1000, 1600 and 1900 GMT (variously, 9,695, 11,970, 15220, 17,815 kHz). On the first Wednesday of each month, Radio New Zealand has a popular DX show at 1030 GMT (9,520 kHz). Radio Prague (Czechoslovakia) has its program for hobby listeners at 2200 (6,015 kHz).

Thursdays The widely heard religious station, Trans World Radio, on the Caribbean island of Bonaire, Netherland Antilles, features a DX program at 0045 GMT (Again, don't forget, that will be late afternoon or early evening Wednesday in North America. (11,815 kHz). Another program to try for is the one aired by Radio Nederland at 2130 GMT. (9715, 11730 kHz)

Fridays On Fridays, the BBC, British Broadcasting Corporation's World Radio Club airs its program at 2345 GMT, in English on a whole series of frequencies. Try any of the following outlets. (6,110, 9,510, 9,580, 15,260 kHz). Other DX broadcasts are Radio Budapest, 1615 (9,833, 11,910 kHz); Radio Sofia (Bulgaria), 1930 GMT (9,700 kHz); Radio Bucharest, 2100 GMT (7,195 kHz).

Saturdays A very popular DX program with



FREQUENCY VS. WAVELENGTH

At first, many DXers are puzzled by the terms frequency and wavelength, and the relationship between them. Actually, both are different ways of expressing the same thing. Wavelength refers to the length, in meters (a meter is roughly 39.4 inches), of a particular radio wave. Frequency describes the number of times per second that the wave "vibrates". Frequencies are expressed in kilocycles per second or kilohertz (more often megacycles per second or megahertz on the higher frequencies). These are the formulas for converting one to the other:

$$\text{Wavelength in meters} = \frac{300,000}{\text{Frequency in kHz}}$$

$$\text{Frequency in kHz} = \frac{300,000}{\text{Wavelength in meters}}$$

MAJOR SW BROADCAST BANDS

90 meter band	3200 to 3400 kHz
60 meter band	4750 to 5060 kHz
49 meter band	5950 to 6200 kHz
41 meter band	7100 to 7300 kHz
31 meter band	9500 to 9775 kHz
25 meter band	11700 to 11975 kHz
19 meter band	15100 to 15450 kHz
16 meter band	17700 to 17900 kHz

North American listeners is that broadcast by Radio Canada International. You can hear it at 2315 and 2345 GMT (9,625, 11,945 kHz). Other Saturday broadcasts are those by the Swiss Broadcasting Corporation at 1530 GMT, on the second and fourth Saturdays of each month (9,590, 11,870 kHz), Trans World Radio's station at Monte Carlo, Monaco, at 1745 GMT (7,180 kHz), and earlier at 0930 GMT (9,640 kHz).

Sundays The oldest of all DX programs is that of Radio Australia, which can be heard Sundays at 1300 GMT (9,580 kHz), and 1530 GMT (9,550, 9,680 kHz). Radio Nordsee International, a pop music, unlicensed pirate broadcaster which operates from a ship anchored in international

This modern studio building belongs to Radio Clube de Mocambique. The station, at Lorenzo Marques, Mozambique, is one of the most popular SWBC outlets in southern Africa.

THE SINPO CODE

SINPO is a shorthand technique used for reporting to stations to inform them of how well you received their signals. The letters stand for the five major factors in reception evaluation: Strength of signal, Interference from other stations, Noise from atmospheric sources, static, Propagation conditions, generally the degree of signal fading, and Overall evaluation of the reception quality. These are rated numerically on a scale of from one to five, with five the optimum and one the minimum conditions. Typically, a strong signal might be reported as SINPO 55444, meaning excellent signal strength, no interference, slight static, slight fading and an overall rating of good. While of use in reporting to many of the major international broadcasters, unfortunately many small and rarely heard stations are not familiar with the SINPO code.

S	I	N	P	O
5—Excellent	5—None	5—None	5—None	5—Excellent
4—Good	4—Slight	4—Slight	4—Slight	4—Good
3—Fair	3—Moderate	3—Moderate	3—Moderate	3—Fair
2—Poor	2—Severe	2—Severe	2—Severe	2—Poor
1—Barely audible	1—Extreme	1—Extreme	1—Extreme	1—Unusable

waters off the coast of Europe as a weekly DX program on Sundays at 0900 GMT. (6,210 kHz). On the first Sunday of the month, try Radio Norway's broadcast to North America at 1620 GMT. (15,175 kHz).

In addition to their broadcasts specifically directed to SWLs around the world, some of these stations offer special incentives to listen in. Some have their own listeners clubs; some have contests—can you imagine winning an all-expenses-paid trip to Portugal and the Portuguese African colonies? Others have prizes. Still others offer listeners badges, pennants and publications. For example, Radio Sweden (Swedish Broadcasting Corp., S-105 10, Stockholm, Sweden), will send, free

of charge, mimeographed summaries of the DXing tips broadcast on its programs to those SWLs who contribute items for the program.

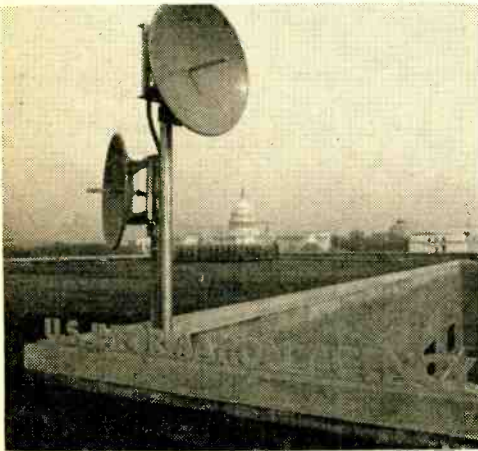
Other Helps For DXers. What are other sources of information on DXing and the stations that are out there to be heard? We hope you'll find our own "DX Central Reporting" a big help. You'll find it, of course, in this magazine.

No serious DXer should be without the annual *World Radio and Television Handbook*. It contains one of the most complete lists of short and medium wave stations, TV outlets and the like in the entire world. It also has data on station addresses, schedules and much much more. It has been called, quite correctly, the DXers Bible.

Here at e/e we frequently receive questions from listeners concerning this station or that, broadcasting in one country or another. Because of the amount of mail received, rarely is it possible to give you the specific detailed answer you are seeking. But, in analyzing the questions received, it can be safely said that the vast majority could be answered by the writers themselves, with much less time and trouble, just by checking a copy of WRTH!

We do suggest you invest in a copy for you'll get your money's worth out of it. The book is published each year in Denmark and is handled through a number of dealers and by some of the DX clubs previously mentioned.

The book can be mail ordered from Gilfer Associates, Inc., P.O. Box 239, Park Ridge, NJ 07656. ■



First step of the VOA's microwave link between Washington DC studios and the transmitters at Greenville, North Carolina.

Four Ways To 4-Channel



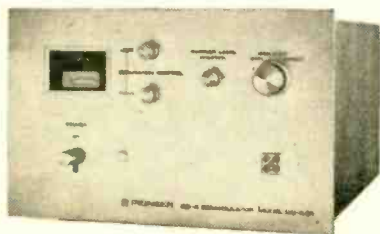
◀ The SA-8000X is from Technics, the new audiophile line by Panasonic, and is an AM/FM 4/2-channel receiver with built-in CD-4 demodulator plus AFD matrix for direct demodulating or decoding every 4-channel medium in use today, without external accessories. The 64-watt (total continuous rms power) receiver is \$499.95.
Circle No. 60 on the Reader Service Page.



◀ Craig's 3140 Quick-Mount 8-track player plays quadraphonic tapes and also gives an enhanced 4-channel effect to conventional stereo cartridges by using the matrix switch. The sound remains on when the fast-forward button is depressed to enable locating a desired selection easily; \$112.95.
Circle No. 63 on the Reader Service Page.



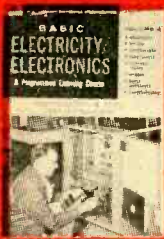
◀ Combining an AM/FM-stereo receiver with 4-channel cartridge player, the General Electric SC4205 also has a Quadrabalance joystick to control all four 2-way air-suspension speakers simultaneously. The 4-channel capability includes discrete 8-track tapes, encoded discs, encoded broadcast, and stereo synthesizer; \$339.95.
Circle No. 67 on the Reader Service Page.



◀ From Pioneer, the QD-240 CD-4 disc demodulator supplies 4-channel sound from all CD-4 discrete discs, and is hooked up between the stereo turntable and the 4-channel amplifier or receiver. Frequency response is 20 to 15,000 Hz. The mode switch has three positions: 2-channel, CD-4, and direct. \$129.95.
Circle No. 70 on the Reader Service Page.

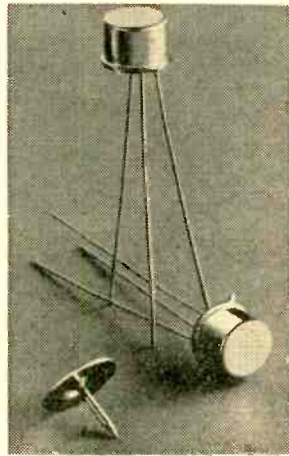
EE's

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This series is based on
BASIC ELECTRICITY/ELECTRONICS,
Vol. 4, published by
HOWARD W. SAMS & CO., INC.

SEMICONDUCTOR TESTING



What you will learn. You will learn how typical semiconductor tests can be made. If you study this chapter thoroughly, you will be able to make simple tests on semiconductors to determine their operating quality without the use of special instruments.



SEMICONDUCTOR TESTING

Semiconductors are reliable devices. One example of this reliability is an early second generation (meaning all transistor) digital computer that was tested during its development. The computer contained over 100,000 individual (not integrated circuits) crystal diodes and transistors. The test was run for two years, averaging 20 hours of operation per day. Within that period there were only *three* semiconductor failures.

While vacuum tubes are the source of most troubles in equipment in which they are used, semiconductors, particularly transistors, are relatively troublefree. However, the hobbyist, technician and student should be able to determine when a semiconductor device is operating properly.

Preliminary

The approach to finding a bad semiconductor is the same as that for locating any other defective component. You do not test a component unless you have a good reason to suspect that it is defective.

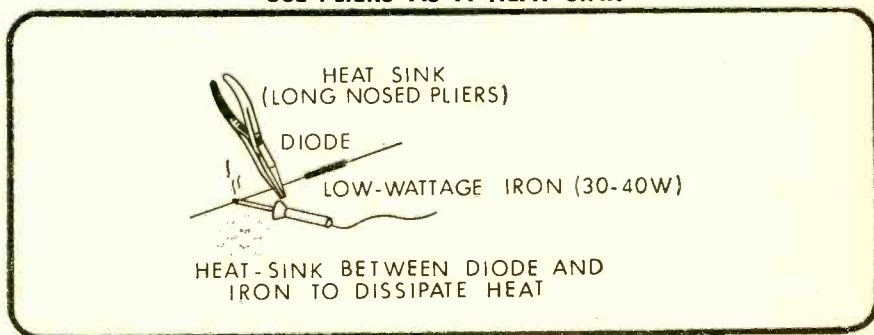
Since most semiconductors are soldered into position, the advice above becomes even more meaningful. Soldering and unsoldering a number of transistors to find a suspected bad one can be a tedious, time-consuming chore. Excessive heating can ruin a semiconductor. Therefore, be sure there is a good reason for removing a transistor before doing so.

Substitution Test—When you are reasonably sure you have found the circuit containing the trouble and that the trouble is, in fact, a semiconductor, you can verify and correct the trouble by a substitution test. As with vacuum tubes, this is probably the simplest and most reliable of all tests. When substitution of a good diode or transistor has restored the circuit to proper operation, the semiconductor that it replaced was the cause of the trouble.

Be very careful when removing and replacing semiconductors. Although strongly constructed, semiconductors are sensitive to excessive voltage, current, and heat.

When soldering or unsoldering a semiconductor, use the minimum heat required. Keep the semiconductor away from the chassis. Use a low-voltage soldering iron (30 to 40 watts) and a heat sink, as shown in the illustration. A heat sink is a device for dissipating heat.

USE PLIERS AS A HEAT SINK



QUESTION

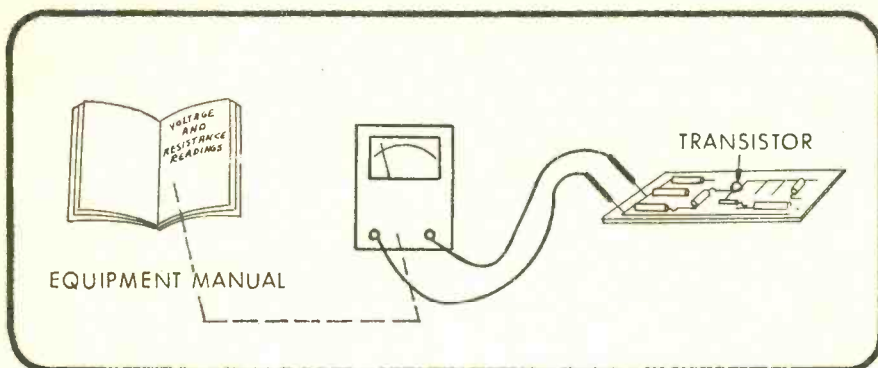
Q1. What factors can ruin a semiconductor?

ANSWER

A1. Excessive current, voltage, or heat can ruin a semiconductor.

When a semiconductor is known to be defective, check the circuit for defects that may have caused the damage. If the defects are not eliminated, they will also damage the substituted unit. These checks can be made with a voltmeter and ohmmeter. Compare readings with those in the equipment manual.

EQUIPMENT MANUALS PROVIDE DATA

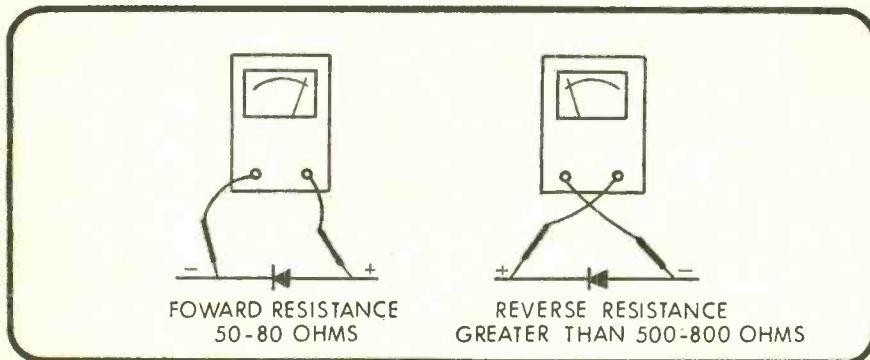


Crystal-Diode Tests

A crystal diode is a semiconductor. Among the crystal-diode family are general-purpose germanium and silicon rectifiers (diodes) and silicon diodes constructed for high-power or very high-frequency purposes. Although these diodes may be effectively tested only under circuit operating conditions, other tests can be made as follows.

Resistance Measurement—A good diode will have a high resistance to current in one direction and a low resistance in the other. The ratio should be at least 10 to 1 for the diode to function as a rectifier. This is called a *reverse-to-forward* resistance ratio, with the greater value being in the reverse direction.

DIODE RESISTANCE MEASUREMENT



Diode Test Set—Test sets are available to check the rectifying qualities of a diode. Some of them provide a combination resistance and current test. When the set is used as an ohmmeter, it will measure forward and reverse resistance. When it is used as a milliammeter, it will measure forward and reverse current. Others use one or the other to obtain the forward-to-reverse ratio. Most sets are constructed as shown in the diagram. (over)

The diode is inserted in the device, and R_1 is used to adjust the meter reading so that the pointer will remain on scale when the switch is thrown. The switch reverses the current direction through the diode. R_2 limits the current to a safe value.

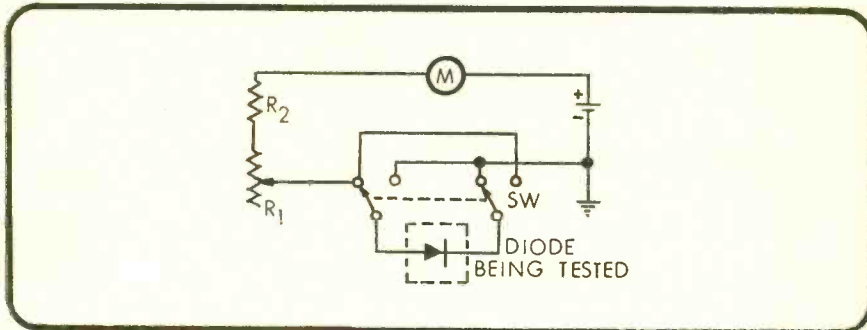
Transistor Testing

There are laboratory instruments that measure transistor characteristics in out-of-circuit and in-operating-circuit conditions. Test sets of lesser capabilities are available for use by technicians concerned with repair, rather than design, of transistor equipment. However,

many worthwhile checks can be made without the use of a transistor tester.

When trouble occurs in transistor equipment, isolate the source of the trouble to a specific circuit before touching a single transistor.

THE SIMPLE DIODE TESTER



QUESTION

Q2. The reverse-to-forward resistance ratio of a diode should be at least — to —.

ANSWER

A2. The reverse-to-forward resistance ratio of a diode should be at least 10 to 1.

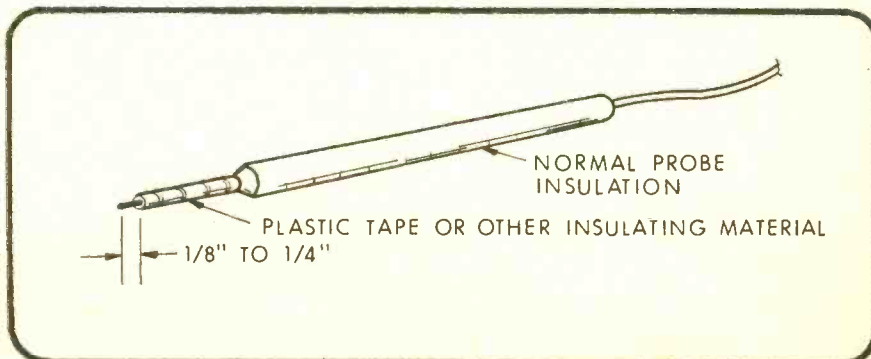
Transistor Testing Precautions

If the equipment manual contains waveforms at test points on a schematic or block diagram, an oscilloscope should be used to locate the circuit that is causing the trouble. If there are no waveforms available, voltage and resistance readings can be used to achieve the same results. As mentioned before, put off actual testing of a transistor until you are sure that it needs testing. When the faulty stage is isolated, use a multimeter to test the other parts of the circuit to determine whether abnormal conditions exist.

The multimeter used should have a high impedance to prevent loading the circuit. Low impedance across a circuit will change resistance and current values and provide a false voltage reading. The battery voltage of the ohmmeter used should not be in excess of 3 volts. Larger voltages may send an excessive amount of current through the transistor.

Parts and connecting leads are usually mounted very close together in the construction of transistor circuits. The metal tips of test probes are long enough to short-circuit leads when taking measurements. If this happens, excessive circuit voltage or current could be shunted to another part. To prevent this, insulate the metal portion of the probes so that

TO INSULATE THE TEST PROBE



only a short portion of the tip is exposed.

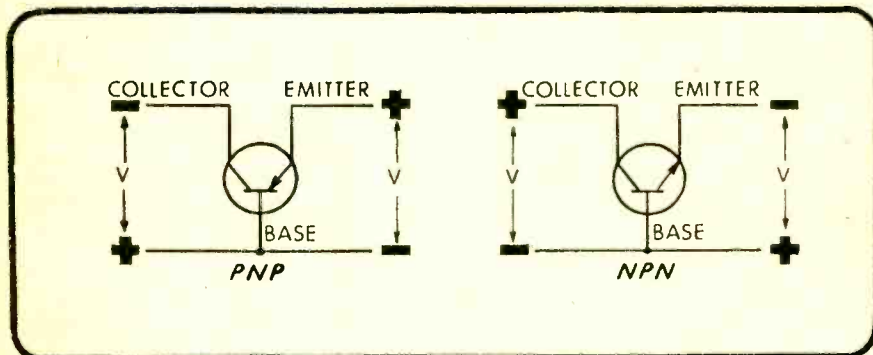
Double Check—When using a test instrument such as an AC voltmeter that could have a capacitor in series with the test lead, ground the probe to make sure the capacitor is discharged. If the capacitor were to discharge through a transistor, the transistor could be damaged.

During the circuit-checking tests it is best to remove the transistor if it is the plug-in type. Removal is not absolutely necessary if you exercise necessary care.

The technical manual for the equipment should supply sufficient information to make circuit checks that include the transistor. These tests involve the amount of bias or voltage applied to and the current through the elements of a transistor. With the exception of some circuits (pulse and power-amplifier stages, for example), transistors are usually biased so that $\frac{1}{2}$ to 3 milliamperes flow through the emitter, and voltage from collector to base is usually 3 to 15 volts.

Polarity, as well as the value of voltages, is particularly important to the safe operation of transistors. Check the amount of voltage first to be sure that it is not too high. Then determine if the polarity is in the correct direction. Voltage on PNP transistors must be negative on the collector and positive on the emitter with respect to the base. Polarities in NPN transistors are the reverse of those in PNP types.

RELATIVE POLARITY, TRANSISTOR ELEMENTS



QUESTION

Q3. If the trouble in a piece of equipment is isolated to one circuit, why should tests be made on other circuit components before testing the transistor?

ANSWER

A3. Detection and elimination of any abnormal circuit conditions will protect the new transistor. The transistor should not be unsoldered until you have determined the transistor may be defective.

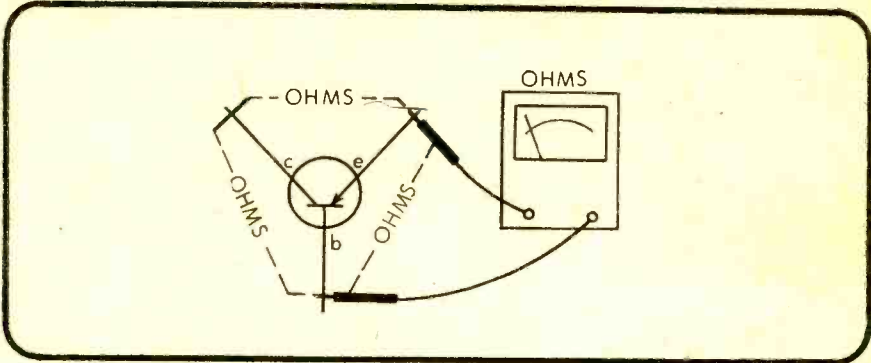
Transistor Tests

If all checks indicate that the transistor may be defective and the transistor must be removed for further testing or replacement, turn off the power to the equipment. Removing or inserting a transistor in an operating unit causes the current in the circuit to surge (rise) for instant. The surge may be enough to damage the transistor.

Ohmmeter Test—Forward and reverse-resistance checks of the transistor elements provide an indication of its condition.

To make the test, ohmmeter readings should be taken in both directions (reverse the test leads) from emitter to base, collector to base, and collector to emitter. The purpose of the test is to determine whether shorts or decreased resistances between elements have occurred. The large-to-small ratios for emitter to base and collector to base should be 500 to 1 or more. Direction of the ratio depends on whether the transistor is an NPN or PNP type.

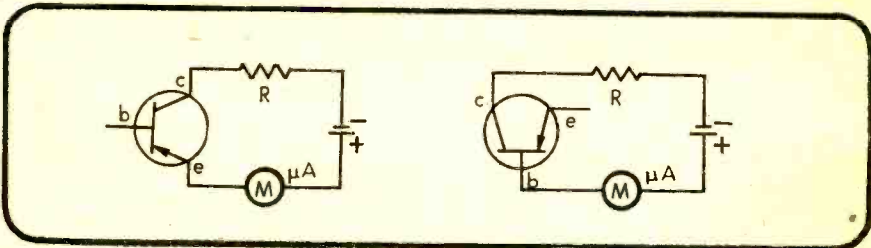
OHMMETER FOR TRANSISTOR TESTING



Most of the commercial testers are simple in design. Of the several tests that can be made in the laboratory, only a few are found in test sets normally used by technicians. The two most common tests are for leakage and gain.

Leakage Test—To determine leakage between elements, most testers place the transistor in series with a meter, battery, and current-limiting resistance. A good tester has a microammeter. If current readings exceed those stated for the transistor, it should be replaced.

COLLECTOR-EMITTER/BASE LEAKAGE



Gain Test—If transistor leakage current is within suitable limits, gain can be tested. Gain is a measurement of the change that occurs in collector current as a result of a small change in base current. The reason for this test is that the current gain capability of a transistor can decrease with age.

A variety of circuits are used to measure gain. All result in a ratio of I_C/I_B (collector current to base current). This ratio is matched against the minimum standard for the particular transistor. If the measured gain is too low, the resistor should be replaced. This test is often referred to as *direct-current gain*, since changes in DC current are involved.

Other Tests—More expensive sets measure the *punch-through* (or *break-through*) voltage level between collector and emitter to base. If current passes at a prescribed rise in voltage between the elements, the transistor would be considered defective.

QUESTIONS

Q4. What does a leakage test indicate?

Q5. What does a gain test indicate?

ANSWERS

A4. A leakage test reveals an excessive flow of current between the elements in a transistor.

A5. A gain test determines the ratio of the change in collector current to a corresponding change in base current.

An AC-gain test on a transistor is quite similar to a trans-conductance test for vacuum tubes. This test measures the ratio of collector-current change to emitter-current change as an *alpha amplification factor*. The ratio of collector-current change to base-current change is a *beta amplification factor*. Both ratios are measured with AC applied to the transistor and are then compared with desired values in a chart.

WHAT YOU HAVE LEARNED

1. Semiconductors, particularly transistors, are reliable and have a long life expectancy.
2. A crystal diode is a semiconductor that allows current to pass more readily in one direction than the other.
3. Transistors are sensitive to excessive heat, voltage, and current.
4. When testing transistor circuits, observe these rules: An ohmmeter that applies a voltage in excess of 3 volts should not be used on a transistor. Test-probe tips should be insulated to prevent application of undesired voltages to transistors. Capacitors in test leads or instruments should not be allowed to discharge through the transistor. Make voltage and resistance readings in the circuit to locate any abnormal situation. Do not remove or install a transistor when equipment is energized. To prevent loading, use a high-impedance voltmeter when taking voltage readings.
5. Bias voltages and collector current can be measured in a transistor while it is still in a circuit. Measurement of reverse and forward resistances between the separate elements will indicate a defective transistor.
6. A diode tester is designed to accurately determine reverse-to-forward resistance ratios.
7. Transistor testers include circuits to measure collector leakage, DC gain, AC gain, and punch-through voltage.

This series is based on material appearing in Vol. 4 of the 5-volume set, BASIC ELECTRICITY/ELECTRONICS, published by Howard W. Sams & Co., Inc. @ \$22.50. For information on the complete set, write the publisher at 4300 West 62nd St., Indianapolis, Ind. 46268.

Ask Hank, He Knows

Continued from page 22

Troubles with PC Board

How do you unsolder a part from a printed circuit board? Do I need special tools?

—K. H., Binghamton NY

I use the same iron to remove a part as I used to solder it in place. Sure, there are special tips, even special irons with suction attachments that slurp up solder when molten. But, the average Joe just needs some common sense and he'll do fine. First, to remove defective resistors and capacitors, cut the part in half with a hand cutter. Now, heat the point where a lead connects to the board and gently pull the part out with a long-nose plier. Pull slowly so no solder splatters. Now, remove all solder from the iron's tip and pick up excess solder from the connection until the PC board hole reappears. Sometimes you can heat the point and tap the board from behind. Be sure the hot solder splatters down to the table. Also, you can

heat the spot and blow gently through the hole. Again, be careful of flying solder. Most parts with leads can be removed this way. Sockets and electrolytic cans are tougher. I rock these out of the board by heating a contact point and lifting carefully, rotating around the part until it lifts off. Remove as much solder beforehand as possible to make life easier. If you are a repairman, then I suggest you pick up some of Unger's specially designed desoldering tips.

Indoor Car Radio Needs Power

I would like to power a 12-volt car radio from the AC line in my den. Do you have any diagrams I could use for this purpose?

—R. H., Estes Park CO

Sure I have, but I'm not giving them to you. The reason is simple, the parts for these circuits cost more than the Sears 28H7108 3-Ampere charger that sells for only \$7.95. It's a 12-volt rig only. If you want 6 and 12-Volt operation, then get Sears 28H7182 4-ampere charger for only \$12.98. They have other units for up to 10 amperes continuous duty for only \$34.95. Why build? You may need some filtering, but then you may not. (Continued on page 98)

DX Central Reporting

(Continued from page 29)

continue apparently depends on listener reaction, so now seems a good time to listen for the Israeli station and report your results.

It is possible that the IBA will continue to try various frequencies, seeking clear channels to North America. But, at this writing, the broadcasts, half in English and half in French, can be heard on 9,009, 11,705 and 11,945 from 0500 to 0530 GMT, and on 11,865, 15,425 and 17,870 kHz, from 1130 to 1230 GMT.

For those of you with rather simple receivers, who have some trouble finding stations on specific frequencies in the crowded short-wave bands, try the 9,009 kHz frequency. It isn't the most powerful of the IBA transmitters, but it is about the only broadcast station in that area of the band and should be relatively easy to find.

If you're seeking a QSL from IBA, address your report to Box 1082, Jerusalem, Israel.

Bandsweep. (Frequencies in kHz, times in GMT) **2,446**—A very nice DX catch that occasionally slips through the ORM on 120 meters is the ORTF station on Reunion Island. This island in the Indian Ocean can be best heard—when it is heard at all—for a few minutes after 0230 sign on **3,250**—You've heard *Radio RSA*, South Africa's powerful international service. Now try the home service of the South African Broadcasting Corporation, broadcasting in English, around 0330 **4,679**—One of the more frequently heard stations in Ecuador is *Radio Nacional Espejo*, in Quito. It isn't that it is one of the strongest signals in the 60 meter band, but being just a bit off the beaten path, frequency-wise, it isn't too hard to find. QSLs, unfortunately, are few and very far between! **4,820**—On those days when the atmospheric noise isn't too bad, now is a good time to try for the lower frequency Africans. A good one to watch for is *Radio Gambia*. It relays the BBC's newscast at 0700 **6,025**—As you may know, there's more to Soviet broadcasting than just *Radio Moscow*. One such Russian station is *Radio Tashkent*, which broadcasts in English from 1200 to 1230 **6,240**—A new clandestine station, *Radio Libertacao* has popped up on this frequency, broadcasting anti-Portuguese programs to Lisbon's colonies in West Africa. Listen for this one, usually broadcasting in Portuguese, during the afternoons until 2300 sign off **11,880**—Here's an easier one for some of you less experienced DXers. Tune the missionary station, ETLF, *Radio Voice of the Gospel*, with its English language religious programs around 1900.

(Credits: Fred Heutte, Dist, of Columbia;

Jerry Lineback, Illinois; Ken Swatkovf, Alberta, Canada; Elliot Straus, New Jersey; Gladys Martin, New York; North American SW Association, P.O. Box 8452, South Charleston, WVA 25303)

Backtalk. Lloyd Tyerman sent us a clipping the other day from his hometown newspaper, the *Stonewall (Manitoba) Argus*. The story told of how Lloyd played a major role in the rescue of two persons aboard a sinking pleasure craft off the Bahamas in April.

Though the story didn't give all the details, apparently Lloyd was monitoring the 27 MHz citizen band when he picked up a May Day call for help. The signal "skipped" in across thousands of miles to Lloyd's Manitoba home.

Reader Tyerman contacted the Royal Canadian Mounted Police in Winnipeg, who, in turn, notified the U.S. Air Force. A Coast Guard ship was dispatched to the scene, off the west coast of Bell Island in the Bahamas. The two persons were rescued just before their craft sank.

Nice work, Lloyd!

Mark Rodocker, Villa Park, Ill., sends along a bit of information on an easily heard Mexican station in the broadcast medium-wave band.

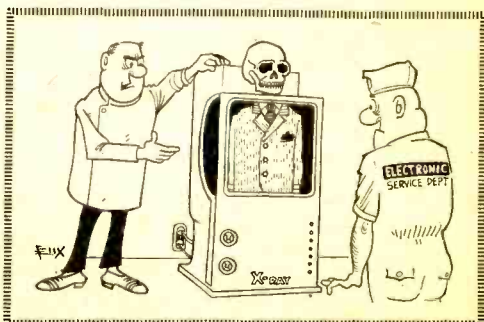
"XEG, Monterrey, N.L., Mexico broadcasts in 1050 kHz. This is a bootleg station, having a 100 kilowatt signal—twice the U.S. legal limit—across the border. With English language pop-rock programs and ads for mail order products during the early morning hours, on weekends, it is a best bet for Mexico."

Thanks, Mark, but there's one little correction to note. XEG is a perfectly legal, Mexican licensed station, not a bootlegger. Our southern neighbor allows stations to run considerably more power than is the case in the U.S. or Canada. Go to it, you BCbers!

"Would you please tell me how I can get registered? I don't know how to go about it as I've never been registered before, but I would like to be!"

That question comes from a Canadian reader, Leo Poirier in St. Catherines, Ontario.

Well, Leo, I imagine what you're talking about is the Monitor and DX Headquarters, operated by Hank Bennett, P.O. Box 333, Cherry Hill, N.J. 08002. Hank issues the well-known WDX identifications which, over the



years, thousands of DXers have obtained. Your DX editor, for instance, is assigned WDX9EZ. There is a fee for the registration and if you're interested in further details about the registration program, I suggest you send a stamped, self-addressed envelope to Hank at the above address.

NewsScan

Continued from page 24

As questions are presented by the instructor, a push-button device on the arm of 265 seats allows the students to pick one of five possible answers. The device immediately indicates to the student whether he is right or wrong, and indicates to the instructor the percentage of the class responding, and the percentage correct or incorrect for each possible answer.

An electronic scanner collects individual student responses and feeds them to a computer,



At teacher's console, Dr. Phil Manning, Professor of Medicine, flashes a question to a class of doctors. Console reports instantly to instructor on how class as a whole has answered question—per cent correct, per cent who selected each wrong answer.

which analyzes the data and relays it to a teletype. The instructor receives an immediate printed read-out with detailed data analysis of question-by-question performance by individual students and the class as a whole. Thus the instructor can rapidly assess student understanding of materials presented and identify areas that need reinforcing. This represents a marked advantage over the traditional method of assessing student comprehension by giving quizzes, which have to be graded and then returned to the student—a tedious process entailing a long time lapse between presentation of the material

(A note from the Editor: If you noticed Don's name missing from the beginning of this column in the last issue, blame it on me. With a pair of cans clamped to my head and the old rig tuned to 41 meters, I did a lousy proof reading job. I'm sorry, readers, and my regrets to Don Jensen, for he's the greatest.) ■

and the instructor's determining how the material has been assimilated.

The system was installed by Instructional Industries, Inc., of Ballston Lake, N.Y., an independent affiliate of General Electric and an outgrowth of an educational systems group in the GE research and development center. An exclusive feature of this system is that it allows the addition of student stations or additional classrooms later without duplicating basic electronic equipment, thus holding down the cost of additions.

Radar Rates Rear Ends

RCA has designed and tested an experimental automobile radar system designed to prevent highway rear-end collisions by tracking cars ahead and sounding a warning when the separation distance becomes unsafe. The compact radar, mounted on the front of a car, transmits a continuous signal which is received by a novel, passive reflector on the rear of the vehicle ahead. The reflector doubles the frequency of the transmitted signal and reflects it back to the radar.

By measuring the time required for the signal's round trip, the radar calculates distance to the car in front and flashes a light and sounds a buzzer when the separation distance decreases below one car length for each 10 miles-per-hour of speed of the car carrying the radar. Range of the radar is 100 yards.

An operational radar of this type might be integrated into a car so that it would automatically release the throttle and apply the



RCA scientist tests an experimental radar developed to prevent highway rear-end collisions. Radar on front of car transmits a signal which is reflected back at twice the frequency by reflector just under license plate on rear of car ahead.

brakes to provide headway control. Furthermore, if special small reflectors were emplaced on the highway shoulders and on collision hazards such as bridges, the radar could automatically apply the brakes should the car run off the road. But don't drink to the RCA system yet! The radar still requires testing and refinement, but RCA scientists believe that an operational system, including both the trans-

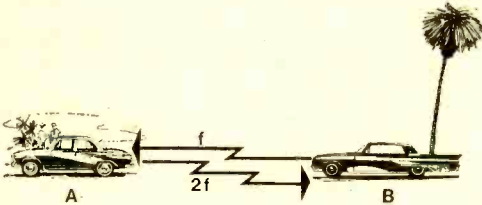


Diagram shows operation of experimental automobile radar developed by RCA Laboratories.

Radar on car B transmits a signal (f) which is reflected back at twice the frequency (2f) by a special reflector on the rear of the car ahead. The radar then calculates the distance between the two cars and sounds a buzzer and flashes a light should the separation become unsafe.

mitting/receiving radar and the special reflector, can be mass produced within five years at a cost to the consumer of between \$50 and \$100 per car—approximately the price of many AM/FM car radios now being installed in cars for entertainment.

Besides its safety applications, the radar also

could permit a smoother traffic flow and significantly decreased travel time in congested areas such as tunnels. Experiments under congested traffic conditions have shown that the number of automobiles passing a given point can be increased substantially if constant speed and separation such as that possible with the radar are maintained.

A key feature of the RCA radar is its rejection of *ground clutter*—false targets created by signals bouncing off highway signs, bridges, overpasses, trees, and other roadside objects. This is achieved by making the reflected frequency the *second harmonic*. Since the signals reflected by the highway itself and roadside objects are not at this second harmonic, they are ignored by the radar. The sensitivity only to the doubled frequency also prevents the interference and “blinding” that normally would occur when two radar-equipped cars travelling in opposite directions pass one another.

The experimental radar transmitter/receiver employs all solid-state electronics. It is mounted on the front bumper of the car, but an operational version could be smaller and concealed in the grillwork or behind a nonmetallic front license plate.

The reflector is the same size as the radar, except it is only one-half inch thick. It is completely passive and requires no power or wiring. Its simplicity would allow it to be produced for under \$10, and therefore it could be readily adapted to even the oldest cars still operating on the highways. It could, in fact, be combined with the rear license plate. Let's hope the price comes down and the application increases. ■

Ask Hank, He Knows

Continued from page 22

For the Birds

How do I keep birds off the ground plane radials of my CB antenna?

—E.G., Baton Rouge LA

Repeat after me, “Shoo, shoo, shoo!” Better than that, do what one reader did. Mount a 117-volt washing machine solenoid on a bracket to the mast of the antenna. Position the solenoid so that the plunger strikes the mast when a push button closes the electrical circuit. The noise and vibrations on the birds tootsies will scare them away without hurting them.

Hates PC Boards

Why must everybody magazine publish projects that must be mounted on printed circuit boards?

—A.S., Gary, ID

Not everybody does. Check this magazine and the number of projects you will find using PC boards, if any, is one. The rest of the projects are PC board free! Some magazines

offer involved projects that the reader cannot hope to build and have working without a custom-made PC board. That's their style. Like it, buy it; otherwise go elsewhere.

His View

I built three of your projects and none of them worked. I had enough!

—J.N., Tallahassee FL

I was once out of work for three weeks—I had enough, too! However, let me make one suggestion. Buy a good soldering iron and get rid of that tube of *Solder Glue*. ■

Hey, Look Me Over

Continued from page 15

video for private listening in bed, etc., without disturbing others. Features include a superheterodyne receiver, RF amplifier. Includes 4 “C” batteries and earphone. Suggested retail price for model 11-707 is \$29.95. For more information, circle No. 39 on Reader Service Page. ■

Hey Herb

Continued from page 53

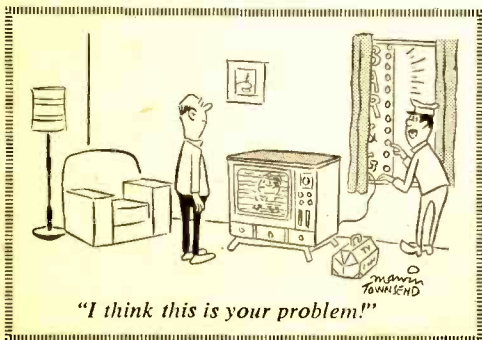
suspect the amplifier you're using is one that was highly rated by several publications, which didn't determine that when loaded with 4 ohms and driven to clipping (maximum output) the power output dropped about 50% and then took several seconds to build back—producing severe clipping of the waveforms until it had stabilized. The amplifier will be okay as long as you don't drive it into clipping. If you need more volume I suggest you get a higher power amplifier.

Hey Herb: For many years I've purchased audio equipment on the basis of intermodulation distortion—at least it was an important performance specification. Now I find one of the leading hi-fi magazines claims you can't hear 6% or less I.M. when listening to a program. Since I.M. specifications are usually well under 1%, often about 0.1%, why do we bother with I.M. at all?

We don't bother with I.M. You do. Some magazines do. But I and many other professional sound technicians haven't turned on an I.M. analyzer in 20 years. *We know that 7% was set as the hear-no-evil limit by the Hollywood experts—and they are real experts—something like 30 years ago.* I.M. was a major problem on optical sound tracks where 12% I.M. was not unusual. It has never been a problem in hi-fi gear. But, I.M. made for a lot of space-filling articles and letters to the editor. It is always an impressive mathematical analysis (to the layman), and is an excellent figure to throw around—at least it sounds as if one knows what he's talking about. I rate any article on I.M., as it concerns hi-fi equipment, in the same category with "discussions" on "RMS watts should really be average watts", "cycles per second is really Hertz", and "the advantages of ferrite recording heads". (Want to buy a very old, rarely used I.M. meter?)

Hey Herb: What is meant by a *bridged* or BTL output circuit, as used in advertising some modern amplifiers?

To avoid having a duplicate line of stereo



"I think this is your problem!"

and 4-channel receivers and amplifiers, many manufacturers now make only 4-channel equipments with special output circuits that permit the power of the rear channels to be combined with that of the front for ordinary stereo use. The extra cost is nominal. The user simply flips a switch and the entire system operates as an ordinary stereo receiver or amplifier. If, at some future date, the user decides to expand to 4-channel he need only add two speakers and open the switch. In this manner the user's new equipment will not become obsolete, as it would be if he purchased only a stereo receiver. Though the bridged or BTL output was originally used to reduce the number of equipments a manufacturer had to make to cover both stereo and 4-channel, it has really turned out to be a protection against obsolescence for the consumer. (Sometimes we buyers win one by accident). ■

Herb would like to answer all the questions our readers send. However, he can only sample the questions received and answer as many as possible through this column. Sorry, it's impossible to answer questions by return mail. Questions of a personal listening nature cannot be answered. Send your questions to Hey Herb, ELEMENTARY ELECTRONICS, 229 Park Avenue So., New York NY 10003.

Blinky Blocks Bright Lights

Continued from page 68

The goggles can be adjusted so that the light intake can be reduced or increased. Therefore their use in dark or very bright surroundings is possible.

The power comes from a 200-hour battery. The lenses are in fact thin polished slices of ceramic sandwiched between two polarizing filters. The filters are crossed at right angles to each other so that they transmit no light. When voltage is applied to the ceramic between the filters it alters the polarization so that the light will pass through the filters. The blinking goggles let the industrial worker see through his job so that he can see through his retirement. ■

These Trolleys Don't...

Continued from page 67

floor). Amstar signals its own elevator, travels to whatever floor has been programmed, exits and continues down corridors to its destination. There it waits until nurses, orderlies or aides come to unload it,

or guide it manually to another location where it was unexpectedly needed. At Fairfax Hospital, patients or visitors rarely see the trollies at work, since most of their operations are confined to behind-the-scenes service areas.

The trollies are loaded in the basement with food, laundry and medical supplies and sent off to their destination at about 1 mph. On the final leg of their automated journey they return to the basement, this

time loaded (by hand) with dirty dishes and linens and rubbish. At present, Fairfax Hospital owns about 60 Amscars. Approximated 13 other hospitals have contracted to have similar systems installed. There's been some talk about eventually teaching these machines some bedside manners to help out the doctors. We do not know how a patient should answer such inevitable pre-recorded greetings as "Good morning. How are you feeling?" ■

Heathkit Metal Detector

Continued from page 76

maximum sensitivity occurs when the metal is approximately under the center of the search head, it is still a good idea to locate the *precise center* using a *dime* as the "treasure" and then to mark the *precise center* on top of the search head with a dot of bright nail polish or white paint. It's a lot easier to find small coins when you know their exact position within 1/2-in.

Building the Kit. The most critical part of the assembly, which is the positioning of the coils in the search head, is done for you at the factory; the coils are positioned properly and supplied cemented and mounted in place. The transistorized electronics is divided between two small printed circuit assemblies. One, containing the oscillators and driver for the search coil is mounted directly inside the search head and is connected to the audio and meter printed circuit assembly which is mounted in the plastic housing (and handle) at the top of the telescopic shaft. The connecting wires for the two printed circuit assemblies pass through the telescopic shaft so they are fully

protected against damage. Though the printed circuit boards represent *simple, no problem* construction, there are a few points where the connecting wires must be snaked through difficult or tight quarters, and Pop will have to figure on giving junior some assistance with the final assembly.

Somewhat unusual, you will find that even though power is provided by a 9-volt transistor radio battery, there is a Zener voltage regulator in the power supply circuit. The regulation insures that performance remains constant as the battery is used, or if the battery is subjected to wide extremes of ambient temperature variations, as might occur if the metal detector was moved from a cool shade into the hot sun. By providing voltage regulation Heathkit insures the user will not be confused by meaningless variations in the tone's level or meter reading.

Summing up. There is no better way to locate metal at a reasonable instrument cost other than with the *induction balance* system used in Heath's GD-348 Deluxe Metal Detector (\$89.95). By providing both a user adjustable sensitivity and search head balance (null) Heathkit insures the user obtains the optimum level of performance possible. For additional information circle No. 1 on the Reader Service Coupon. ■

Antique Radio Corner

Continued from page 50

each year. Another is The Antique Radio Club of America. This is a new club and publishes a bulletin named the *Antique Radio Gazette*. The DeForest Pioneers is a society of the Pioneer Associates of Dr. Lee DeForest, Father of Radio. They publish a newsletter. There is also the Canadian Vintage Wireless Association which accepts members in the United States. Their bulletin

is called *The Cat Whisker*.

I know of two local clubs for radio collectors. One is called the Indiana Historical Radio Society and also publishes a quarterly bulletin. It is based in Indiana, but will accept members from all over the United States. The other club is named The Rocky Mountain Antique Wireless Assoc. The club members live in and around Denver, Colorado.

Another way to learn about old radios is to visit the large number of public and private radio and wireless museums. Some of the outstanding public museums are: The

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Smithsonian Institute in Washington DC, The Henry Ford Museum at Dearborn, Mi, The Signal Corp Museum at Fort Monmouth NJ, the ARRL Museum at Newington, CN, and there is a very fine exhibit of antique radios, speakers, tubes, etc. at the Indiana State Museum at Indianapolis, ID.

The display at the Indiana State Museum was arranged by the Indiana Historical Radio Society with the cooperation of the Museum Curator. The photographs shown are from the museum exhibit, and were taken by John Noble, a club member.

This winds up what could be the first of many Antique Radio Corners. The future of this department is how useful it is to the readers of this magazine. With this in mind I have prepared a Fact Sheet for collectors of antique radio and wireless equipment, plus a list of Public Radio and Wireless Museums. You may have a FREE copy of both by sending a long stamped self-addressed envelope to Antique Radio Corner, ELEMENTARY ELECTRONICS, 229 Park Avenue South, New York NY 10003.

In future columns we will have book reviews, some history at Atwater Kent and other early pioneers of the radio industry, hints on restoring radios, and in general try to keep you informed on what is happening in the field of antique radio collecting. ■

Antiquing an Old Tube

Continued from page 69

about 3/32" in diameter letting the screw cut its own threads in the hole. Clip off the screw leaving about 1/8" projecting from the base and then file the clipped end of the pin smooth.

Caution: Do not drill too deep into the tube base or you might strike the glass inside the base and ruin the tube. Use a depth marker on the drill so you will not drill too deep.

Who Has It? Possible sources for type 30 tubes or other battery tubes having the same type bases as the 30s and having low filament voltages and low filament drain:

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A purist collector may say that you are cheating when you substitute a 30 for an O1A job. Maybe so, but your restored ancient receiver will be operative, and if your luck holds out you may uncover an O1A someday. ■

SSB Today

Continued from page 65

Mode indicator. Standard accessories are microphone and power cord.

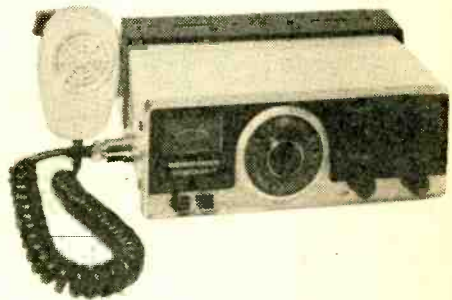
Editorial Remarks: The Titan IV has a mechanical filter, solid-state circuitry except for final transmitting tube, crystal spotting for AM, and microphone gain control. ■

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Editorial Remarks: Large meter for reading S-units and RF power, automatic burglar alarm switch, RF noise-cancelling circuitry. ■

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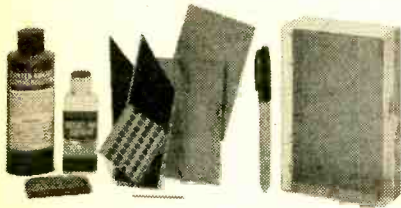
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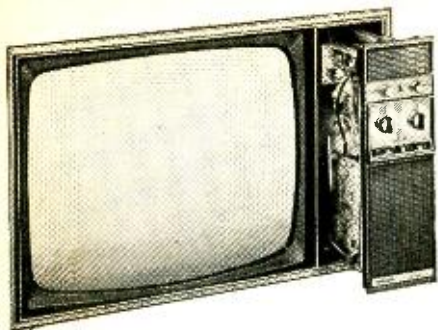
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