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JUNE 1966

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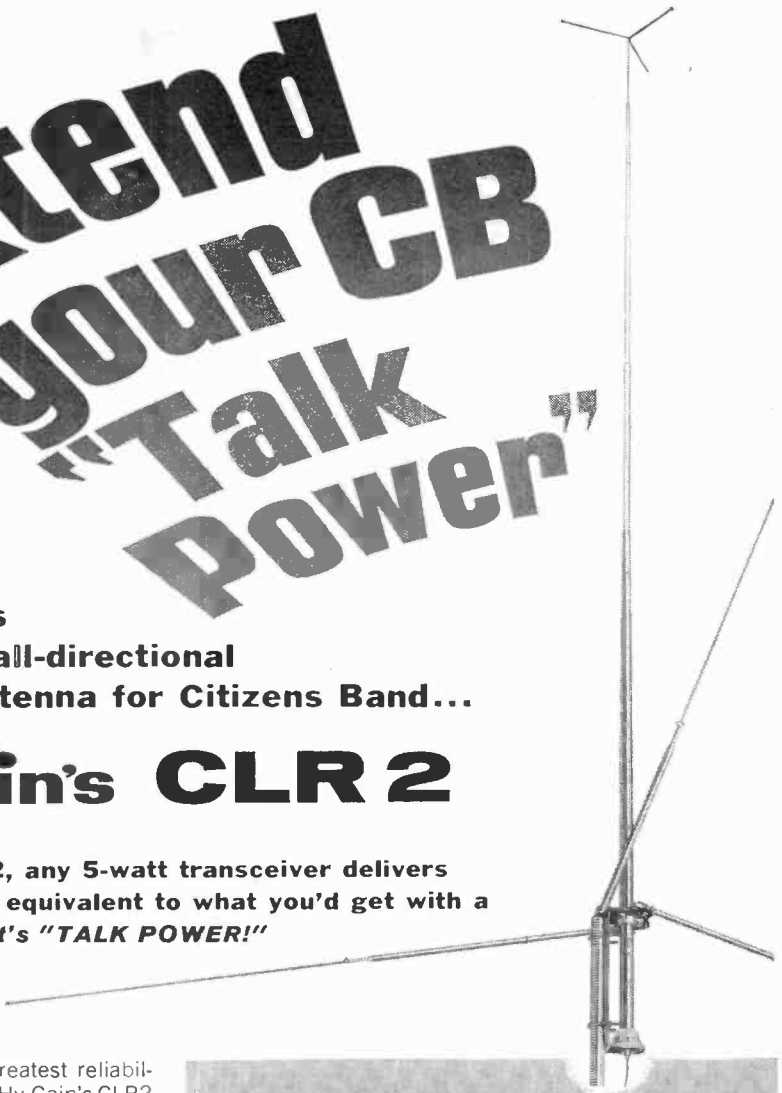

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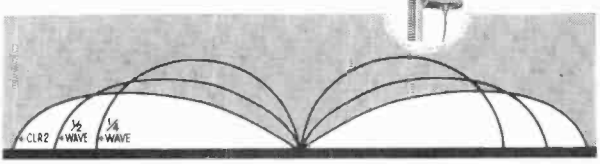

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CIRCLE NO. 17 ON READER SERVICE PAGE

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VOLUME 24 **JUNE, 1966** NUMBER 6

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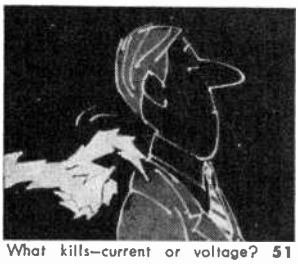
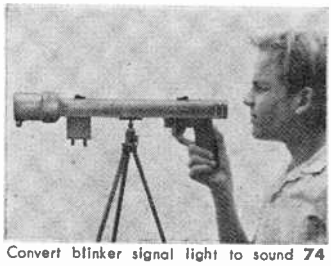
DEPARTMENTS



What kills—current or voltage? **51**



Convert blinker signal light to sound **74**

POPULAR ELECTRONICS is Indexed in the Readers' Guide to Periodical Literature

This month's cover photo by Bruce Pendleton

POPULAR ELECTRONICS, June 1966, Volume 24, Number 6 is published monthly at 307 North Michigan Avenue, Chicago, Illinois 60601. One year subscription rate for U.S., U.S. Possessions and Canada, $5.00; all other countries, $6.00. Second class postage paid at Chicago, Illinois and other mailing offices. Subscription Service: Portland Place, Boulder, Colorado 80302.

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Circulation Office
Portland Place
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All subscription correspondence should be addressed to POPULAR ELECTRONICS, Circulation Department, Portland Place, Boulder, Colorado 80302. Please allow at least six weeks for change of address. Include your old address, as well as new—enclosing if possible an address label from a recent issue.

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LETTERS
FROM OUR READERS

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MUCH ADO ABOUT HERTZ

In "Old World Standards Breaking Through" (April, 1966) you question the sensibility of adopting hertz as a unit of frequency. If cycle and hertz were equivalent, you might have a valid gripe. Actually, hertz is equivalent to cycles per second, and is a true frequency unit. Too often frequency is specified in cycles and the per second factor tacitly assumed. This may justify, in part, the creation of a new unit.

DANNY W. MCDONALD
Silver Spring, Md.

I agree that the term cycles is time-honored and sensible. Since one hertz equals one cycle, however, no real change is being made,

so it's kind of unimportant. But wow! When I got down to the bottom of the article, I darn near fell over. It actually looks like you said you don't like the metric system! Incredible!

WILLIAM H. ROBERTS, III
Reno, Nev.

In reference to the term "Hertz" in place of the word cycle, I get the feeling there is almost nowhere to turn in an effort to do something about this sort of thing. The tone of the announcement in the April issue is as if you have raised your eyebrows, shrugged your shoulders, and then turned the other way. Perhaps this isn't quite true but you leave me with the thought that you have a "hands tied" attitude. Is there no editorial objection to a thing like this?

C. S. STOCKSLAGER
Brookfield, Ill.

We have no disagreement with you, Danny. You do admit that while the "old" frequency designators did infer cps, they generally did

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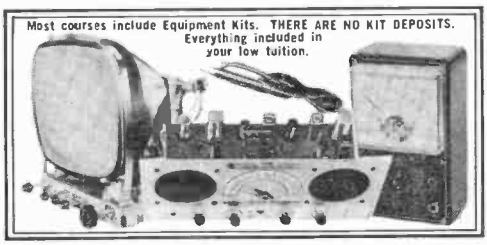

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LETTERS *(Continued from page 6)*

not carry the per second notation. Could be the term hertz is a step in the right direction, but it too will infer "per second." Bill, honest and truly, we have nothing against the metric system. See "Comes The Revolution" (May, 1966) for some very good reasons why we should use the metric system. We just didn't want to upset our printer, at least for another month. There is no way to turn, C.S., except maybe in cycles. There are many very fine electronic products on the surplus market that have been shunted aside by an ever-expanding technology, and electronics magazines that don't keep up with the changing standards will be competing for shelf space with these products.

ULTRASONIC OMNI-ALARM

In the explanation of how the "Ultrasonic Omni-Alarm" works (April, 1966), the last sentence in the first column on page 43 should read "resistor *R5* isolates the transducer," not *R8*. Resistor *R8* is part of the biasing network for *Q2*.

GEORGE CORNING
Redondo Beach, Calif.

The Parts List for the Ultrasonic Omni-Alarm calls for a 0-15 volt d.c. voltmeter. The front cover of the magazine shows a 0-10 ma.

meter on the alarm. Which is correct? Please send your answer as soon as possible so I can get started on this wonderful project.

JIM VARRONE
Miami, Fla.

Thank you, George; you're right. Jim, the Parts List is correct even though the cover does show a 0-10 ma. meter. It's possible that the author monitored current instead of voltage with the original model. Actually, the meter is optional, but it does make it easier to adjust alarm operation.

ELECTROMAZE WINS AGAIN

In response to your invitation for comments on the "Electromaze Puzzle" (April, 1966), let me tell you what happened to me the first time out. Starting at "Start," I tried hard to think of a 20-letter synonym for oscil-

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LETTERS (*Continued from page 8*)

loscope. I skipped down to Exit 1 and tried to work backwards. Obviously 10 had to be "neutron," but I had a heck of a time trying to think of a 20-letter synonym for "align." So then I skipped down to Exit 2 and found that I had a choice of either of two synonyms for "mica," one with 10 letters and one with 19 letters, the fourth letter being "a" in either case. Down I went to the final exit; the nut to crack here seemed to be an 11-letter synonym for "radian."

In the firm conviction that your magazine must be intended for intellects much more powerful than mine, I crawled like a miserable 10-fingered mass of brainless tissue toward p. 107 and the solution. You know what I found—vast expanses of white squares gaping where I had tried to fit in the weirdest of etymological concoctions! I will eventually recover from the bone-crushing blow to my ego, and my subscription will still be running, so let's have some more "Electromaze Puzzles" by all means.

STUART W. KELLOGG
Lexington, Mass.

Stuart, now that you have let the cat out of the bag, we have included this additional hint in the instructions in order to give everyone an equal opportunity. There's another Electromaze on p. 65.

ANTENNA STUBS

For years our television set has been "haunted by ghosts." We tried everything: noise filter, interference filters, additions to the antenna, etc. Nothing worked. Then we read the item in your Tips and Techniques column (March, 1966) entitled "Mismatch Stub Chases TV Ghosts." It works.

HARRY GOLDSTEIN
Toronto 3, Ont., Canada

REFLEXED REFLEXOMETER

The "Reflexometer" (March, 1966) presented an immediate challenge because of the rather obvious waste of relay contacts. With a little rearranging, I was able to use d.p.d.t.'s in place of *your* 4p.d.t. relays. I hated to see half of the second set of contacts wasted, so I added a buzzer to liven things up.

CARL STANISLAWSKI
Adelphi, Md.

If you are really ambitious, you can add four more players, hook up a bell and a buzzer, and you can play College Bowl.

JOHN POBANZ
Athens, Ohio

Although this circuit is an unusual application of electronics to the world of games, the use of relays seems wasteful, since they are very expensive, and their price far outweighs the toy's possible play value. With the

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LETTERS (*Continued from page 10*)

use of the "amazing" NE-2 neon bulb, however, this circuit can be constructed without relays at a small fraction of the original cost, and with the advantage of faster response.

GARRY BOROSS
Nanuet, N. Y.

Interest in the "Reflexometer" is running high. We have received several modifications and will try to present a number of them in the September or October issue. We are thinking of offering cash prizes for the best or

most unusual modifications. A penciled diagram and a brief explanation of how it works is all that is necessary, but a photo of the unit you built will also be useful. Send them to: Letters Editor. POPULAR ELECTRONICS, *One Park Avenue, New York, N. Y. 10016.*

DISCOURAGING PATENT PROCEDURES

I have several of what I feel to be more than just useful good ideas that I would like to patent. I have tried going through lawyers' offices and find that they have too long an arm and I have too short a pocketbook. Can you give me the ABC's of getting patent work done so that I might reap some financial gain?

DON PECK
Pilot Rock, Oreg.

Don, obtaining a patent is a highly specialized form of legal endeavor. There is no inexpensive substitute for a good patent attorney.

NOT ENOUGH HOURS IN A DAY

Your magazine is a "trouble maker." Almost every issue has a project in it that I have to construct in order to satisfy myself. It interferes with my work and study courses. On the other hand, your projects have taught me how to handle transistors, and I have enjoyed myself. I should very much like to see more R/C projects and possibly a transistor tester that can show frequency cutoff.

DONALD L. BEABOUT
St. Louis, Mo.

Donald, it looks like you are going to be absent from work and flunk some of your study courses, because we have more trouble for you in the works. —30—

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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 science. 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.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio Kit in the world, and is universally acuepted 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 and 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.

THE "EDU-KIT" IS COMPLETE

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, punched 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.

FREE EXTRAS

• SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits: the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-shooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

PRINTED CIRCUITRY

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.

UNCONDITIONAL MONEY-BACK GUARANTEE

ORDER FROM AD—RECEIVE FREE BONUS RADIO & TV PARTS JACKPOT WORTH $15

☐ Send "Edu-Kit" postpaid. I enclose full payment of $26.95.
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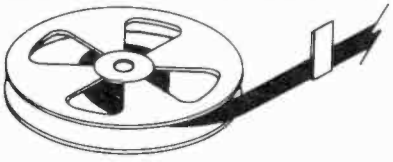
CIRCLE NO. 27 ON READER SERVICE PAGE

PARTS METHODS IDEAS GADGETS DEVICES TIPS & TECHNIQUES

END-OF-TAPE SIGNALS TELL YOU WHEN TO STOP

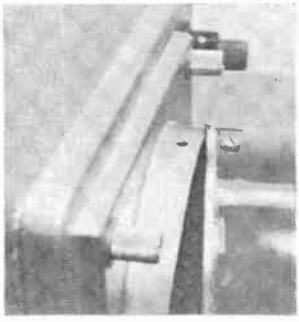
There's nothing more aggravating when you're recording a program than to discover that the end of the tape has come off the reel—unless it's having the tape come off the rewind reel when you are rewinding. Fold two



pieces of Scotch tape in the shape of a "U" and slip them over the tape—sticky side touching both sides of the tape—about 10 feet from each end. They should be long enough so that they protrude about ¼" from the top of the tape. When the tape reaches either point, there will be an unmistakable click—which will tell you it's time to stop the machine. If you use *red* Scotch tape, you can also make a visual check. —*William S. Gohl*

HOODED SCOPE SHIELDS TRACE FROM SIDELIGHTS

If your oscilloscope has a projecting rim around the CRT face, you can easily make a viewing hood to improve trace definition in a lighted room. Drill a clearance hole for a sheet metal screw at the top center of the rim as shown, and drill a tap hole for this screw in an empty coffee can (a 2-lb. can is just the right size for a 5" scope) to line up with the hole in the rim. Remove the bottom of the can and dress the edges to prevent cuts and scratches. Paint the inside flat black to eliminate re-



(*Continued on page* 20)

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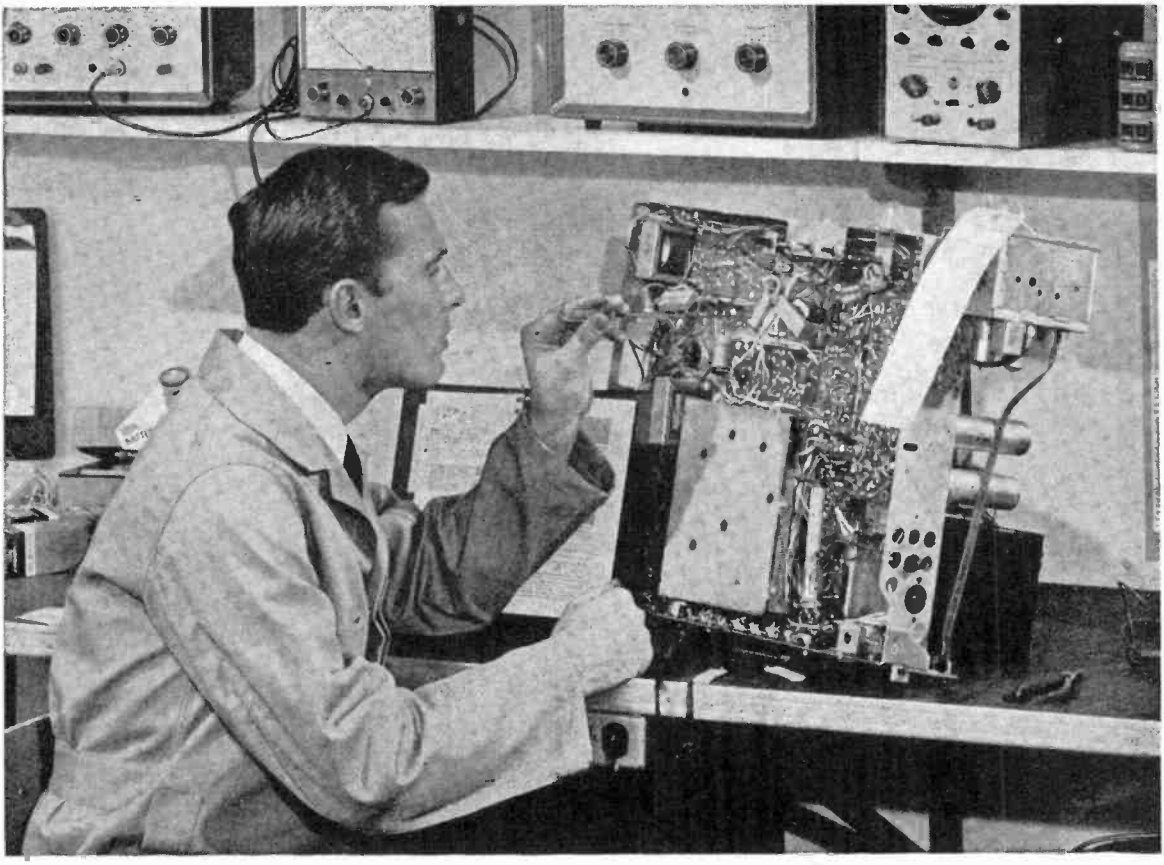

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Start building a profitable career in electronics now!
NEW RCA "AUTOTEXT" programmed instruction will help you learn faster and easier!

If you're considering a future in electronics, now is the time to start! A great new teaching aid—"AUTOTEXT" programmed instruction developed by RCA and introduced by RCA Institutes will help you master the fundamentals of electronics almost automatically. Even people who have had trouble with conventional home training methods are finding it easier and more fun to start their training in Electronics Fundamentals the RCA way. Prove it to yourself as others throughout the country are now doing. An interest or inclination in electronics is what you need. RCA "Autotext" helps you to do the rest. You'll be ready to go on to advanced training sooner than you ever thought possible! The future is unlimited; the jobs are available. The important thing is to get started now.

Founded in 1909, RCA Institutes is one of the largest technical schools in the United States devoted principally to electronics. The very name "RCA" means dependability, integrity, and scientific advance. RCA Institutes offers the finest facilities of home training. A Service of the Radio Corporation of America, RCA Institutes gives you the technical instruction you need to plan, build and realize the career you want in today's fastest growing field.

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- Nuclear Instrumentation
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Liberal Tuition Plan. All RCA Institutes Home Study courses are available under a Liberal Tuition Plan. This plan affords you the most economical possible method of home study training. You pay for lessons only as you order them. If, for any reason, you should wish to interrupt your training, you can do so and you will not owe a cent until you resume the course. No other obligations! No installment payments required.

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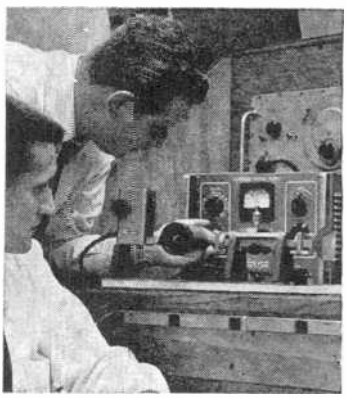
You Get Prime Quality Equipment. All kits furnished with the course are complete in every respect, and the equipment is top grade. You keep all the equipment furnished to you for actual use on the job... and you never have to take apart one piece to build another.

CLASSROOM TRAINING IN NEW YORK CITY

No previous training required. You are eligible even if you haven't completed high school.

RCA Institutes Resident School in New York City offers training that will prepare you to work in rewarding positions on research and production projects in fields such as automation, transistors, communications, technical writing, television, computers, and other industrial and advanced electronics applications. If you did not complete high school, RCA will prepare you for such training with courses specially designed to provide the basic math and physics required for a career in electronics. Check classroom training on attached card, and full information will be rushed to you.

Free Placement Service. RCA Institutes graduates are now employed in important jobs at military installations with important companies such as IBM, Bell Telephone Labs, General Electric, RCA, and in radio and TV stations all over the country. Many other graduates have opened their own businesses. A recent New York Resident School class had 93% of the graduates who used the FREE Placement Service accepted by important electronics companies... and had their jobs waiting for them on the day they graduated!



Coeducational Day and Evening Courses. Day and Evening Courses are available at RCA Resident Schools in New York City. You can prepare for a career in electronics while continuing your normal full-time or part-time employment. Regular classes four times each year.

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RCA The Most Trusted Name in Electronics

TIPS

(*Continued from page 14*)

flections. (For a more professional appearance, you can paint the outside of the can as well.) The hood can be quickly installed and removed without any tools.

—*Charles Erwin Cohn*

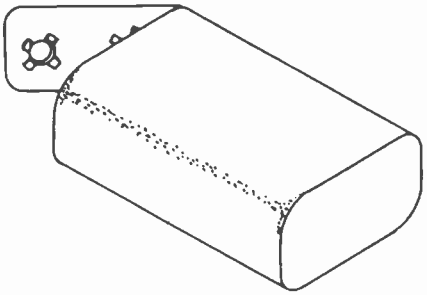
ICE TONGS COOL HOT FINGERS

The last time I got burnt pulling a hot tube with my bare hands, I decided to prevent it from happening again. I glued two small strips of foam rubber packing inside the jaws of an old ice-cube picker-upper to make a tube puller. And do you know what? No more burnt fingers.

—*Ken Weitzenhoffer*

SALVAGE TERMINALS FROM OLD BATTERIES

Why not save a few pennies and salvage the terminals from your worn-out batteries, for use in construction projects? It's a cinch to remove them. Some batteries, such as the 9-



volt transistor type, have male and female connectors mounted on an insulated strip. You can remove this strip without breaking it, or cut it in half, according to your needs. Terminals and sockets from other types of battery packs can be salvaged in a similar manner. Be sure to use care when opening the batteries to avoid messing up your clothing and your work area.

—*William S. Gohl*

"TIPS" WANTED

Do you have a favorite "tip" or "technique" that you would like to pass on to other readers? It may be worth money to you. Send it in (about 100 words or so, with a rough drawing and/or a clear photograph), and if it is accepted, you will receive a check in return. The size of the check will depend upon the originality of the idea and how practical it is. Material not accepted will be returned. Address the "package" to: Tips & Techniques Editor, POPULAR ELECTRONICS, 1 Park Avenue, New York, N. Y. 10016.

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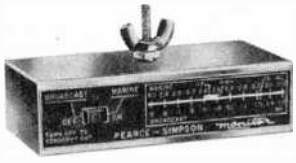
NEW PRODUCTS

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon on page 15.

CAR RADIO CONVERTER

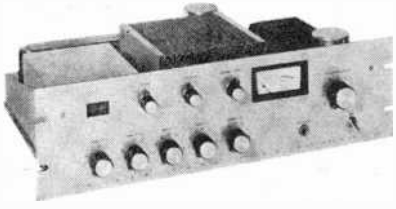
Want to know where the fish are biting? You can tune to ship-to-ship broadcasts at the flick of a switch if you install *Pearce-Simpson's* "Monitor" in your car. It converts an ordinary domestic or foreign car radio into a powerful marine receiver. Only 4½" x 1" x 2½", the solid-state, self-powered unit weighs just 6 ounces and can be installed in 10 minutes. It draws 200 times *less* current than an ordinary flashlight bulb. The "Monitor" will enable you to receive marine weather reports, Coast Guard emergency signals, marine operators, and time checks (from Station WWV).



Circle No. 75 on Reader Service Page 15

FIVE-CHANNEL MIXER-AMPLIFIER

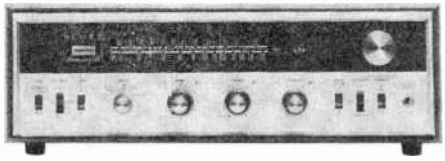
A well-known loudspeaker manufacturer, *R. T. Bozak,* has announced its first entry in the electronic field: the Model CMA-5-50 mixer-amplifier. This solid-state unit combines on a single chassis a mixer with five individual level-controlled input channels and a 50-watt power amplifier. The input channels are modular plug-in circuit cards; any of three types of channel can be plugged into any of the five inputs. Both low-level microphone input, with RTAA equalization, and high-level input are available. Overall frequency response of the amplifier is within 1½ db from 20 to 20,000 cycles. Portable case optional.



Circle No. 76 on Reader Service Page 15

FET AM/FM STEREO RECEIVER

Virtually total elimination of all cross modulation and drift, plus greater usable sensitivity, is promised by *H. H. Scott's* 382 solid-state AM/FM/FM stereo receiver—the 65-watt 382 is the first receiver to utilize new field-effect transistors in both AM and FM front-end circuitry. Features include the automatic adjustment of tuner bandwidth for the quality of the incoming signal and an automatic gain control. The tuner section includes a silver-plated FET front end for 2.5-μv. sensitivity (IHF) with 85 db cross modulation rejection. The solid-state amplifier stage delivers a conservative 32.5 watts music power per channel into a 4-ohm load (22.5 watts per channel at 8 ohms).



Circle No. 77 on Reader Service Page 15

25-CHANNEL CB TRANSCEIVER

Two emergency H.E.L.P. channels are featured in *Lafayette Radio Electronics'* imported "Comstat 25" transceiver in addition to the regular 23 CB channels. The "Comstat 25" utilizes a frequency synthesizer circuit to provide crystal control for all 25 channels on both receive and transmit functions. Its dual-conversion receiver has 0.8-μv. sensitivity, selectivity of 6 kHz at 26 db down, illuminated tuning dial and S-meter, variable squelch and variable fine tuning. The transmitter features an advanced "Range Boost" circuit, modulation indicator, and a switch for p.a. work. "Comstat 25" is supplied with *all crystals,* mobile mounting bracket, and ceramic push-to-talk microphone.

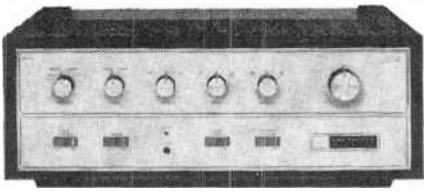
Circle No. 78 on Reader Service Page 15

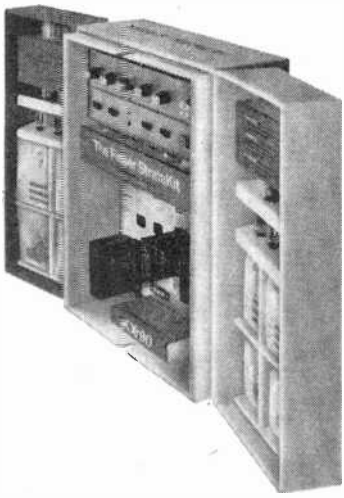
MAGNET-BASE CB ANTENNA

The Alnico magnet in the base of *Hy-Gain Electronics'* "Magna-Topper" mobile CB antenna permits instant installation on any car, truck, tractor, or other vehicle. There are no holes to drill, no special tools required. You simply hook up the feedline furnished with the antenna to any CB transceiver, place the antenna on the roof top, trunk deck, or any other metal surface, and that's it. Tests have shown that the magnet will hold the antenna in place even at speeds of over 80 mph. And the antenna can be easily moved from vehicle to vehicle. Just 29" tall, the "Magna-Topper" has a durable stainless steel whip section

Who makes the only great amplifier for $99.50?

You do... with the new Fisher KX-90 StrataKit.





Now, for the first time in high fidelity history, you can own a truly distinguished stereo control-amplifier for less than $100—if you are willing to build it yourself.

Fisher refuses to compromise quality. Therefore, even at $99.50*, the Fisher KX-90 StrataKit incorporates the same basic standard of fidelity as the most expensive Fisher components. Take away its price tag and it would still excite the admiration of the fastidious audiophile.

With 40 watts of clean power, the KX-90 can drive even inefficient speakers to their maximum performance level. Superior output transformers make certain this power will not fall off steeply at the frequency extremes. Advanced preamplifier features, including rocker switches and complete phono/tape facilities, provide unlimited flexibility.

It's all yours if you follow directions. And that's no problem with the exclusive Fisher StrataKit method. No experience is necessary. Assembly takes place by simple, *errorproof* stages (Strata). Each stage corresponds to a *separate* fold-out page in the uniquely detailed instruction manual. Each stage is built from a *separate* packet of parts (StrataPack). Major parts come already mounted on the extra-heavy-gauge steel chassis. Wires are *pre*cut for every stage —which means every page. All work can be checked stage-by-stage and page-by-page, before proceeding to the next stage.

The end result is a Fisher stereo control-amplifier that is fully equal in performance as well as reliability to its factory-wired prototype. Fisher guarantees this. And who should know better than Fisher?

FREE! $1.50 VALUE!

Send for *The New Kit Builder's Manual*, an illustrated guide to high fidelity kit construction, complete with detailed specifications of all Fisher StrataKits.

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*WALNUT CABINET, $24.95

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The Fisher

CIRCLE NO. 14 ON READER SERVICE PAGE

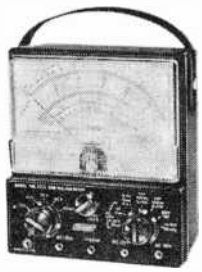
PRODUCTS *(Continued from page 22)*

equipped with a Hy-Q loading coil and lifetime adjustable tuning rod. It comes with 16 feet of coaxial cable and a PL-259 connector.

Circle No. 79 on Reader Service Page 15

SENSITIVE VOM

Extraordinary sensitivity is claimed for *Mercury Electronics'* Model 1800-volt-ohm-milliammeter: it goes down to the 0.25-volt scale for solid-state transistor work. Housed in a portable, high-impact durable case, the Model 1800 features a full-view, easy-to-read 6" meter. It measures a.c. voltage in six ranges from 0-2.5 to 5000 with an input resistance of 5000 ohms per volt at better than 4% accuracy; d.c. voltage in eight ranges from 0-0.25 to 5000 with an input resistance of 20,000 ohms/volt and 2% accuracy; d.c. current in six ranges (0-50 ma. to 10 amperes) with 2% accuracy; output in four ranges (from −20 to +50 db); resistance in three ranges (0-20 megohms) with 2% accuracy.



Circle No. 80 on Reader Service Page 15

PORTABLE COLOR GENERATOR

According to *Sencore, Inc.*, the new "Lo-Boy" solid-state RCA licensed color pattern generator has been created to fill the increasing need for a portable generator for field use and to provide a low-cost generator for the beginner. The timer circuits are so simple that the controls are located on the front panel and are

adjusted just like the horizontal and vertical hold controls on a TV set. Powered by "C" cells that are replaceable from outside the unit, the "Lo-Boy" provides the five basic patterns used in convergence: ten standard RCA-type color bars, individual horizontal and vertical lines, crosshatch, and adjustable-size white dots. A variable interlace control allows for the correction of the interlace found on some TV sets.

Circle No. 81 on Reader Service Page 15

VERSATILE VACUUM BASE

There are a great variety of uses for *Edmund Scientific's* inexpensive vacuum base. It permits the attachment of many tools and appliances to most flat surfaces in seconds, yet allows instant removal. The bottom of the base is a neoprene pad; the top is a metal plate to which you affix the appliance. A slight pressure on the top as you push down a lever on the side creates a vacuum which resists a force of 200 pounds perpendicular to the base, 50 to 75 pounds parallel to the base.

Circle No. 82 on Reader Service Page 15

"DUSTMITE" RECORD CLEANER

Having trouble keeping your hi-fi records clean? "DustMite" is said to be capable of removing even the smallest debris from the record surface and grooves. It does the job by means of static attraction and the mechanical action of a special pile fabric that fits into the grooves, cleaning each one hundreds of times per play. "DustMite" tracks the record in the same manner as a stylus. Result: clean sound.

Circle No. 83 on Reader Service Page 15

SIX-BAND PORTABLE RECEIVER

Performance comparable to that of professional communications receivers is claimed for the six-band portable introduced by *Hallicrafters*. Called the WR-4000, the solid-state unit is powered by regular size-"D" flashlight batteries. Each of the six bands is displayed individually on a drum-type dial, and a logging scale is provided for pinpointing frequencies. The bands are: 185-400 kHz (long-range radio navigation); 535-1650 kHz (standard AM broadcast); 2-4 MHz, 5.85-10.3 MHz, 11.4-18.2 MHZ (international short-wave frequencies); and 86.5-108.0 MHz (entertainment FM frequencies). Two antennas are included—a loopstick for AM and FM, and a whip for short-wave and FM reception. A self-contained 4" x 6" oval speaker and a headset jack are also provided.

Circle No. 84 on Reader Service Page 15

AMATEUR RADIO MOBILE ANTENNA

Designed for five-band amateur operation, the "Lancer 1000" mobile antenna announced by *Mosley Electronics* ranges in length from 8 feet on 10 meters to 9 feet, 7 inches, for 15 to 80 meters. The corrosion-proof antenna is power-rated for 1 kw. AM/CW and 2 kw. PEP SSB input to the final on the five amateur bands. The top and bottom whip sections screw together for use on 10 meters. Operation on the other amateur bands is accomplished through interchangeable waterproof coils. When the antenna and all four coils are purchased simultaneously, a protective coil caddy is furnished free of charge.

Circle No. 85 on Reader Service Page 15

Plain Talk from Kodak about tape:

Giving your tape library a longer prime of life

How long can you keep a recorded tape? As of today, nobody knows for sure. Recording companies have tapes dating back to the late 1940s that are still in fine shape. Actually, the aging problem for tape is somewhat akin to the ones faced by movie-makers. Their problems are tougher, though . . . movie-makers have to worry about latent chemical reactions, greater mechanical strains, etc. And yet, we can see movies made more than a half century ago if the films have been given proper care and expert duping. Like photographic films, many audio tapes are made on acetate base. Ours is Kodak's famous DUROL Base, the stronger, tougher triacetate (we also make KODAK Tapes with a tempered polyester base for extra toughness or for long-play applications). Lab tests show that DUROL Base holds up as well as photographic film. So . . . tape wise, there's no reason your great grandchildren won't be able to enjoy your present efforts.

T.L.C. makes the big difference. Tender loving care is a must when saving anything worthwhile. The same goes for tapes. One obvious safeguard is to keep tapes away from strong magnetic sources like large electric motors or transformers which could demagnetize a recording.

Keep it clean. Tapes hate dirt just as much as regular records do. Thanks to sturdy, one-piece construction, Kodak's new "library décor" box helps keep dirt out... won't fall apart over the years as conventional tape boxes sometimes do. And this new box looks better. Play it clean too, of course. Clean your recorder heads, capstans, rollers and guides regularly with a cotton swab moistened with one of the commercial cleaners sold for that purpose. Use a degausser periodically to remove any magnetization of recording heads.

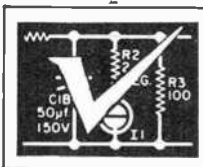
Keep it cool. Tapes should be kept away from extremes of temperature and humidity. High temperatures may affect the plastic support and increase the possibility of print-through... the transfer of magnetic signals from one layer of tape to the next.

Keep it "backwards". For truly valuable recordings, a good trick is to keep your tapes in the "tails out" format rather than rewinding them. The uneven winding induced in the tape by fast rewinding can cause physical warping of the tape over a period of time. Here too, you're better off with KODAK Tapes because KODAK 5" and 7" Thread-Easy Reels are of dynamically balanced, one-piece construction. This gives you freedom from wobbles and pulsations on both "record" and "rewind"... keeps the tape under smoother tension . . . just what the doctor ordered for long tape life. The need for smooth winding can not be overemphasized.

Last but not least, it's a good idea to dupe your really old tape recordings onto fresh KODAK Tape in order to standardize on KODAK Tape quality. That's an interesting subject all by itself, and we'll try to devote a "Plain Talk" to it soon! KODAK Tapes on DUROL and polyester bases are available at electronic, camera and department stores. To get the most out of your tape system, send for free 24-page "Plain Talk" booklet which covers the major aspects of tape performance. Write Department 940, Eastman Kodak Company, Rochester, N. Y. 14650.

EASTMAN KODAK COMPANY, Rochester, N. Y.

CIRCLE NO. 9 ON READER SERVICE PAGE



OPERATION ASSIST

Through this column we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other P.E. readers. Here's how it works: Check the list below. If you can help anyone with a schematic or other information, write him directly—*he'll appreciate it. If* you *need help, send a postcard to Operation Assist,* POPULAR ELECTRONICS, *One Park Avenue, New York, N.Y. 10016. Give maker's name, model number, year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Because we get so many inquiries, none of them can be acknowledged.* POPULAR ELECTRONICS *reserves the right to publish only those items not available from normal sources.*

McMurdo Silver Model 700 transmitter, circa 1950; tunes 144-240 MHz. Schematic needed. (A. Fukushima, 704 Casa Loma, 105 Ward Pkwy., Kansas City, Mo.)

Hammarlund receiver, surplus; tunes .54 to 54 MHz on 6 bands; has 20 tubes. Tech manual TM11/851 needed. **Motorola** Model 401 car radio, ser. 43694, circa pre-war; has 7 tubes. Operating manual needed. (J. Penney, Box 713, Anchorage, Alaska 99501)

Philco Model 38-8 receiver, circa 1938; tunes AM from 5.5 MHz to 19.5 MHz; has 6 tubes. Schematic and parts list needed. (S. K. Clarke, 619 Jefferson Ave., Rahway, N.J. 07065)

BC-AN-229 receiver made by Western Electric; has 6 tubes. Schematic and power supply hookup connection diagram needed. (J. Grunden, Rt 2, Box 545, Yakima, Wash.)

Philco Model 620 receiver, ser. E27336; tunes BC and s.w.; has 6 tubes. Schematic needed. (Dale Davis, 4524 Ave. B. Austin, Tex. 78751)

RT-350 A/URC 14 walkie-talkie, made by Philharmonic. Schematic needed. (Neil Lewbel, 8130 88 St., Glendale. N.Y. 11227)

Philco Model 42-380 receiver, code 121; tunes BC and s.w.; has 8 tubes. Schematic needed. (Edward F. Yarnall, Jr., Box 174, Mildred, Pa. 18632)

Precision "Tube Master" Model 10-12. Schematic, operating manual, and roll chart MRCF2B needed. **Feller Electronic** "Stethoscope" Model TS-3A signal tracer. Schematic and operating manual needed. (Alvan P. Eddy, Box 111, Hampton, S. C. 29924)

AN/ART-13 transmitter, made by Collins Radio; tunes 2 to 18 MHz.; has 813 final and two 811 modulators. Maintenance manual needed. (Jim S. Horn, 519 Rainier Way, Issaquah, Wash. 98027)

Airline Model 04BR-907A receiver, circa 1940; tunes BC and s.w. Tuning dial scale, pointer, and 2 plastic push buttons needed. (Garnet W. Frank, Route 1, Potsdam, N.Y. 13676)

E. H. Scott Model SLR-H receiver, surplus, ser. 4611; covers 3 bands from 0.53 MHz to 15.6 MHz. Schematic needed. (John J. Hangac, 38 Alder St., Yonkers, N.Y. 10701)

Webster Model W945 amplifier, ser. 59789; has 13 tubes. Schematic and service manual needed. (Louis M. Giudice, 45 Heathcote Rd., Elmont, N.Y. 11003)

Philco Model 37-630 receiver, code 121; tunes from 540 to 22 MHz; has 6 tubes. Schematic needed. (Gary Luthardt, 3201 Sherman St., Marinette, Wis. 54143)

(*Continued on page 88*)

WELCOME ABOARD!

International's "FLYING SHOWROOM 66" will visit your area soon. Welcome aboard this fabulous electronic flying display.

During 1966, International's Martin 202 Flying Showroom will tour cities throughout the United States, bringing with it displays of International electronic equipment and products, plus a technical staff available for consultation. ■ A space age electronic show for Citizens Radio dealers and users, Amateur Radio operators, users of commercial 2-way radio, manufacturers requiring special electronic products, radio experimenters and hobbyists. ■ If you are a manufacturer, radio equipment dealer, Amateur or Citizens Radio Club, or other interested groups, we will attempt to schedule a specific time and date to visit your area. Watch for announcement or write International Crystal Manufacturing Co., Inc. for details.

Discuss your technical and engineering requirements with International's staff. See how International electronic products can work for you.

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CIRCLE NO. 18 ON READER SERVICE PAGE

6 HEATHKIT® Values . . . See

NOW AVAILABLE FOR IMMEDIATE DELIVERY... HEATHKIT 21" COLOR TV!

THE ONLY 21" COLOR TV YOU CAN INSTALL 3 WAYS!

1. In a wall
2. In your own cabinet
3. In either Heath optional factory-assembled cabinets

Kit GR-53A

$375.00

(less cabinet)

COMPARE THESE FEATURES!

• "Rare-earth" 21" color tube for brighter colors • 24,000 volt regulated picture power • Tunes channels 2-83 • Automatic color control & gated automatic gain control for steady, "jitter-free" pictures • Deluxe "turret-type" tuners with "push-to-fine-tune" that "remembers" so you don't have to readjust each time you return to a channel • All critical assemblies prebuilt, aligned & tested . . . just 3 simple circuit boards to wire . . . requires no special skills or knowledge • 1-year warranty on picture tube, 90 days on all other parts

No Need To Wait . . . Enjoy "True-To-Life" Color TV Now! Until recently, this unique color TV kit has been on a reservation basis due to the nation-wide shortage of color tubes. Now we have them in stock and can fill your order immediately.

The Only 21" Color TV You Can Align & Maintain . . . eliminates costly TV service calls for simple color picture adjustments and minor repairs. Exclusive built-in self-servicing facilities coupled with simple-to-follow instructions and detailed color photos show you exactly what to do and how to do it. You become the expert! Results? Clean, true-to-life color pictures day in and day out.

From Parts To Pictures In Just 25 Hours! As easy to build as an audio amplifier. And you enjoy the savings (quality compares to sets costing up to $200 more). You even set-up and converge the picture . . . another cost-saver! Easy credit terms available, too. Use the coupon to order now!

Kit GR-53A, 125 lbs., all parts except cabinet, for wall or custom cab. mounting.....**$375.00**
GRA-53-7, 82 lbs., deluxe walnut cab. (illust.)..**$108.00**
GRA-53-6, 51 lbs., economy walnut-finished cabinet **$46.50**

Kit GW-14

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Assembled GWW-14

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23 crystal-controlled transmit & receive channels for the utmost reliability. Low battery drain . . . 0.75 A transmit, 0.12 A receive. Only 2⅞" H. x 7" W x 10½" D . . . ideal for car, boat, any 12 v. neg. gnd. use. "S" meter, adjustable squelch, ANL, built-in speaker, PTT mike, aluminum cabinet. 8 lbs.

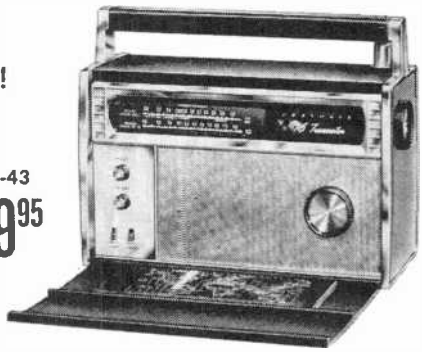
Kit GWA-14-1, 5 lbs., optional AC power supply for base-station operation **$14.95**
GWA-14-2, 1 lb., 23-Channel Crystal Pack (46 crystals) . . . reg. $137.50 value.....only **$79.95**
Kit GWA-14-4, 3 lbs. . . 6 to 12 v. DC converter for GW-14 .....**$14.95**
CB crystals only $1.99 with any Heathkit CB Transceiver order.

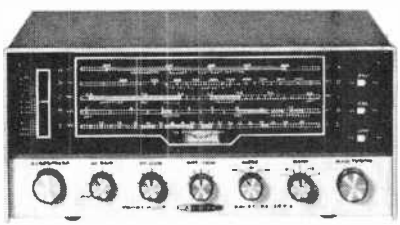
The Other 244 In FREE Catalog!

Deluxe All-Transistor, 10-Band Shortwave Portable!

10 bands tune longwave, standard AM, FM and 2-22.5 mc shortwave. 16 transistors, 6 diodes, and 44 factory-built & aligned RF circuits. Separate FM tuner & IF strip same as used in deluxe Heathkit FM tuners. Two built-in antennas, 4" x 6" speaker, battery-saver switch. Operates anywhere on 7 flashlight batteries, or on 117 v. AC with optional charger/converter GRA-43-1 @ $6.95. Assembles in 10 hours. 17 lbs.

Kit GR-43
$159.95



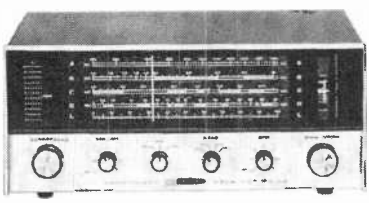


Kit GR-54
$84.95

New Deluxe Shortwave Radio!

Compare it to sets costing $150 and more! 5 bands cover 200-400 kc, AM, and 2-30 mc. Tuned RF stage, crystal filter for greater selectivity, 2 detectors for AM and SSB, tuning meter, bandspread tuning, code practice monitor, automatic noise limiter, automatic volume control, antenna trimmer, built-in 4" x 6" speaker, headphone jack, gray metal cab., free SWL antenna. 25 lbs.

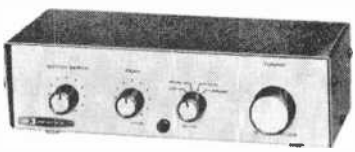
Low Cost Shortwave Radio!



Kit GR-64
$37.50

Covers 550 kc to 30 mc—includes AM plus 3 shortwave bands. 5" speaker; bandspread tuning; signal strength indicator; 7" slide-rule dial; BFO; 4-tube circuit plus 2 rectifiers; noise limiter; external antenna connectors; Q-multiplier input; gray aluminum cabinet; AM antenna. 15 lbs.

New "Q" Multiplier!



Kit GD-125
$14.95

Use with matching GR-64 (opposite) or similar SWL receivers with IF circuits from 450-460 kc. Creates extra-sharp selectivity through an efficient "Q" of 4000 and provides a notch for adjacent signal attenuation. Includes built-in power supply. Charcoal cabinet gray front panel. 3 lbs.

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ELECTRONICS LIBRARY

TRANSISTOR ETCHED-CIRCUIT PROJECTS

by James Kyle

The experimenter/hobbyist who doesn't try building his own printed circuit board projects is missing a lot of fun. In this book, Jim Kyle has assembled the plans for some 30 different projects—all on printed circuit cards—some unbelievably simple, some moderately complex, but all of them interesting. A noteworthy feature of the volume can be found in the last eight pages, which are really overlays to assist in the etching of your own boards.

Published by Howard W. Sams & Co., Inc., 4300 W. 62 St., Indianapolis, Ind. 46206. Soft cover. 152 pages. $2.95.

RADAR—PRINCIPLES AND PRACTICES

by F. Jonathan Mivec

Many electronic technicians are reluctant to attempt the repair or adjustment of radar circuits because they can't help feeling that such circuits are too complex for them. This volume was prepared to acquaint the average technician with the basic circuits used in radar and to explain their operation in simple terms. It is surprising how much similarity there is between many of these circuits and the circuits usually found in TV sets, test equipment, etc. Liberally illustrated.

Published by Techpress, Inc., Brownsburg, Ind. 46112. Soft cover. 260 pages. $4.95.

DICTIONARY OF ELECTRONICS

by Harley Carter

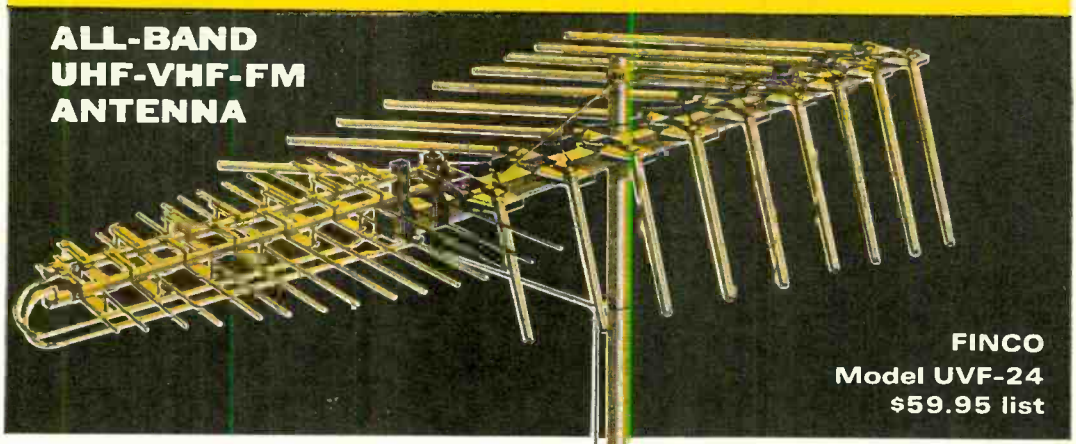
If you don't believe that electronics has developed a language of its own, take a look at this dictionary. Thousands of definitions have been worked into this British publication—definitions ranging from the simplest and most commonly used expressions to Dyads, Lenard Rays, and Schottky Effects.

Published by Hart Publishing Co., Inc., 510 Sixth Ave., New York, N.Y. 10011. Soft cover. 410 pages. $2.65.

(Continued on page 32)

FINCO COLOR-VE-LOG ANTENNAS
FOR UHF, VHF, FM RECEPTION

ALL-BAND UHF-VHF-FM ANTENNA

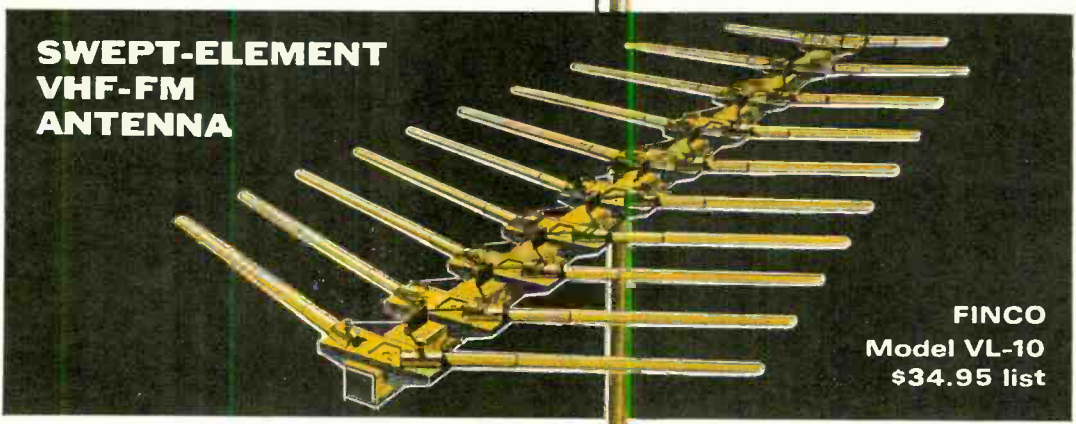


FINCO Model UVF-24 $59.95 list

The one antenna that does the work of 3! Gives startlingly clear black and white pictures and beautiful color on both UHF and VHF television channels — plus the finest in stereophonic and monophonic sound reproduction.

FINCO Model UVF-18—$42.50 list
FINCO Model UVF-16—$30.50 list
FINCO Model UVF-10—$18.50 list

SWEPT-ELEMENT VHF-FM ANTENNA



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CIRCLE NO. 13 ON READER SERVICE PAGE

LIBRARY (*Continued from page 30*)

KNOW YOUR SIGNAL GENERATORS

by Robert G. Middleton

Signal generators are among the most versatile and frequently used pieces of test equipment. In this book, you will find explanations of generator circuits and details on some of the more basic applications. Bob Middleton tells you how to calibrate the various bands, analyzes common troubles, and gives practical tips on keeping a generator in top operating condition. The book is intended for the beginner as well as for the old-timer who wants to know what makes the newer type of generators "tick." However, it is assumed that the reader has a basic working knowledge of electronics.

Published by Howard W. Sams & Co., Inc., 4300 W. 62 St., Indianapolis, Ind. 46206. Soft cover. 144 pages. $2.50.

SEMICONDUCTOR CIRCUITS HANDBOOK, Volume II

Over 50 simple manufacturers' circuits—power supplies and regulators, power converters, logic circuits, and nonlinear circuits—are presented here. Each circuit is fully explained for ease of construction, and all components used are readily available. Portions of this book were reprinted from the U. S. Department of Defense MIL-HDBK-215.

Published by Techpress, Inc., Brownsburg, Ind. 46112. Soft cover. 128 pages. $1.95.

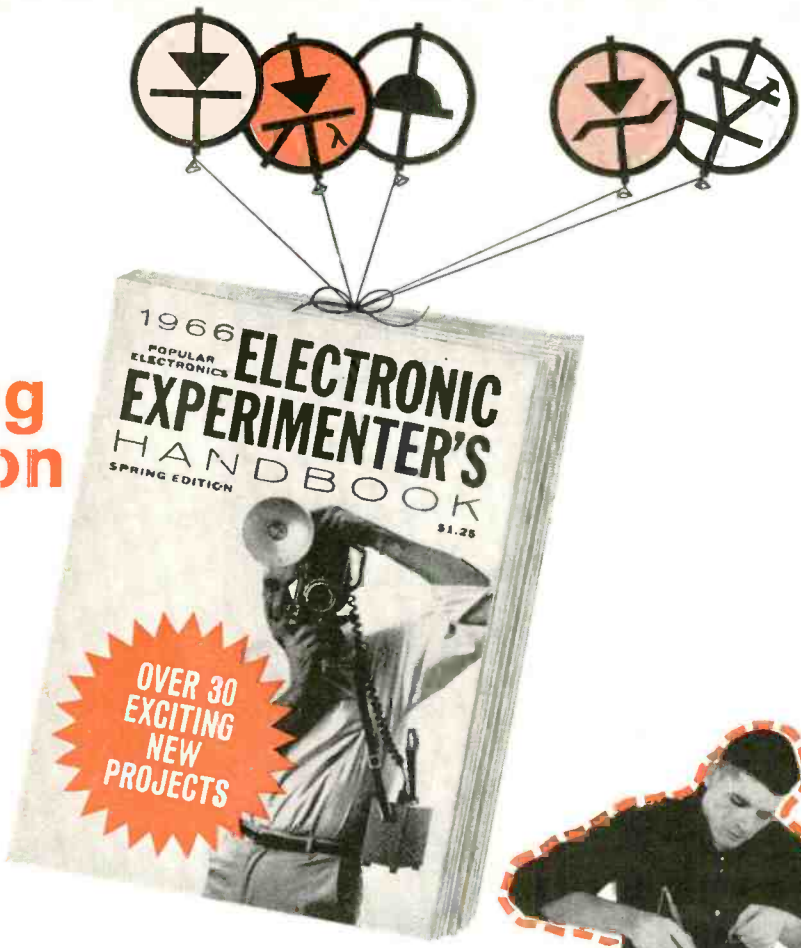
PRACTICAL TRANSISTOR SERVICING, Second Edition

by William C. Caldwell

This book tells you how transistors work and how to isolate troubles in all types of transistor radios—including auto radios. It also tells you how to service all types of transistorized equipment (now including FM sets) better and faster by using pretested procedures. Circuit components and their functions are discussed, as are the causes of improper voltages, and the testing of transistors. Actual case histories are given.

Published by Howard W. Sams & Co., Inc., 4300 W. 62 St., Indianapolis, Ind. 46206. Soft cover. 192 pages. $2.95. —30—

spring edition



Now Available—The all-new Spring 1966 Edition of ELECTRONIC EXPERIMENTER'S HANDBOOK! Another big package of over 30 fascinating do-it-yourself construction projects for:

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You'll build such valuable units as...a super photo flash... a simple auto light minder...a transistor FM multiplexer... compact BCB DX antennas...an electric fence charger...and a self-regulating lighting controller.

Each has complete, easy-to-follow schematics, parts lists and how-to instructions that guarantee you perfect finished products! Plus—dozens of professional pointers, tips and techniques to increase your electronics skills and proficiency.

In all, more than 148 pages of challenging projects that will deliver hour after hour of sheer fun...and provide you with economically-built, useful items (to keep, or sell for a profit) after you've finished.

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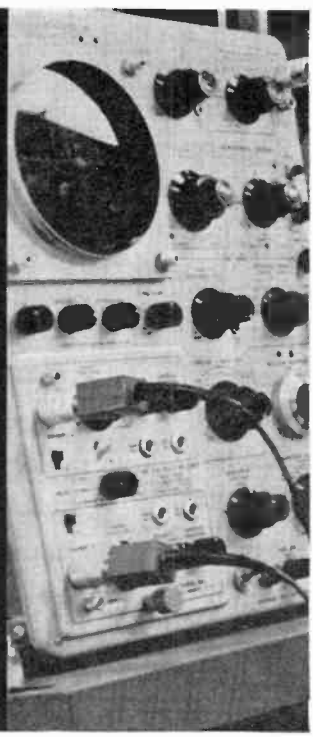
PAYMENT MUST BE ENCLOSED WITH ORDER.

In today's electronics boom, the demand for men with technical education is far greater than the supply of graduate engineers. Thousands of real engineering jobs are being filled by men without engineering degrees—provided they are thoroughly trained in basic electronic theory and modern application. The pay is good, the future is bright...and the training can now be acquired at home—on your own time.

How to become a "Non-Degree Engineer"



The electronics boom has created a new breed of professional man—the non-degree engineer. Depending on the branch of electronics he's in, he may "ride herd" over a flock of computers, run a powerful TV transmitter, supervise a service or maintenance department, or work side by side with distinguished scientists on a new discovery.

But you do need to know more than soldering connections, testing circuits and replacing components. You need to really know the fundamentals of electronics.

How can you pick up this necessary knowledge? Many of today's non-degree engineers learned their electronics at home. In fact, some authorities feel that a home study course is the *best* way. *Popular Electronics* said:

"By its very nature, home study develops your ability to analyze and extract information as well as to strengthen your sense of responsibility and initiative."

Cleveland Method Makes It Easy

If you decide to advance your career through home study, it's best to pick a school that *specializes* in the home study method. Electronics is complicated enough without trying to learn it from texts and lessons that were designed for the classroom instead of the home.

The Cleveland Institute concentrates on home study exclusively. Over the last 30 years it has developed techniques that make learning at home easy, even if you once had trouble studying. Your instructor gives the lessons and questions you send in his undivided personal attention—it's like being the only student in his "class." He not only grades your work, he analyzes it. And he mails back his corrections and comments the same day he gets your lessons, so you read his notations while everything is still fresh in your mind.

Students who have taken other courses often comment on how much more they learn from CIE. Says Mark E. Newland of Santa Maria, Calif.:

"Of 11 different correspondence courses I've taken, CIE's was the best prepared, most interesting, and easiest to understand. I passed my 1st Class FCC exam after completing my course, and have increased my earnings by $120 a month."

Always Up-to-Date

Because of rapid developments in electronics, CIE courses are constantly being revised. This year's courses include up-to-the-minute lessons in Microminiaturization, Laser Theory and Application, Suppressed Carrier Modulation, Single Sideband Techniques, Logical Troubleshooting, Boolean Algebra, Pulse Theory, Timebase Generators...and many more.

CIE Assures You an FCC License

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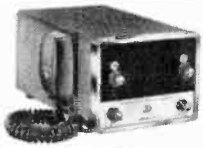

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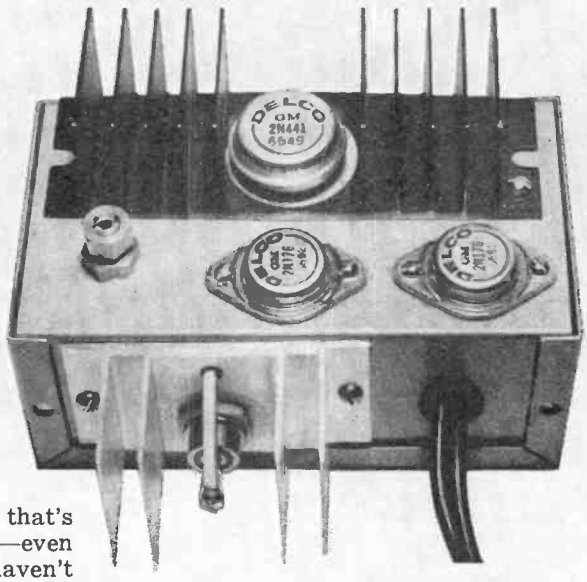
BREAKTHROUGH!

SOLID-STATE CAR VOLTAGE REGULATOR

With no springs to adjust, and no relay contacts to erode, wear, or stick, the solid-state voltage regulator with all-electronic switching is an ideal replacement for the older electromechanical units



By BRIAN C. SNOW
Engineering Development Services
Delco Radio Division
General Motors Corporation

COVER STORY

EVER HEARD of a regulator that's designed to outlast your car—even if it's a Cadillac? Maybe you haven't because the concept is new—so new, in fact, that you can't even buy this regulator from your dealer . . . yet. But you *can* make one—an all-electronic device with no moving parts—for about $15.

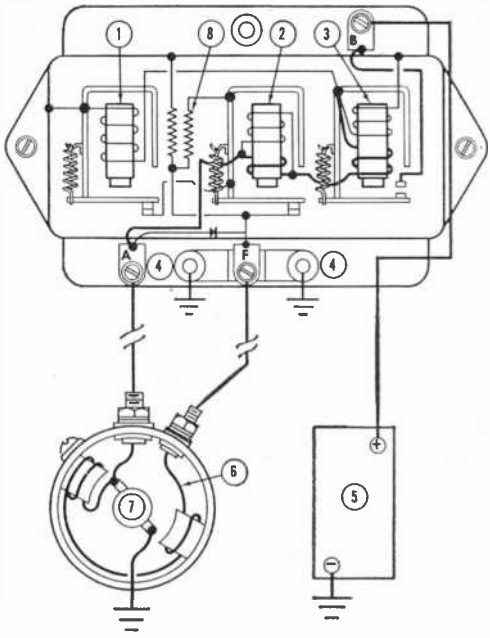
This new solid-state design for 12-volt, negative-ground, generator-equipped cars does away with constant regulator failures that cause your generator to burn out prematurely, or your battery to keep on discharging. It prevents excessive charging or failure of the generator to charge due to regulator contacts that pit, stick, or oxidize. Voltage and current regulation are accomplished quietly, electronically!

Conventional Regulator. To understand how a solid-state (electronic) regulator works, you must first understand how the ordinary current and voltage regulator (Fig. 1) works. The regulator contains a circuit breaker (cutout) relay, a current regulator relay, and a voltage regulator relay. The circuit breaker relay acts like an automatic switch between the generator and the battery. It closes the charging circuit when the generator is charging, and opens it when the generator is *not* charging, i.e., when the engine is just idling or not running at all. Thus, the battery is prevented from discharging through the generator during these periods.

The purpose of the current regulator is to limit the generator output current to a predetermined maximum level—nominally, 30 amperes. When this limit is reached, the relay picks up, removing the short across the resistance. And since this resistance is in series with the generator field coil, the field current is reduced, thereby reducing the generator output.

The reduced current causes the relay to drop out, shorting out the resistance once more, and causing the current to

Editor's Note: If the unit above and the one on the cover look different—they are. The cover photo was taken of a prototype. The proof-tested version is shown and described in this article.



LEGEND

1 Voltage regulator coil	5 Car battery
2 Current regulator coil	6 Generator field lead
3 Circuit breaker (cutout) coil	7 Generator armature
4 Grounding screws	8 Resistor

Fig. 1. Conventional regulators employ two relays to achieve voltage and current regulation. A third relay acts as a circuit breaker to keep the battery from discharging through the generator field coil.

rise again. These changes occur so rapidly that the relay contacts open and close at a high frequency rate (about 200 times per second), thereby holding the output fairly constant.

The voltage regulator acts to hold the voltage of the car's electrical system constant within close limits. When the generator voltage rises to a predetermined value (approximately 15 volts), the voltage relay contacts open and close at a rapid rate, cutting a resistor in and out of the field circuit to limit the generator output.

The disadvantages of this electromechanical device are immediately apparent. Contact erosion and wear introduce resistance into the circuit. Metal fatigue of springs causes voltage and current sensing levels to change. These combinations of changing relay characteristics cause erratic relay operation that can be directly attributed to failure of the regulator to limit voltage and currents to acceptable levels.

Solid-State Regulator. In the solid-state regulator (Fig. 2), diode *D1* acts as the circuit breaker. When the generator output is low, or non-existent, the cathode of *D1* is reverse-biased by the car battery voltage, and no current can flow through the generator circuit to discharge the battery. But when the generator is charging, its output overcomes the reverse bias and *D1* conducts to charge the battery.

The generator field is excited by the output of *Q3*, whose base is biased "on" by the voltage divider consisting of *R7*, *R8*, and *R9*. Diode *D4* provides reverse bias to *Q3*, allowing it to operate at a much higher temperature. Diode *D2*

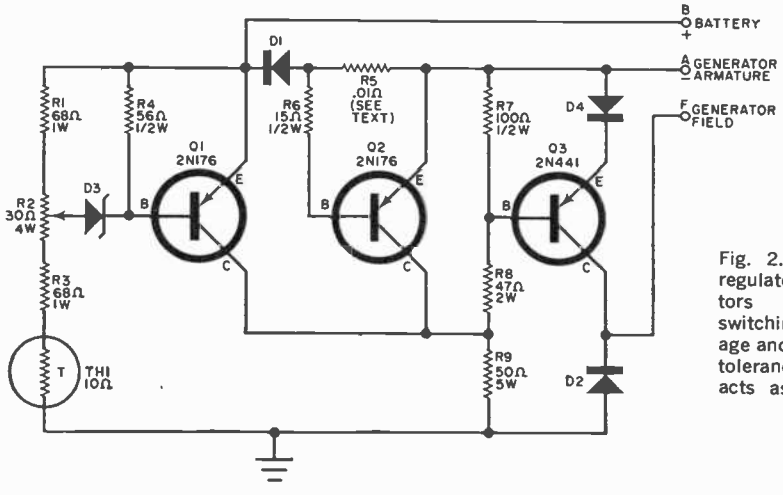
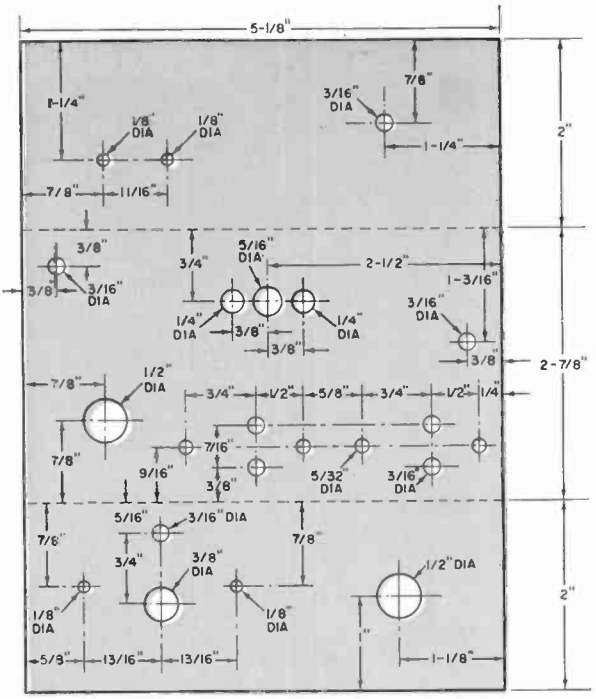


Fig. 2. In this solid-state regulator circuit, transistors perform automatic switching to regulate voltage and current within close tolerances. A diode (D1) acts as a circuit breaker.



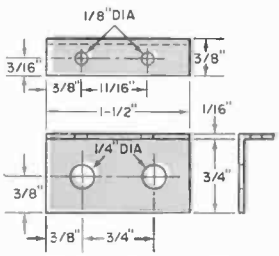
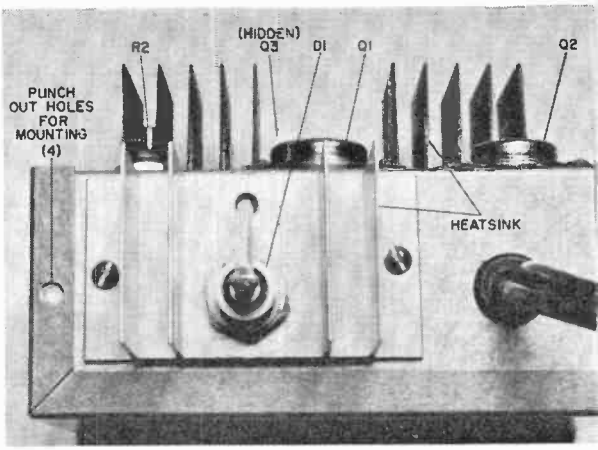


Fig. 3. The layout of the author's design provides proper spacing of mounting dimensions to give finished product good appearance and balance, while providing greater ease during wiring and assembly.

prevents any voltage spikes produced by the inductive field from damaging *Q3*.

Transistor *Q2*, which is normally biased "off," acts as the current regulator. When the generator output tends to rise above the established 30-ampere limit, the drop produced across *R5* causes base current to flow. As *Q2* conducts, the drop across *R8* is increased, and *Q3*'s collector current is reduced; this, in turn, reduces the field current to limit the generator output.

Potentiometer *R2* is adjusted to obtain the desired generator output. When the generator output tends to exceed this limit, as in the case of high-speed driving, the thermistor resistance goes down because of increased power dissipation; as a result, a greater voltage is developed across *R2*. This causes *D3* to

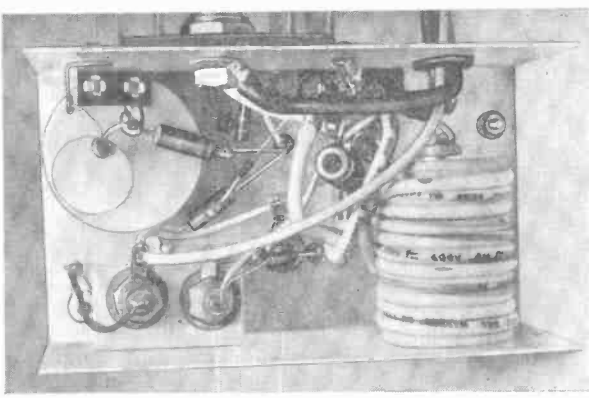


Remove the regulator cover and punch out four holes along the rim of the chassis. Then put the chassis aside temporarily. To mount unit, drill four holes in cover and install horizontally in the desired location. Now insert the chassis in the cover with connecting cable pointing downward, and secure with four #6 x ¼"-long self-tapping screws.

break down and fire, placing a forward-biasing voltage on *Q1*'s base.

As *Q1* conducts, the drop across *R8* again reduces the forward bias on *Q3*, reducing its output just enough to once again readjust the generator output. Because this action occurs at a very rapid rate, the generator output is maintained within the required limits.

Construction. The author suggests that you use a 5¼" x 3" x 2⅛" Minibox to house the regulator. Layout and mounting dimensions are given in Fig. 3. After



Although the Minibox enclosure measures a scant 5¼" x 3" x 2⅛", it provides ample room for mounting all of the components without overcrowding. The coil you see on the right-hand side of the chassis is R5, which has a d.c. resistance of only 0.01 ohm.

PARTS LIST

D1—1N1183A diode, 40 amperes, 50 PIV
D2, D4—1N1612 diode, 5 amperes, 50 PIV
D3—1N754 zener diode, 6.8 volts, 400 mw.
Q1, Q2—2N176 transistor
Q3—2N441 transistor
R1, R3—68-ohm, 1-watt resistor
R2—30-ohm, 4-watt wirewound potentiometer
R4—56-ohm, ½-watt resistor
R5—0.01-ohm resistor (48" of #14 wire—see text)
R6—15-ohm, ½-watt resistor
R7—100-ohm, ½-watt resistor
R8—47-ohm, 2-watt resistor
R9—50-ohm, 5-watt resistor
TH1—10-ohm thermistor (Fenwal NB1H1)
TS1—Single-lug terminal strip
TS2—Two-lug terminal strip
1—5¼" x 3" x 2⅛" Minibox (Bud CU-2106A or equivalent)
1—Heat sink for transistor Q3 (Delco Radio 7276040 or equivalent)
1—Heat sink for diode D1 (Delco Radio 7281360 or equivalent)
Misc.—Transistor and diode mounting kits, #6 solder lugs (2), wire (15 feet of #10 rubber-covered, 1 foot of #20 hookup), solder, scrap aluminum, screws, nuts, 3-pin automotive-type connectors (1 set), ⅜" rubber grommet.

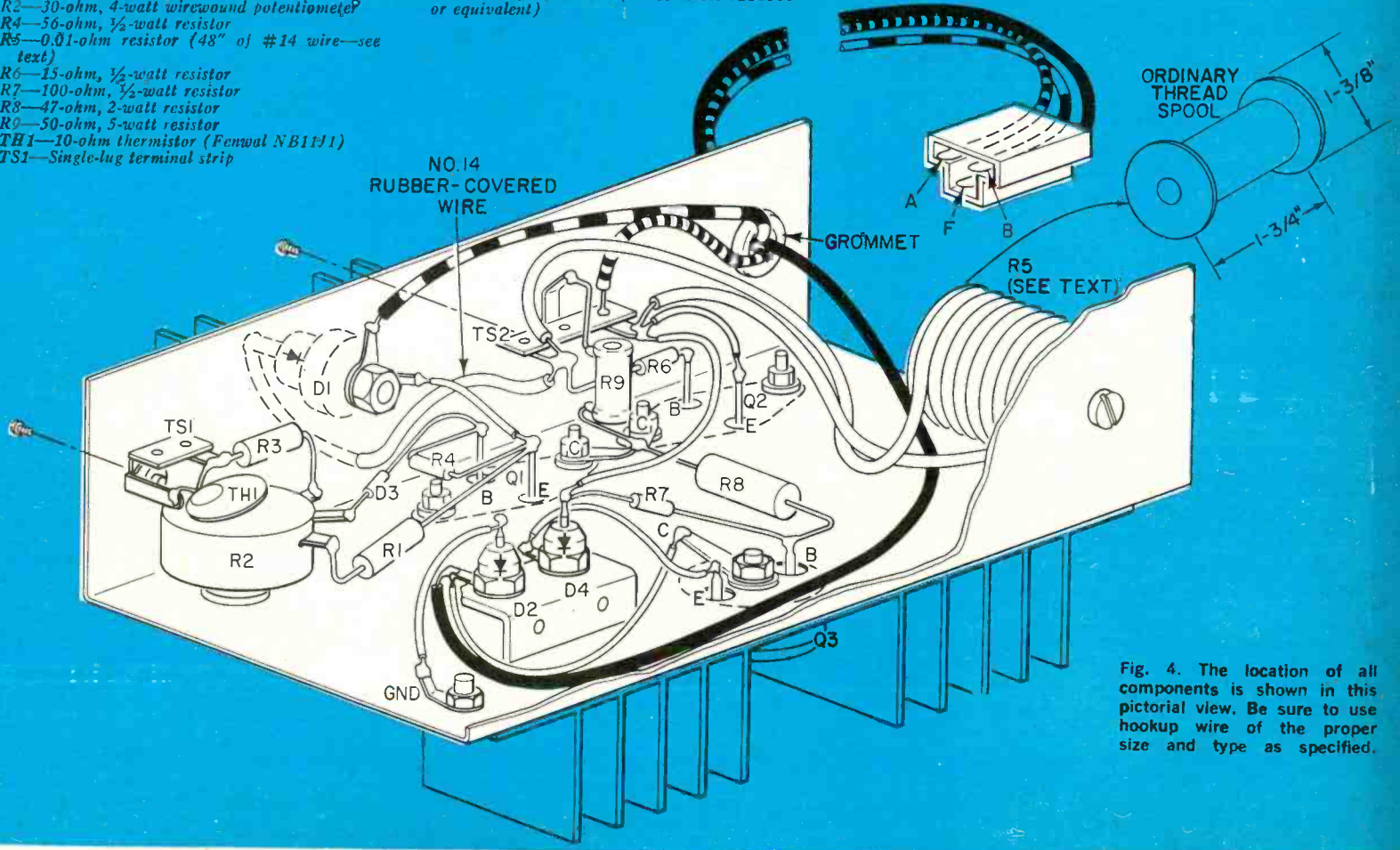


Fig. 4. The location of all components is shown in this pictorial view. Be sure to use hookup wire of the proper size and type as specified.

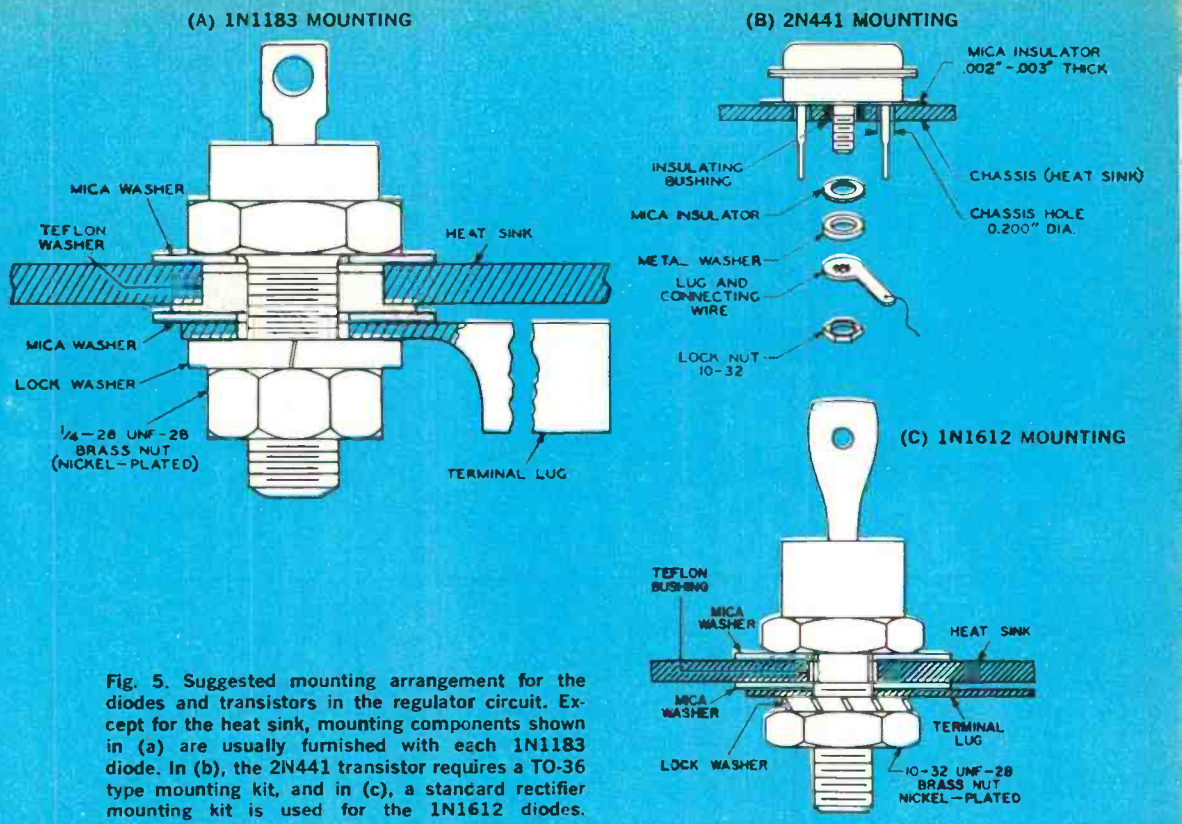


Fig. 5. Suggested mounting arrangement for the diodes and transistors in the regulator circuit. Except for the heat sink, mounting components shown in (a) are usually furnished with each 1N1183 diode. In (b), the 2N441 transistor requires a TO-36 type mounting kit, and in (c), a standard rectifier mounting kit is used for the 1N1612 diodes.

punching and deburring the chassis, you can proceed to assemble the regulator (see Fig. 4).

Mount *D1* on a heat sink following the mounting arrangement shown in Fig. 5(a). Apply a thin layer of silicon grease on all mica washers supplied with the mounting kits. Use the heat sink mounting hardware to secure *TS1* and *TS2* on the inside of the chassis, as shown in Fig. 4. Mount a #6 solder lug under the ground lug of *TS2*.

Mount the 2N441 transistor (*Q3*) on a heat sink following the mounting arrangement shown in Fig. 5(b). Mount the remaining two transistors (*Q1* and *Q2*) directly on the chassis at the locations shown in the photograph. Secure the L-shaped bracket on the inside back panel, and then install *D2* and *D4* on the bracket in accordance with Fig. 5(c).

You can now wire up the unit. Be sure to use #14 rubber-covered wire from the anode of *D1* to *TS2*. Except for the interconnecting harness, which is made from #10 color-coded wire, you can use ordinary #20 solid or stranded hookup wire for all other connections.

To make up resistor *R5*, wind a 48" length of #14 rubber-covered wire evenly on a 1⅜"-diameter by 1¾"-long thread spool. At a point approximately 1½" from the wire ends, twist the leads together to prevent them from unraveling on the spool. Then mount the coil on the panel using an 8-32 x 2¼" screw with nut and flat washer.

Decide where you want to mount the regulator—anywhere under the hood, away from engine heat, will do—and prepare an appropriate length of #14 three-conductor color-coded wire, with a three-prong automotive-type connector at one end.

Insert a ⅜" rubber grommet at the location shown (Fig. 4) and run the free ends of the harness through the grommet to the indicated terminals. Solder all connections properly. Now recheck the entire circuit against the pictorial to make sure the wiring is complete, and that there are no shorts.

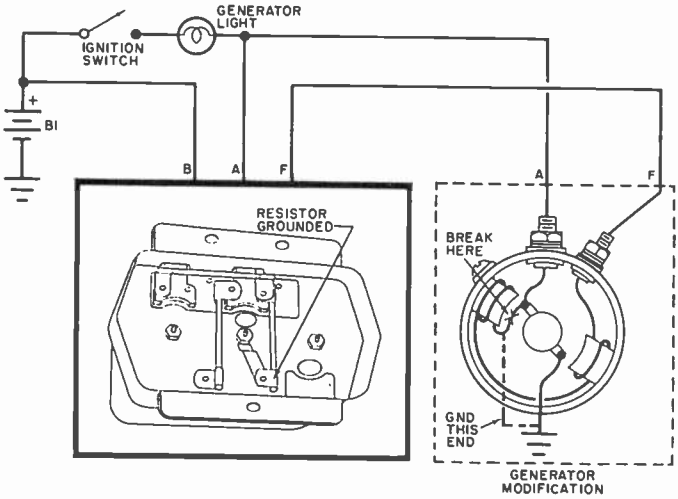


Fig. 6. On some Ford cars the regulator resistors are grounded as shown at left. If you have this type of regulator, you must modify the generator by disconnecting one end of the field from the armature at the point marked with an "X," and then ground the free end.

Modification. If you have a Ford car, remove the cover from the old regulator and examine the resistors inside the case to see if one side is grounded as shown in Fig. 6. If the resistors are not grounded, no changes are required.

But if the resistors are grounded, you'll have to modify the generator circuit slightly, as shown in the inset (Fig. 6). Remove the field (*F*) connection at the point indicated, and connect the ground side of the field directly to the engine or frame. Cars other than Fords do not require any modification.

Hookup. Refer to Fig. 7 and install a mating male connector at the ends of the wires previously removed from the old regulator. Be sure the *field*, *battery*, and *armature* wires are not reversed at the connector pins.

To protect the regulator from foul weather and eventual corrosion, apply two or three coats of clear lacquer on all exposed surfaces. But before you apply the lacquer, check to make sure the regulator is properly grounded to its supporting frame.

Testing. After the regulator has been installed, measure the battery voltage with a voltmeter. It should measure about 12.5 volts. Then start the car and measure the voltage again. If the battery is close to being fully charged, the reading should rise to between 14.0 and 14.8 volts within a few minutes, and should remain within these limits at an ambient temperature of approximately 75°F. A substantially lower or higher temperature will result in a voltage difference of plus or minus a few tenths of a volt.

Depending on your area of the country, and the time of the year, you may require different standards. For example, at 50°F the reading should be be-

(*Continued on page* 92)

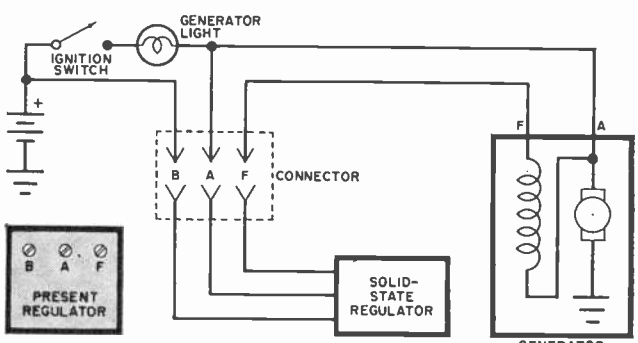
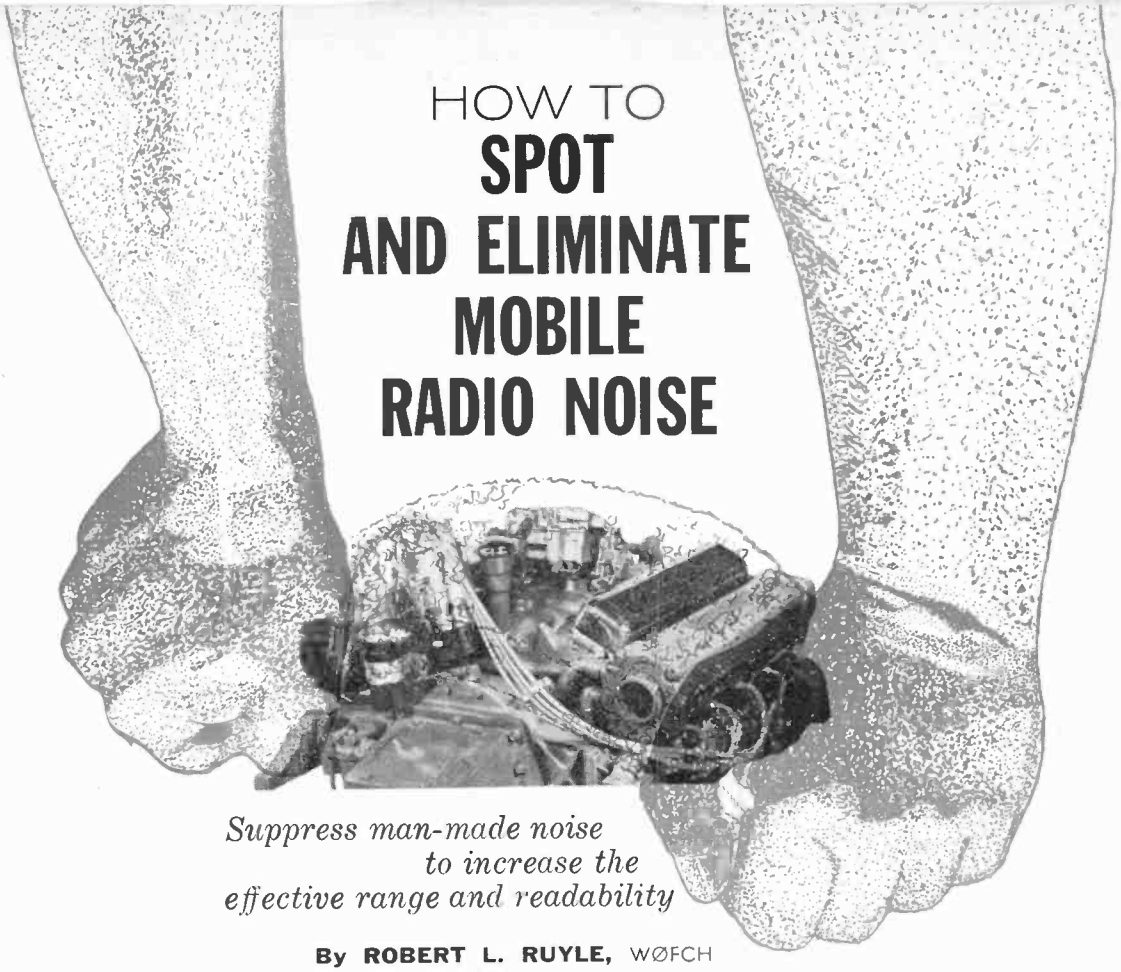


Fig. 7. When you remove the old regulator from your car, install a connector socket at the free ends of the battery (B), armature (A), and the field (F) wires to mate with the plug on the regulator.

HOW TO SPOT AND ELIMINATE MOBILE RADIO NOISE



Suppress man-made noise to increase the effective range and readability

By ROBERT L. RUYLE, WØFCH

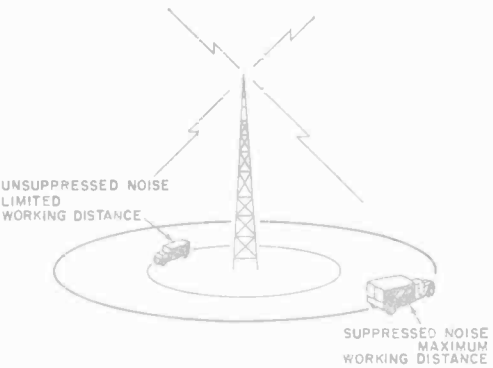
ELECTRICAL interference prevents clear reception and reduces the working range of mobile communications equipment. Efficient suppression of mobile radio interference can only come about when you identify the source and determine how it is getting into your radio.

The term "mobile" covers a wide range of vehicles: cars, trucks, trains, tractors, etc. Mobile radio installations are generally afflicted with noise from ignition systems, charging systems, switching circuits, moving metal parts, metal-to-metal contacts, and other electrical noises.

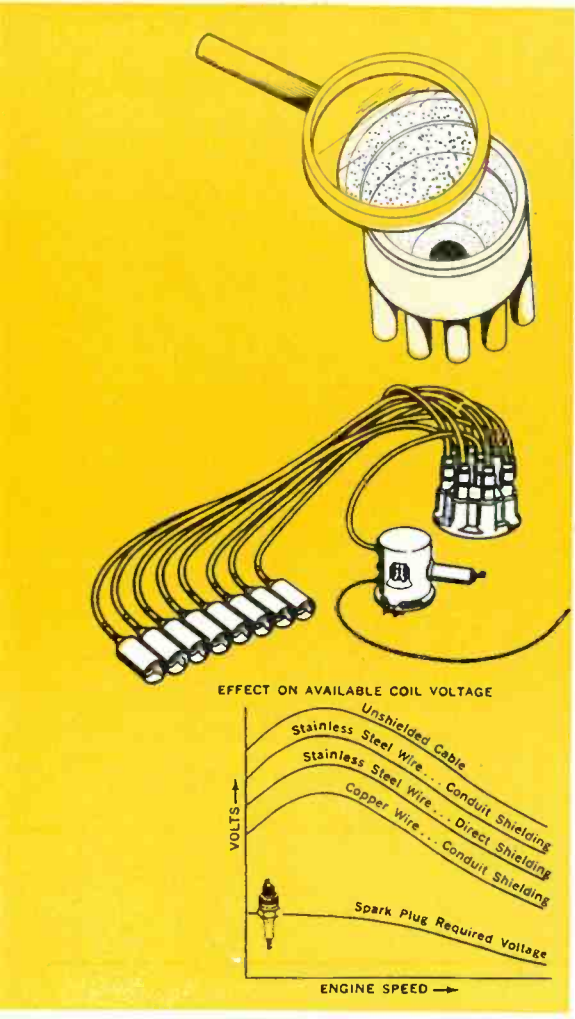
Each of these noise makers can be identified, and steps can be taken to suppress them.

Ignition System Noise. Ignition system noise usually originates from one or more of four places: spark plugs, wiring, distributor, and the ignition coil.

Spark plug interference is heard as a popping noise in the radio receiver which increases to a loud buzz as engine speed is increased. Use of a resistor-type spark plug is an effective way to suppress this kind of interference. The



Reception distance can be increased considerably by suppressing noise at the receiver—without increasing transmitter power or receiver sensitivity.

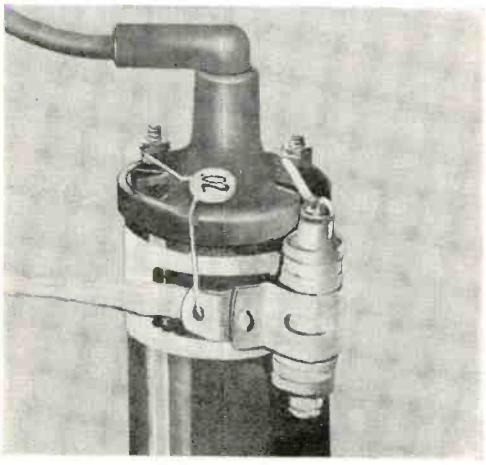


One of the drawbacks to engine noise suppression is loss of power. Just like dirt inside the distributor cap, shields over the spark plug cables do cause a certain amount of high voltage loss.

Distributor interference also causes popping, and its pitch also varies directly with engine speed. Check to see that the distributor cap and rotor are clean. The distributor cap and rotor should be replaced every 25,000 miles for best performance. After 25,000 miles, the inside of the distributor cap usually becomes impregnated with millions of tiny metallic particles.

To suppress the popping noise caused by the distributor, you can use a 10,000-ohm resistor or resistor-type cable between the distributor cap and the ignition coil. However, never use an external suppressor at the distributor cap center tower if the cap contains a molded-in resistor.

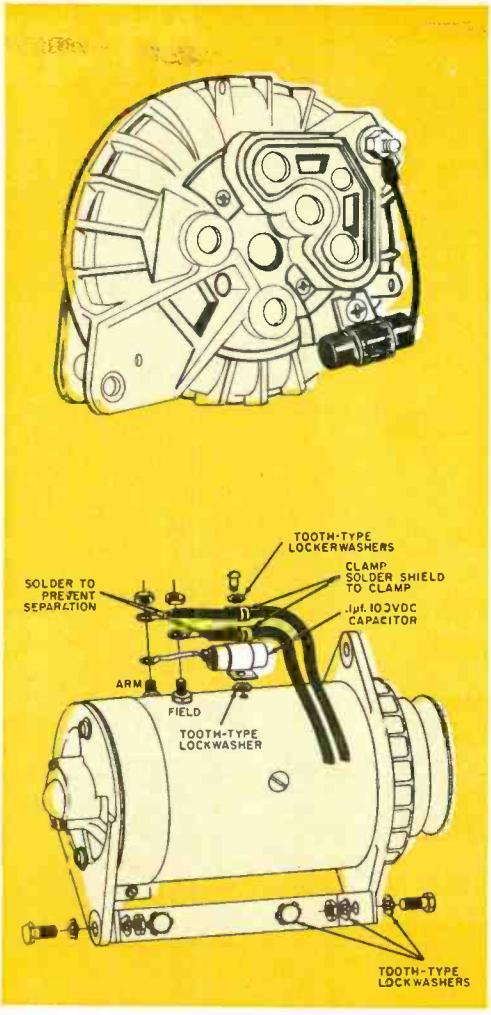
Wiring between spark plugs and distributor cap and between the distributor cap and ignition coil can radiate noise. A shielded ignition system offers the most effective suppression of ignition noise. For maximum voltage at the plugs, keep your high tension leads as short as possible. If shielding causes marginal engine performance, it may be necessary to install a higher output coil or a transistorized ignition system.



Interference from the ignition coil can be bypassed to ground by inserting a 0.1-μf. feedthrough capacitor between the coil and its battery lead, and a 0.2-μf. bypass type on the points side of the coil.

Ignition coil interference can be easily filtered by installing a 0.1-μf. coaxial-type capacitor. Attach the capacitor to the supporting band of the ignition coil and mount it as close as possible to the nearer the resistor to the spark gap, the more effective it is; the resistor tends to isolate the cable from the noise in the spark plug. The less noise in the cable, the less it radiates. Also, the high frequency part of the spark is "chopped off."

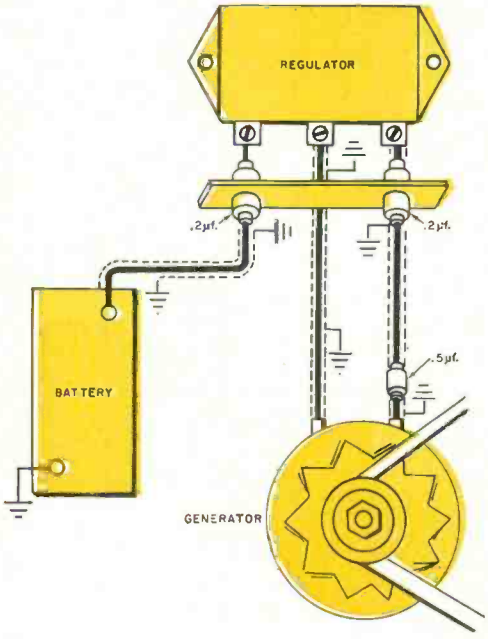
You can insert carbon-type suppression resistors in the ignition leads between the distributor cap and each spark plug or use suppressor-type cable in the wiring harness, but resistor-type spark plugs prove to be more effective and the easiest to troubleshoot when something goes wrong.



Alternators are usually equipped with a special filter to protect the rectifiers and to suppress radio noise. The generator's field terminal also requires a special filter. Do not use ordinary capacitors.

Alternators generally do not create a noise interference problem; but when they do, it's hard to suppress the resulting noise. The trouble, heard as a whine, usually comes from static buildup on the internal alternator elements. The best remedy for this condition is to insert a coaxial feedthrough type capacitor in each alternator lead, between the alternator and the rectifier. Install a 0.5-μf., 50-volt, 50-ampere rated capacitor.

Generators are common offenders;



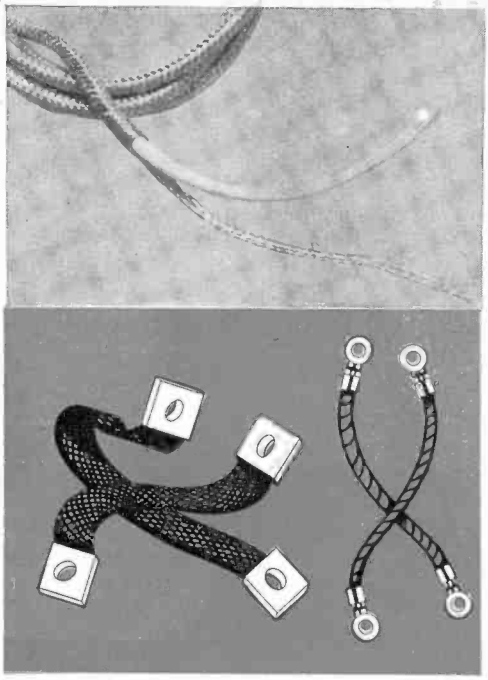
Feedthrough capacitors and shielded cable can be used to suppress generator and regulator noise. If noise persists, a resistor-capacitor type filter can be attached to the regulator's field terminal.

coil terminal. Disconnect the battery lead from the coil and connect it to the capacitor terminal. Connect the other terminal of the capacitor to the ignition coil using a short length of #10 copper wire. Also connect a 0.02-pf., 1000-volt, ceramic capacitor between the low voltage terminal on the coil and the ground lug of the coaxial capacitor. Be sure to keep the leads as short as possible.

Generating System Noise. Noise from the generating system can usually be traced to alternators, generators, and voltage regulators.

often generator noise is blamed on the ignition system, but the telltale whine it produces should keep you from making a mistake. When looking for a means to quiet generator noise, be sure to install filters and capacitors in a proper manner, particularly around the generator's field terminal.

Voltage regulators cause an annoying interference when the relay contacts arc. The resultant popping noise in the receiver changes very little even when the engine speed is varied. You can relate this source of noise to ammeter movement while listening to the receiver.



Shields and bonding straps properly used are effective noise suppression devices. If not installed correctly, they can introduce new troubles. Mechanical and electrical connections must be well made.

If the noise occurs at the same time that the ammeter needle swings to charge or discharge, chances are that the trouble is in the regulator.

Here again, proper connection of a filter to the regulator is important. Do not install an ordinary capacitor on the field terminal of the generator or the regulator; it may eliminate the noise, but it can ruin the generator and the regulator in short order. Instead, use a special resistor-capacitor filter especially designed for this purpose.

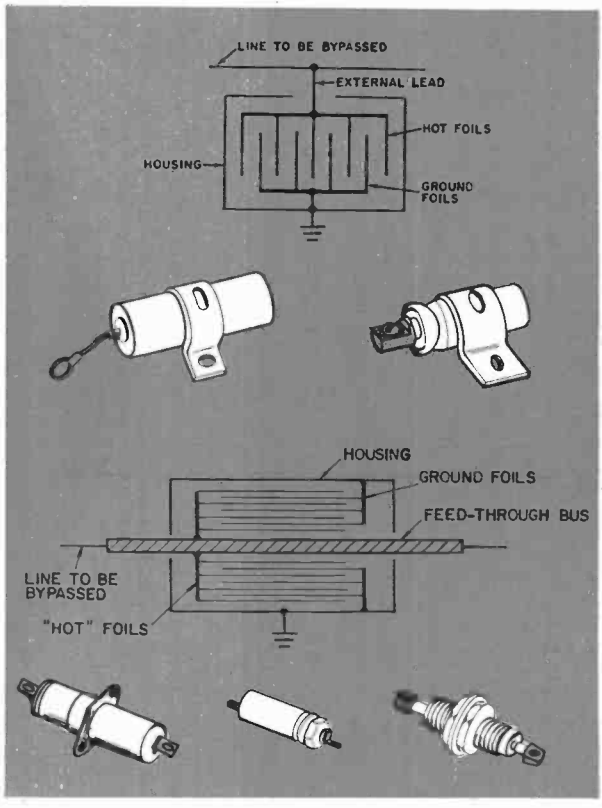
Accessory Interference. Electric windshield wipers, blowers, tachometers, sensors for 'idiot" lights, and a host of other electrical gadgets are all potential noise makers.

Accessory motors, such as the electric *windshield wiper* motor and *blower* motors for the heater and air conditioner, can usually be taken care of in short order by placing a 0.5-μf. capacitor between the hot-lead terminal and ground. *Tachometers* can only be cured by using a good shielded wire from the engine pickup to the transmitter unit, and from transmitter unit to the meter indicator.

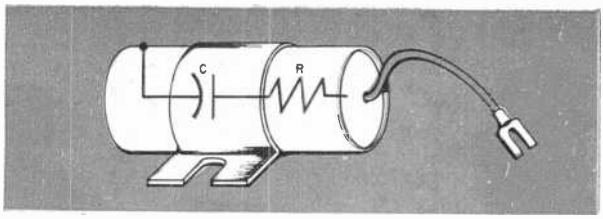
Idiot lights, particularly the one for oil pressure, are frequent offenders. These lights are turned on by sensors that are placed at different points on the engine. The sounds from the sensors can be recognized by a "clicking or hissing" sound in the receiver. Find the "noisy" sensor and install a 0.5- or 0.25-μf. capacitor.

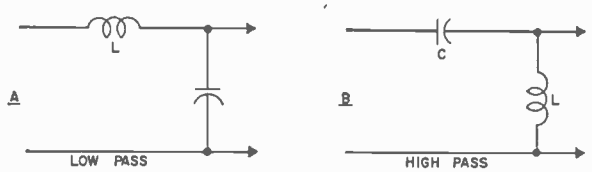
Instrument gauges such as the gas gauge can also cause a load of static, just like a noisy volume control. Use a 0.5-μf. capacitor to bypass the noise from the instrument to ground.

Metal-To-Metal Contact. The best way to eliminate noise from metal-to-metal contact is to electrically bond the two pieces of metal. To check all the joints in a car requires a long and tedious search. Some of the most common trouble spots will be found along the exhaust system, particularly the tailpipe, and be-

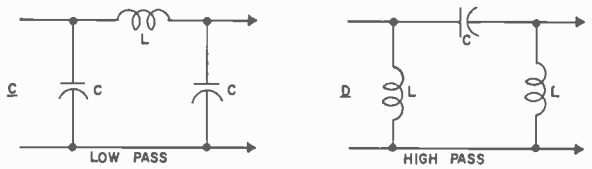


Bypass-type capacitors (top) are not required to handle line current, but have frequency limitations. Feedthrough capacitors (bottom) are better able to filter high frequencies, but must carry current.

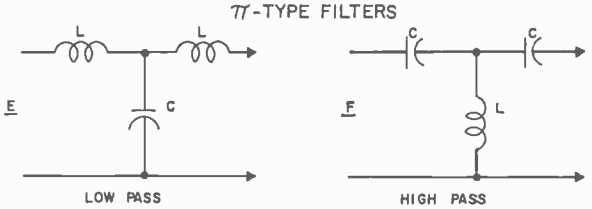




L-TYPE FILTERS



π-TYPE FILTERS



T-TYPE FILTERS

Because some RC filter networks look like ordinary bypass capacitors, care must be exercised not to make improper substitutions. However, many different types of networks are used and are housed in containers about as large as voltage regulators.

tween engine and car body, hood and trunk deck and car body, air cleaner and engine, radio and car body, bumper and car body, and even between antenna elements.

The importance of good bonding cannot be overemphasized, because if you don't have a good electrical and mechanical connection, you may very well be creating—rather than reducing—your interference problem. Wide braided straps of copper wire make excellent bonds when properly secured mechanically on clean surfaces. Be sure to remove grease, paint or other coatings that will compromise a good electrical connection.

Don't overlook the little bonding clips between the hood and the car body. These little clips serve a purpose.

Static Discharge. If you hear a "rushing" noise when your car is traveling down the road, and the noise disappears when you apply the brakes, chances are that your car's wheels are building up static electricity. Check inside the outer wheel bearing dust cover on the front wheels to make sure that you have static springs installed and that they are in good condition.

You can also inject graphite powder into the tires. To do this, let the air out of the tires, remove the valve core, squirt graphite into the tire, re-install the valve core, and finally, re-inflate the tires.

Interference Suppression Devices. There are five basic components or devices used to suppress radio interference: capacitors, filters, resistors, shields, and bonds.

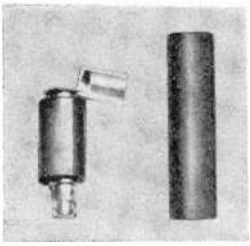
Capacitors are classified according to their internal configuration and their electrical properties. For noise suppression work, they are commonly referred to as either bypass or feedthrough types.

Bypass capacitors have been with us for a long time. Normally, the metal case of the bypass capacitor serves as the ground terminal, and is secured to the equipment by means of a wrap-around bracket. The live terminal is usually a single wire lead that is connected to the line to be cleared of interference. The short lead wire on this type of capacitor becomes resonant at about 10 MHz and therefore limits its effectiveness to frequencies below this value. Typical bypass capacitors range in size from 0.01 to 2 μf.

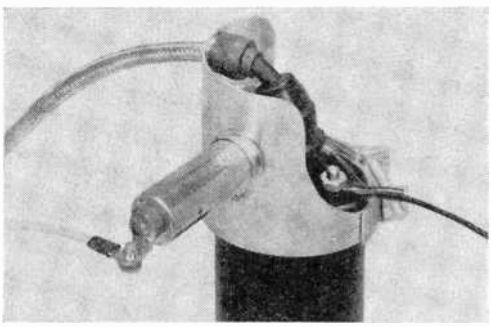
PARTIAL LIST OF MANUFACTURERS

Your local distributor and mail-order houses can usually recommend and supply suitable radio noise suppression components and kits. Additional information can generally be obtained directly from the individual manufacturers.

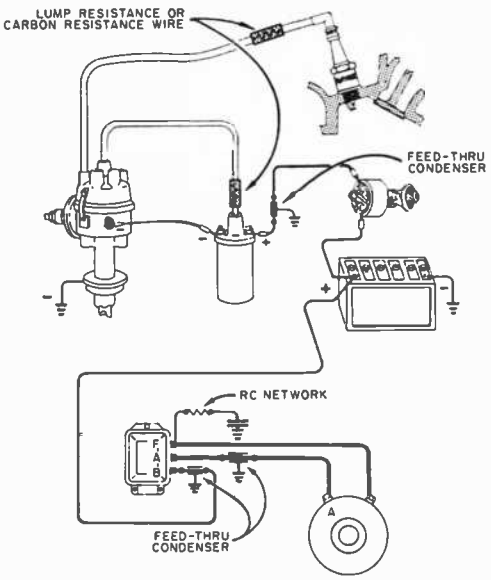
Aerovox Corp., Distributor Div., 740 Belleville Ave., New Bedford, Mass.
Birnbach Radio Co., Inc., 145 Hudson St., New York, N.Y.
Continental-Wirt Electronics Corp., 26 W. Queen La., Philadelphia, Pa.
Cornell-Dubilier Electronics, 50 Ave. "L", Newark, N.J.
Estes Engineering Co., 1639 W. 135th St., Gardena, Calif.
GC Electronics Co., Div. Textron Electronics, Inc., 400 S. Wyman St., Rockford, Ill.
Hallett Mfg. Co., 5910 Bowcroft St., Los Angeles, Calif.
E. F. Johnson Co., 2525 Tenth Ave., S.W., Waseca, Minn.
New-Tronics Corp., 3455 Vega, Cleveland, Ohio
Ohio Carbon Co., 12508 Berea Rd., Cleveland, Ohio
Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill, N.Y.
Herman H. Smith, Inc., 2326 Nostrand Ave., Brooklyn, N.Y.
Sonar Radio, 73 Wortman St., Brooklyn, N.Y.
Sprague Electric Co., 91 Marshall St., N. Adams, Mass.



Resistive elements are used to suppress noise from spark producing circuits. This type of suppressor should be placed as close to the spark source as possible to reduce radiation.



Ultimate solution to ignition noise is shielding and filtering. While it may be more expensive to put everything under cover, there is less chance of losing engine power due to spark suppression.



What the well-dressed ignition and generating system will look like after a radio noise suppression treatment. To complete the job, you should connect a good ground strap between the engine and car body.

Feedthrough capacitors differ from bypass capacitors in that the line from which interference is to be cleared is brought through the center of the capacitor, eliminating the additional connecting lead. As a result, this type of capacitor has no upper frequency limitations, and should be used if possible.

Proper installation of capacitors is of great importance. Always keep lead length as short as possible, and be sure to fasten a capacitor securely to obtain a good electrical ground connection and to minimize loosening effects of vibration.

Filters combine the bypass action of capacitors and the reactance of inductors and resistors. Also available are some special types of filters which are tuned to act as low-pass or high-pass devices for use in very difficult situations.

Resistors are used in the spark-producing circuits. Carbon or composition resistive elements are generally enclosed in an insulated housing. External-type resistor-suppressors are normally designed for temperatures over 85° C, but internal types—as in spark plugs—can work under higher temperatures, up to 150° C.

Most resistors, whether external or internal, are in the 5000- to 10,000-ohm range. Suppressor-type high-tension ignition cables have a resistive center conductor instead of wire—on the order of 4000 ohms per foot—but age, temperature, vibration and rough handling cause short life. When the resistance value exceeds 18,000 ohms per foot, the cable should be replaced.

Shields for radio interference are usually made from solid metal sheeting, wire mesh, or braided metallic wire.

Bonding is accomplished by electrically connecting two metallic surfaces to provide a continuous low-impedance path for spurious currents to flow from one to the other. Direct bonds (welds), jumper bonds (tinned copper braid straps), and special bonds (brushes, slip rings, etc.) are the three most common types of bonding methods used.

Corrosion is the number one enemy of a good bond. Where possible, moisture-proof all connections to make them more permanent. -30-

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The author acknowledges contributions to this article by Champion Spark Plug Co., P. O. Box 910, Toledo, Ohio, and Hallett Mfg. Co., 5910 Bowcroft St., Los Angeles, Calif. 90016. Champion's excellent booklet called "Giving Two-Way Radio Its Voice" and Hallett's booklet entitled "Nothing But Noise!"—which will answer most of your questions about a commercial noise suppression system—are available for the asking from these companies.

LOOK OUT! IT'S HOT!

By **CHRISTOPHER SHERIDAN**
Associate Editor

Our basement technician says to treat electricity with the respect it deserves

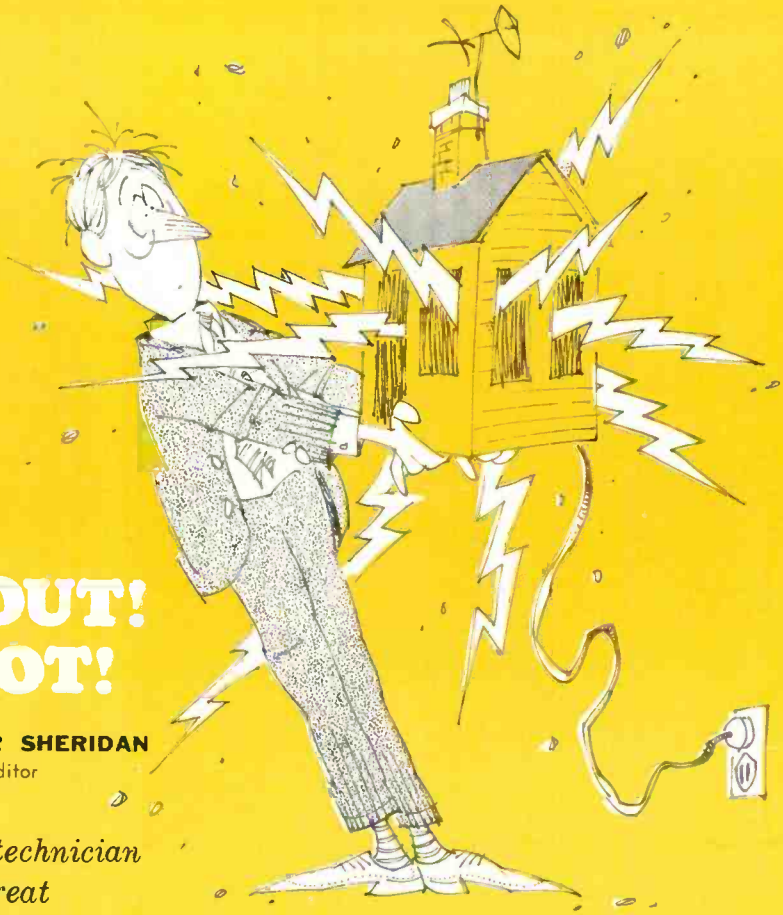


Illustration By Paul Coker

RINGING Ziggy Carmichael's doorbell brought no response, as usual. I'll probably catch him in the basement, I thought, making my way in through a side door with a defective CB rig in tow. Ziggy ran a TV service from his home, and he spent much of his spare time with our local CB club members, fixing their gear and sometimes giving lectures. He was president of the club and, as far as most members were concerned, the best repairman around—in spite of the fact that he charged club members little or nothing for his services.

Ziggy looked up as he heard me descend the stairs to his workshop. "How do you like this?" he asked, pointing to a shiny new CB transceiver sitting on the workbench.

"Is it yours?"

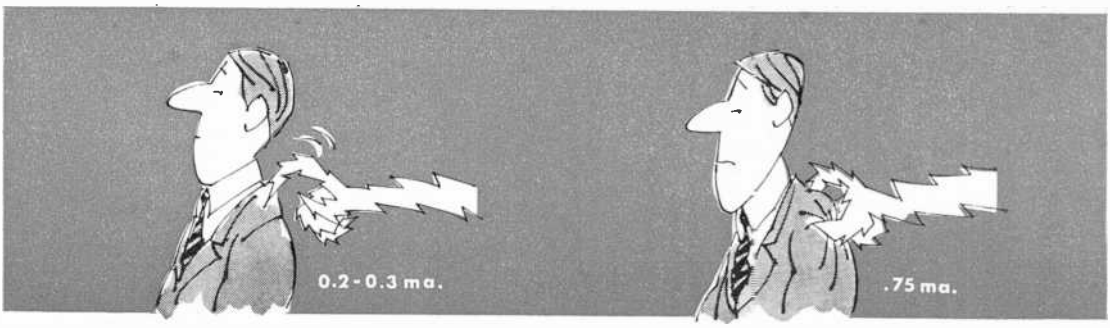
"No, it belongs to my father. He's got the CB bug, but he doesn't like to build things, so I did it for him. . . . Be with you in a minute, soon as I finish checking it out," he said, noticing the CB rig cradled under my arm.

I watched as Ziggy probed around the new set with a VOM, poking in and around the controls and chassis. Then, seeing him reverse the unit's plug in the wall socket and start to probe again, my curiosity got the best of me and I asked him what he was looking for.

"Shock hazards," he replied. "It's a little safety check I make on all units leaving the shop. I'm making sure there are no potentially dangerous hot spots."

I glanced at the face of the small meter. "Doesn't register, or does that mean it's good? How does this thing work, anyway?"

"I'm using a 1000 ohms-per-volt a.c.



VOM shunted with a 1500-ohm, 10-watt resistor," he said, shifting his glance between the unit and meter. "One meter lead is tied to a good 'earth' ground, and with the other lead I probe the parts of the unit that are exposed to the operator. A meter reading of 7.5 volts or more indicates a potentially dangerous current leak existing between the unit and ground which needs fixing. The '7.5 volts' is based on the maximum allowable leakage current in the minimum safety requirements set up by the Underwriters Laboratory."

I couldn't help but grin, and Ziggy, noticing it, snapped out: "I know what you're thinking. I'm a worry wart and this is just a waste of time. But a little prevention goes a long way when you're playing around with electricity. Using this little gimmick can darn well save your life."

Ziggy was always in the habit of quoting facts when he wanted to get a point across. This time it was no different as he told me that this year, according to the National Safety Council, about 1000 people will lose their lives due to accidental electric shock. I was amazed, but I was even more surprised to learn that ordinary 117-volt house current was the biggest single cause of such fatalities.

"Once in a while I read of something happening to someone in the paper," I said, "but frankly, I'm probably like most people and just take electricity for granted."

"Don't take it for granted." By now his tone was pedantic. "Fact is, in electrical accidents, one out of 14 disabling injuries results in a fatality. That's a death rate two-and-one-half times the death rate of those injured in auto accidents. Food for thought, eh?"

Nodding my head in agreement, it occurred to me that Ziggy taught electrical safety and resuscitation methods to interested groups—the Boy Scouts, for one. Here was an opportunity to bolster up my electric shock I.Q.

"Ziggy, while we're on the subject, let me ask you a few questions. How many volts are dangerous? What makes shock so hazardous when you're wet? What—"

"Hold it, one question at a time," Ziggy cut in. "But first, let's take a look at your CB rig. What's the problem?"

"Probably a bad filter capacitor—it's picked up a loud hum."

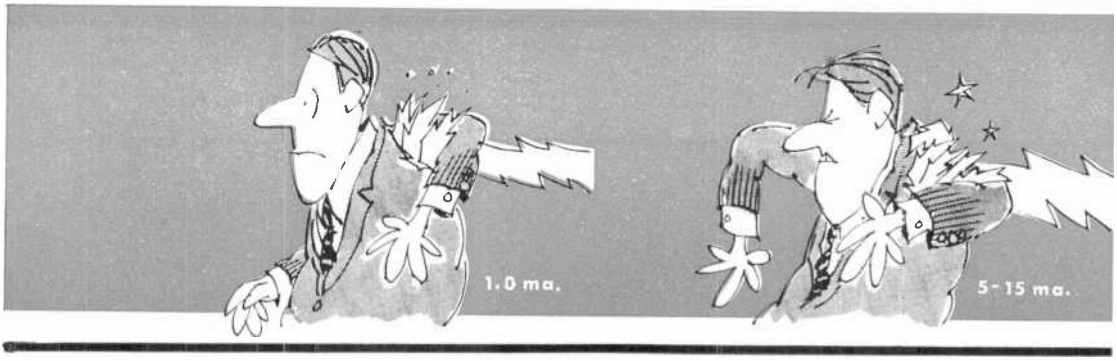
After trying the rig out, Ziggy agreed. "Getting back to your questions," he said, "if there's one rule to remember about electricity, it's that you should treat 75 volts as you would 750 volts. It doesn't take much of a shock to be lethal. In fact, as little as 25 volts at 70 ma. can be fatal. And under optimum conditions, 15 to 20 ma. will do the job if the current passes through the heart and the victim can't let go."

"Why can't the victim let go?" I asked, watching him take my set apart.

"The shock contracts the muscles and paralyzes the nerves of the victim. If a sufficiently large number of nerves are involved, sudden violent contractions of the muscles throw him away from the shock source."

Examining the 50-μf. filter capacitor, Ziggy's face was practically buried in a maze of wires. "It doesn't look too bad for an old rig. We'll bridge it with another capacitor and see what happens. I have a couple of used ones around here somewhere. Ten will get you twenty you have a bad rectifier, too."

I made my way over to a small box hidden under his workbench where he kept his good used tubes and fished out



a 6X4—just in case he would have to replace the rectifier, too.

"Can't keep any secrets from you guys," Ziggy snorted. "You know just where to look."

"Call it experience. But let me ask you something else. How does shock affect the human body?"

"Most shock fatalities," he said resignedly, "involve the heart. You see, the heart generates a small current which keeps it pumping the blood throughout the body. An outside current across the heart easily disrupts this minute current, causing the heart to flutter or stop altogether. This is called ventricular fibrillation, and once it occurs, it's very hard to start the heart beating rhythmically again. On the other hand, a shock through the brain or other parts of your breathing apparatus can stop your breathing."

"You could also say that a shock can cause you to drop what you're carrying or fall off a ladder, as well as give you painful burns," I added.

Ziggy agreed. "Okay, smart guy, which would you say is the controlling factor of shock severity—current or voltage?"

I thought I didn't have to think this one out. "Voltage!"

"Wrong," he shot back. "Amperage. But skin resistance, voltage, current path, and shock duration all have a hand in determining its severity. All these factors work together."

"How much amperage is dangerous?"

"Most authorities say 15 ma., and more."

"Fifteen milliamps! That's not much."

"Well, look at it this way," Ziggy said. "Current as small as 0.2 ma. will pass safely through the body but can be felt as a tap on the skin, and those as little as 1 ma. will cause a tingling sensation. Current stronger than 1 ma. will start to grip, and 15 to 20 ma. will cause pain and the victim might not be able to let go."

He explained that usually as little as 20 to 70 ma. *can* be fatal, and that most medical authorities flatly state that 70 to 90 ma. *is* fatal.

"Currents between 100 and 200 ma. are doubly dangerous," he continued, "as they tend to cause ventricular fibrillation *and* respiratory paralysis. But, strange as it may seem, those greater than 200 ma. are often less dangerous as heavier currents cause heart contractions so severe that the heart is clamped for the shock duration, thus preventing ventricular fibrillation."

"Do different voltages act the same way?"

"Pretty much the same," Ziggy answered. "Contact with a 117- or 220-volt, 60-cycle a.c. line tends to cause ventricular fibrillation, while contact with 220 to 1000 volts usually results in both ventricular fibrillation and respiratory paralysis. Shocks of 1000 volts and more tend to cause only respiratory paralysis as high voltage clamps the heart."

After much searching, we found a replacement capacitor for my rig. Ziggy blew the dust off it and started soldering it in.

"It's not hard to understand," he continued, "why most fatal shocks involve water in some way when you consider that, ordinarily, dry human skin is highly resistive to current. But when the skin is wet, its resistance drops tremendously and more current can flow through the body."

(*Continued on page* 55)

RESUSCITATION

VITAL SECONDS IN WHICH YOU CAN SAVE A LIFE

Respiratory Paralysis
Apply Artificial Respiration

Tilt head far back. | Pull chin upward. | Pinch nostrils and blow. | Check for exhalation.

(1) Lay the victim on his back. Place one hand under neck and lift. Tilt head back as far as possible so that the neck is extended.

(2) Pull chin upward until the head is extended back as far as possible. Keep victim in this position.

(3) Pinch the victim's nostrils and place your mouth firmly over his mouth. Blow hard enough to make his chest rise. With an infant, place your mouth over his mouth and nose.

(4) If the victim's chest does not rise, recheck his head and jaw position. The air passage may be blocked. Turn the victim on his side or face down with head in a down position, tongue pulled forward. Slap victim to dislodge any foreign matter. If the victim is a child, hold him momentarily head downward over your arm or lap and slap child on the back.

(5) With adults, blow one vigorous breath every five seconds. With small children, blow shallow breaths every three seconds. Continue procedure until help arrives.

Ventricular Fibrillation
Apply Cardiac Massage

Press down firmly and quickly on breastbone.

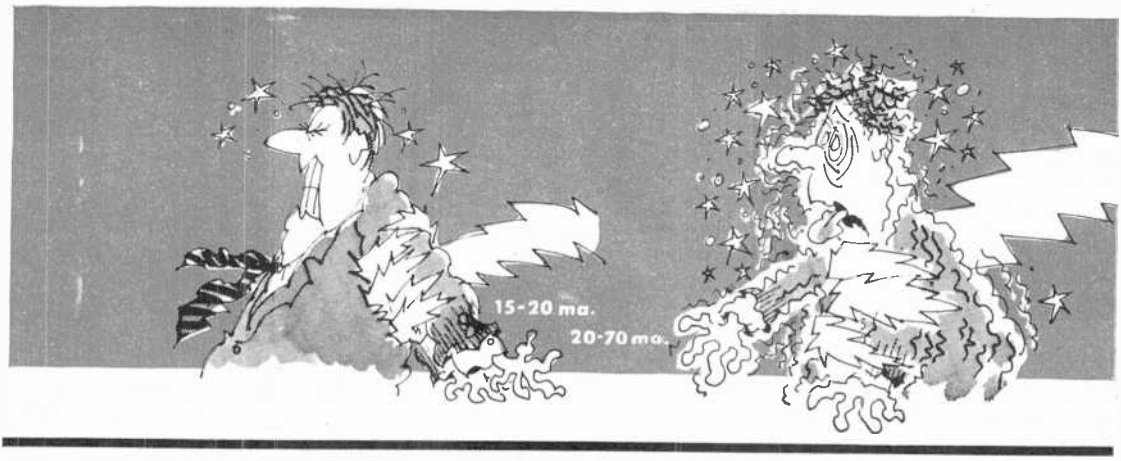
(1) The most accurate indication of ventricular fibrillation is the lack of pulse. Place the pads of your fingers alongside the victim's "Adam's Apple" and check for a pulse. If there is no pulse, check victim's pupils. If they are enlarged and do not narrow in response to light when you open the lids, immediately apply closed chest cardiac massage. Do not apply it if the victim has broken ribs.

(2) Place the victim on his back on a hard surface. Kneel at the victim's side and give him a few quick breaths of mouth-to-mouth artificial respiration.

(3) Place the heel of one hand on the lower third of the victim's breastbone and the other hand on top of the first hand.

(4) Flex your fingers so no pressure is applied to the ribs. Press down firmly and quickly, depressing the breastbone 1½"-2". With children, use one hand; with babies, use two fingers. Then release pressure. Repeat this cycle every second.

(5) If you are alone, interrupt cardiac massage every 15 to 20 strokes to force two or three breaths of air into the victim's mouth. If another rescuer is present, concentrate on giving 60 strokes a minute and let him apply artificial respiration (12 times per minute). Continue procedure until help arrives.



"What is the normal skin resistance?"

"It averages between 100,000 and 600,000 ohms for the human body when dry, but drops to 1000 ohms or so when wet. Figure it out. Suppose your body was wet and you happened to handle a defective a.c. radio. More than 100 ma. would shoot through you. That's enough current to stop the heart and clamp your lung muscles. Most likely you'd be dead before you hit the floor."

"What about the body's internal resistance?" I asked.

"The internal resistance is much lower than the skin resistance. That's why electric current becomes more dangerous if it enters the body through a cut on the skin, or if it burns through the skin —as it will do if contact with the current source is continuous. From hand to foot, the internal resistance might measure 500 ohms; from ear to ear, about 100 ohms. Your skin resistance varies from point to point also. Measure it yourself sometime with an ohmmeter; wet the skin where the probes contact, and watch the resistance drop."

"But for a current to be dangerous, it has to take a path across the brain or heart area, right?"

Ziggy nodded. "The path from the head to the left leg is particularly dangerous as it involves both the heart and brain. That's why it's a good idea to keep one hand—preferably the left—in your pocket when working around electricity."

He finished soldering the capacitor in. "The longer an electric shock lasts," he went on, "the more the heating along the path. The skin resistance drops, and more current flows through the victim. Always remove a shock victim from the source of shock as soon as possible—without, of course, giving yourself a shock."

He stated that resuscitation should be started immediately. "The longer you delay, the poorer the victim's chance of revival. You have four minutes at the most to act."

He went on to explain mouth-to-mouth artificial respiration and how it is applied to a victim whose breathing has stopped, and how closed chest cardiac massage is used with ventricular fibrillation.

"Just a few years ago," he added, "ventricular fibrillation was irreversible. Today, it's different. Hospitals use what they call a defibrillator to shock the heart back to normal. But the trick is to keep the victim alive until he can be helped."

"And that's where cardiac massage comes in," I deduced.

"Right. Cardiac massage substitutes externally applied pressure for the rhythmic contraction of normal heart muscles, thereby maintaining circulation at a level sufficient to maintain life. Everybody should know how to apply resuscitation—you never know when you or a member of your family may need it. The YMCA, Red Cross, and a lot of other organizations teach these methods."

"Well, in your experience, which would you say is worse—an a.c. or d.c. shock?"

"Make no mistake about it," Ziggy answered. "They're both deadly. Fact

(*Continued on page* 94)

What slave unit flashes when it "sees" a light, "feels" a touch, or "hears" a noise?

IT'S THE JINNIFLASH

By LOUIS E. GARNER, Jr.

IN THE LAND of "1001 Nights," Jinn were revered spirit creatures who could perform outstanding feats of magic. The most famous was—you guessed it—Aladdin's slave, the condescending genie in a lamp. That was yesterday; nowadays genies are as rare as hens' teeth. But we do have the Jinniflash, a slave flash unit which triggers at everything from a clap of the hand to a drop of water.

If you're a photographer, you'll have a ball using the Jinniflash as a wireless remote flash or for special open-shutter shots to capture wild life or other fast-breaking action. If you are not a photographer, you can still put the Jinniflash to plenty of uses. For example, it can serve as an outdoor sensor to warn you of rain. Or you can make a burglar alarm out of it. Frankly, the applications for this device are limited only by your own ingenuity.

How It Works. The Jinniflash (Fig. 1) consists of a pair of d.c. amplifiers (*Q1* and *Q2*) working in a Darlington configuration to trigger an SCR (*SCR1*) which, in turn, fires a flash bulb connected at jack *J1*.

The control signal to the amplifier can come from any one of a number of devices, including a microphone, photoelectric cell, or temperature or humidity sensor. The sensitivity of the sensor element can be set by a biasing voltage established by potentiometer *R3* and applied through limiter *R2* to the sensing device plugged into socket *SO1*.

With switch *S1* closed, capacitor *C1* charges through resistor *R4* to the battery (*B1*) voltage. With the SCR normally in its nonconducting high-resistance state, it suddenly switches to a low-

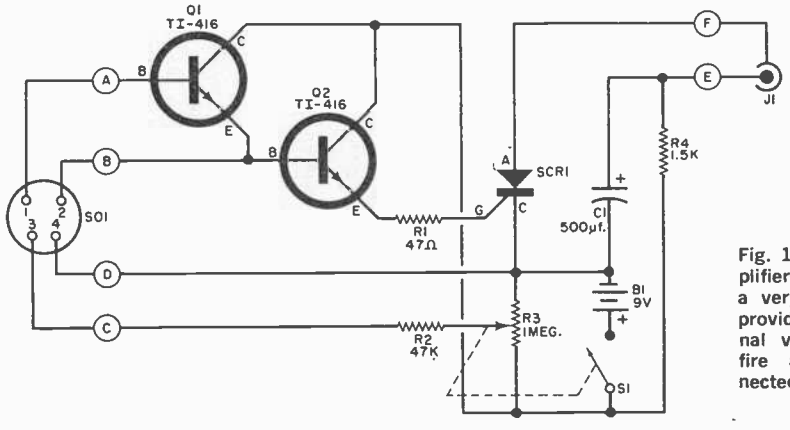
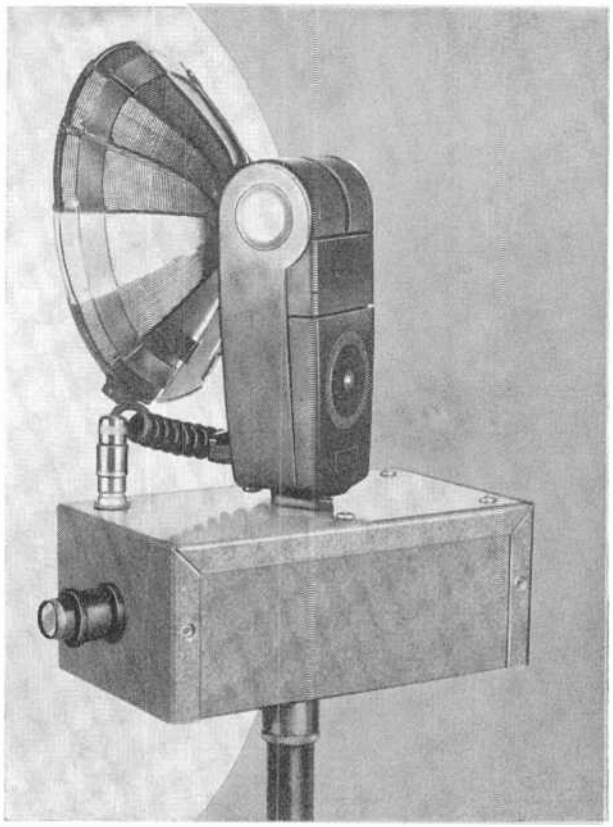


Fig. 1. A pair of d.c. amplifiers (Q1 and Q2) in a very sensitive hookup, provide an amplified signal voltage to SCR1 to fire a flash unit connected across jack J1.



PARTS LIST

B1—9-volt battery
C1—500-μf., 15-volt electrolytic capacitor
J1—Phono jack
P1—Phono plug
P2—Four-prong plug (Amphenol 71-4S or equivalent)
Q1, Q2—TI416 transistor (or equivalent)
R1—47-ohm, ½-watt resistor
R2—47,000-ohm, ½-watt resistor
R3—1-megohm potentiometer (with on-off switch S1)
R4—1500-ohm, ½-watt resistor
S1—On-off switch (part of R3)
SO1—Four-prong socket (Amphenol 78-S4S or equivalent)
SCR1—2N3228 silicon-controlled rectifier
1—Standard flashgun (surplus)
1—Moisture sensor plate
2—General Electric X6 or equivalent cadmium sulphide photocells
1—Crystal or dynamic microphone cartridge (Shure R7 or equivalent)
1—5" x 3" x 2¼" Minibox (Bud CU-2106A or equivalent)
Misc.—Etched circuit board, ¼" Moly stud, standoffs, knob, battery connector, wire, etc.*

**A pre-etched circuit board is available from DEMCO, 430 Redcliff Dr., San Antonio, Texas, 78216 for $1.25, postpaid. A complete package (less flashgun and sensors, but with sensor plugs) is available for $8 postpaid.*

resistance conducting state when a signal from the amplifier output is applied through *R1* to its gate electrode. This fires the flash bulb in *J1*, discharging *C1*.

With its anode circuit now open, the SCR switches back to its nonconducting state, and *C1* charges up again through *R4*, ready for its next trigger.

Construction. The Jinniflash is amazingly easy to build. It can be assembled in the 5¼" x 3" x 2⅛" Minibox used here, or in any other suitable metal, wooden, or plastic container. Those builders prefering a printed circuit board can etch their own, using the layout of Fig. 2, or buy one from DEMCO. (See Parts List.)

If you prefer to use your own handwired board—and many people do—choose a piece of unclad perforated phenolic board cut to the proper size to fit into the cabinet you are using. For the size cabinet shown here, you'll need a piece measuring 2½" x 3½".

The circuit board is installed in the chassis on standoff spacers as shown. If metal spacers are used, be careful not to ground the foil (if a PC board is used) or terminal connections to the chassis.

For greater flexibility in operating the unit, you should mount the nut portion of a ¼-inch Moly screw on the bottom cover so that the unit can be placed on a standard photographic tripod. The sensor receptacle (*SO1*) and jack for the flash unit are also mounted on the case. Sensitivity potentiometer *R3* and switch *S1* can be located on the circuit board as shown in Fig. 3, or they can be fastened on the chassis itself. You can mount the battery in a battery holder or, as was done in this case, press it in place with a thick piece of foam rubber cemented to the bottom cover.

A modified flashgun can be screwed in place on top of the unit (Fig. 4) to hold and fire the flash bulbs. To modify the flashgun, open it up and disconnect the battery and capacitor, leaving the lamp circuit to the cord intact. Then replace the regular PC plug at the end of the cable with a phono plug.

If you use a flashgun, you can reuse the capacitor taken out during modifi-

unit for slave operation, set it up on a tripod and direct the triggering light source from the desired distance at the photocell. Then turn on the unit and adjust its sensitivity control (*R3*) until the flash goes off. That is the proper sensitivity for the particular sensor.

Slave Flasher. If you want to fire the unit by means of an external light source, you can use a cadmium sulphide photocell, such as a GE X6, connected across inputs 2 and 3 of *SO1* as in Fig. 5 (a). Best results are obtained if the photocell is shielded from all direct lighting, except, of course, the activating light source.

A small flashlight can be used at distances of up to 20 to 25 feet to trigger the unit. If a much brighter light, such as a

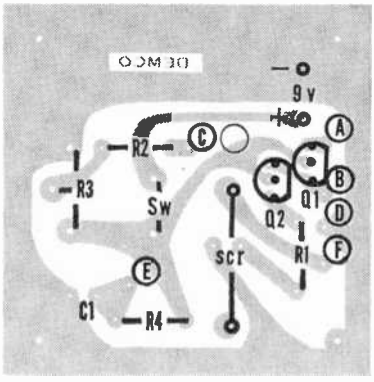


Fig. 2. Actual size photo of PC board is at top of page. X-ray view showing parts layout is directly above.

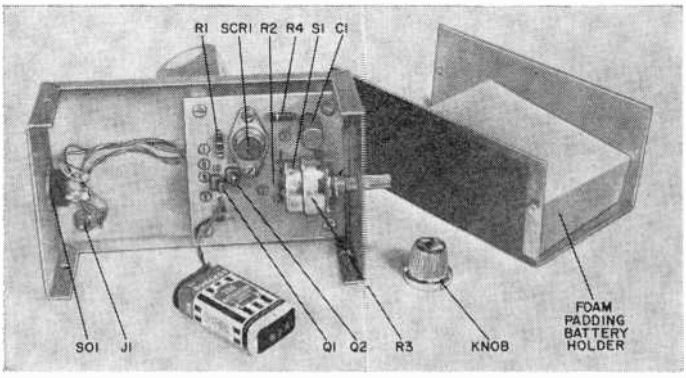


Fig. 3. If you use a printed circuit board, you can lay out the Jinniflash as shown here. The thick foam padding pasted in the bottom cover of the unit serves to hold the battery in place.

cation. Usually a 400-μf. unit, this capacitor can be paralled with a 100-μf. unit to make up the 500 μf. required for *C1*. The battery from the flashgun can also be employed instead of *B1*.

If you don't need the reflector, and are not using a flashgun either, you can simply replace *J1* with a socket that takes flashbulbs. Now all that remains is to wire up the sensor or sensors you plan to use. Figure 5 shows various types and their connections.

Applications and Use. Some of the more common applications of the Jinniflash are described below.

Naturally, for each new application, it will be necessary to adjust the unit for the proper sensitivity. To prepare the photoflood or photoflash lamp is employed, you can trigger the Jinniflash from a much greater distance.

Burglar Alarm. Wanna catch that thief? Let the Jinniflash tell you when he's around. Simply wire the photocell as shown in Fig. 5 (b). This arrangement reduces the firing bias applied to *Q1*'s base through a voltage divider formed by the photocell.

To set the alarm, mount a sharply focused light source on one side of the protected entryway, and set up the Jinniflash on the other side, across from it. Turn the unit *on* and alternately pass your hand to interrupt the beam while adjusting *R3*. At the proper setting the test lamp will flash when the beam is interrupted.

When the beam is interrupted by an intruder, the unit shifts from a low-resistance to a high-resistance state, increasing *Q1*'s base bias, and resulting in the triggering of the SCR to fire the flash bulb.

Audible Triggering. The Jinniflash can also be set off by a sharp sound if you use a standard high-impedance microphone cartridge as the noise sensor. The mike should be wired as shown in Fig. 5 (c), using shielded cable. With the proper microphone and a loud noise source, such as a starter pistol, the unit can be triggered from distances on the order of 25 or more feet. The practical applications of this sound-activated flasher are virtually limitless.

Touch or Moisture Sensing. If you want the Jinniflash to go off at the first drop of rain, high moisture, or body contact, simply connect a moisture sensor between terminals 1 and 3 of *P2* as shown in Fig. 5 (d). Then adjust *R3* for the proper sensitivity by trial.

As a touch sensor, the unit will fire a flash bulb remotely, when photographing wild game life, for example, or merely to perform tricks on a stage if you are practicing to be a magician.

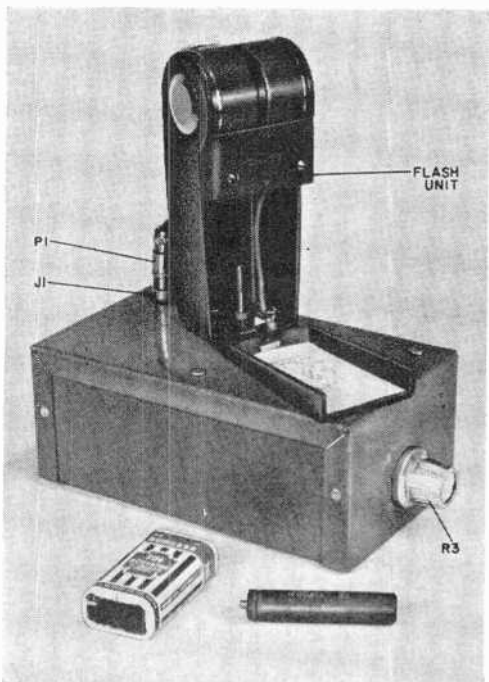


Fig. 4. If you employ the BC flashgun, remove battery and capacitor from the case. Then connect a shorting wire across the capacitor connecting leads.

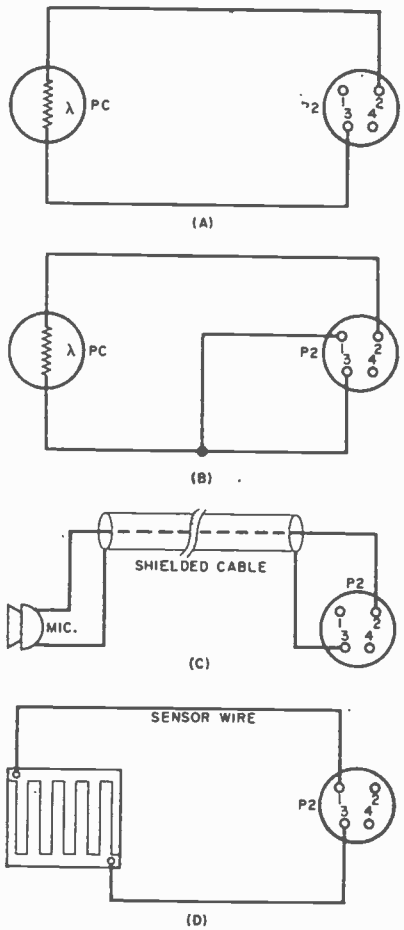


Fig. 5. These plug-in sensing elements facilitate interchangeability. In (a) photocell is wired for slave flash operation; in (b) arrangement is for burglar alarm applications; in (c) a microphone is the sound pickup device; and in (d) the pickup unit operates from body contact, water, or moisture.

In another application, you can use the arrangement of Fig. 5 (b), replacing the photocell with a fine piece of wire or foil. If you adjust *R3* properly, a break in the wire will fire the flash bulb.

Naturally, you'll have to do a little experimenting with the different sensors for best results. But whatever you do, remember: the Jinniflash is your *slave*! You can do with it as you wish . . . but please, let your conscience be your guide. -30-

ADVANCED EXPERIMENTER'S CORNER

INTERSTATION HISS SUPPRESSOR FOR FM TUNERS

By JAMES T. SAMUELSON

IF YOU HAVE a hi-fi FM tuner similar to the Heathkit PT-1, the addition of only four parts will kill the "Niagara Falls" sound effect heard between stations. This interstation hiss is unwelcome and unnecessary. A hiss suppressor can be added to most FM tuners equipped with a built-in tuning meter amplifier.

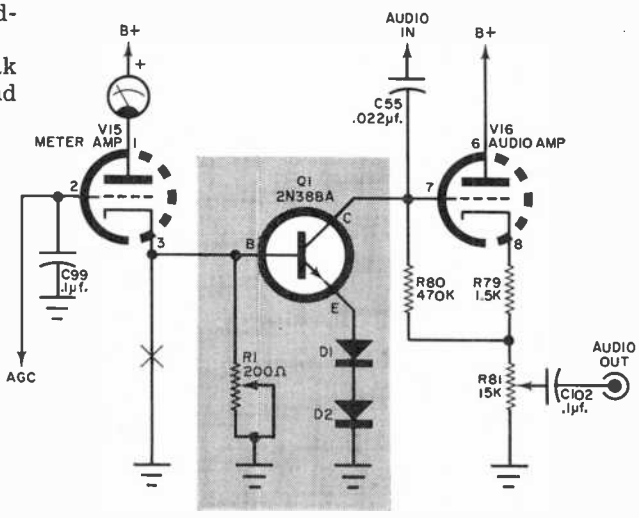
Referring to the schematic diagram, you simply open the cathode-to-ground connection of *V15* at *pin 3*, and wire in the parts as shown. A small piece of phenolic board can be used to support the added components. Connect the collector of *Q1* to *pin 7* of *V16*. Then set potentiometer *R1* to a desired threshold level, and button up the set.

Interstation hiss, or "white noise" as it is often called, is usually heard when r.f. or i.f. amplifiers are operating under maximum gain conditions. When no signal or a very weak signal is present, little or no a.g.c. voltage is developed and the amplifiers run wide open. A strong or medium signal, on the other hand, develops a negative voltage which biases the amplifiers to a lower amplification level and reduces white noise accordingly.

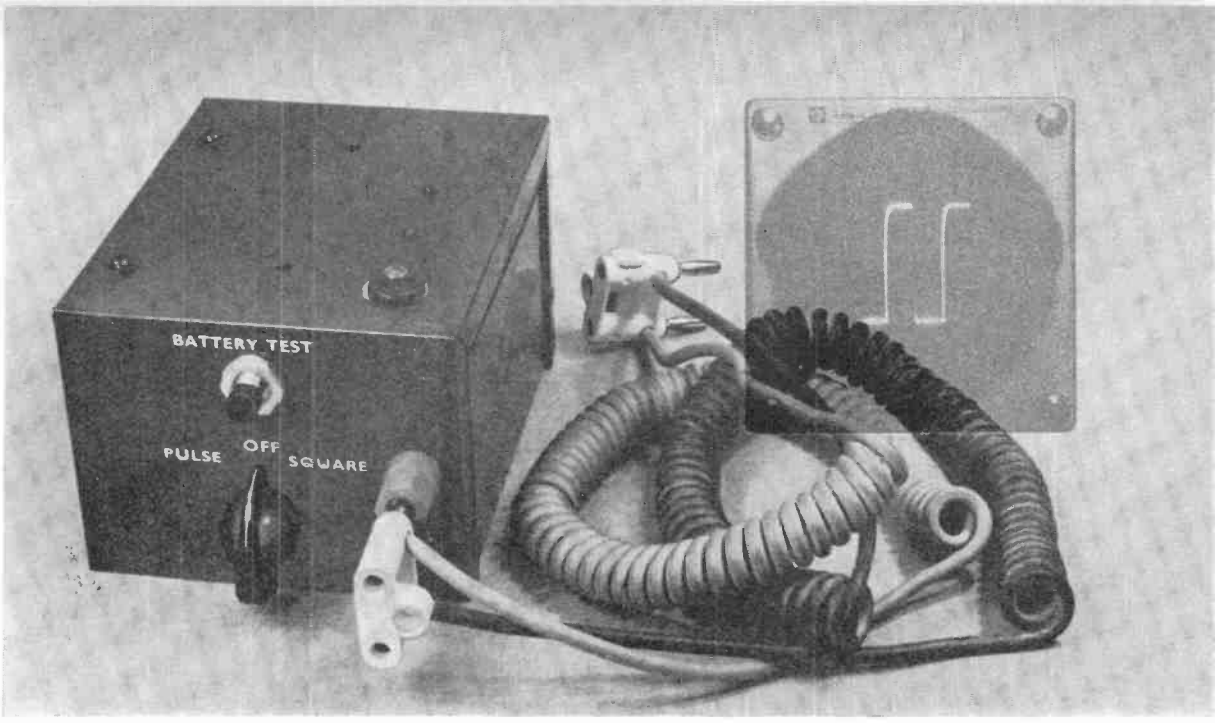
When negative a.g.c. voltage is weak or missing, *V15* also runs wide open, and a relatively large current runs through *R1*, *V15*, and the meter, developing a relatively large voltage across *R1*. This voltage at the junction of *R1* and *Q1* is positive with respect to *Q1*'s emitter and causes *Q1* to conduct, "shorting" the signal input (which is now nothing but noise) on the grid of *V16* to ground.

But when a signal is present, a.g.c. voltage cuts down the current flow through *V15*, reduces the voltage drop across *R1*, removes the forward biasing voltage on the base of *Q1*, and *Q1* stops conduction. When *Q1* doesn't conduct, collector resistance to ground is very high and the audio amplifier operates as though the anti-hiss circuit doesn't exist.

Threshold level is determined by *D1* and *D2* (general-purpose silicon diodes), and the setting of *R1*. Once *R1* is adjusted, it does not have to be reset, except perhaps to compensate for tube aging. A fixed resistor can be substituted for *R1* after it has been properly adjusted and the amount of resistance needed in the circuit is determined. -30-



This circuit can be added to any FM tuner with a tuning meter amplifier and a cathode follower or audio amplifier output. Only four components are needed and they can be mounted on a small piece of punched phenolic board measuring only 1" x 2". The "subchassis" can then be attached to a convenient support under the chassis deck of the FM tuner. To keep the size small, a low-cost, multiple-turn potentiometer is suggested for R1; after several months of use, as the tuner tubes began to age, this control still did not require resetting.



BUILD: SOLID-STATE SCOPE CALIBRATOR

Low-cost, high-efficiency calibrator also serves as portable signal source

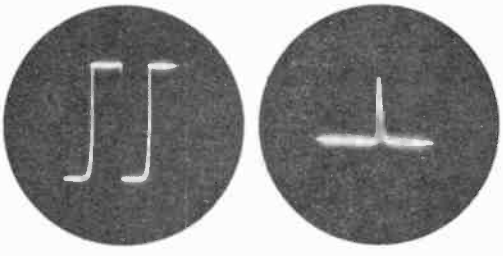
By FREDERICK FORMAN and EDWARD NAWRACAJ

SIMPLE, useful, accurate . . . that about sums up this versatile oscilloscope calibrator which puts out a selectable 10-volt, 1020-Hz square-wave or a 50-microsceond, 1- to 2-volt amplitude, 1020-Hz pulse. With this $18-to-build instrument, you can not only check the vertical calibration and time-base (horizontal) linearity of your oscilloscope, but get this . . . you can even check its basic sweep frequency! The calibrator can also serve as a portable signal source with one thousand and one applications.

How It Works. The scope calibrator (Fig. 1) is basically a simple solid-state astable multivibrator designed to close tolerances. Transistors *Q2* and *Q3* comprise the multivibrator, whose frequency is determined essentially by the values of timing components *C1*, *C2*, *R3* and *R4*. The nominal 1020-Hz frequency can be reduced to an exact 1000-Hz signal by merely shunting *C1* and *C2* with a 20-pf. capacitor.

Emitter follower *Q4* serves to isolate the multivibrator from the loading effects of the output circuit while functioning as an impedance-matching device. Transistor *Q1* serves only as a battery condition indicator. It is employed in an emitter follower configuration with a 10-volt lamp (*I1*) serving both as an indicator and as the emitter resistor.

As the source battery deteriorates, its output gradually approaches the zener



Actual photographs of square-wave (left) and pulse (right) produced by solid-state scope calibrator.

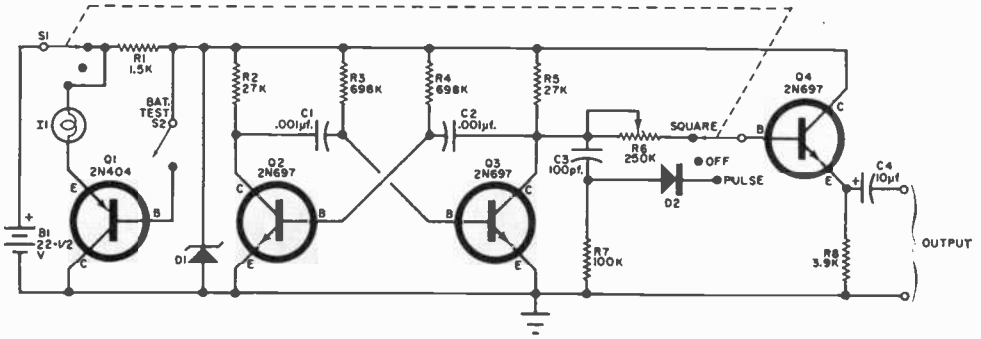
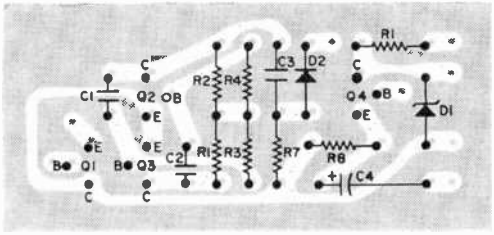


Fig. 1. Essentially a square-wave generator, the scope calibrator also produces a positive-going pulse for test purposes. The battery condition is monitored by means of the test lamp (I1) in Q1's circuit.

(*D1*) voltage, reducing *Q1*'s base bias, and thus causing the lamp to glow more and more dimly. This can be observed by pressing the battery test switch (*S2*). However, because the calibrator would normally be used only on occasion, rather than continuously, the life of the battery can be expected to approach its no-use or shelf life.



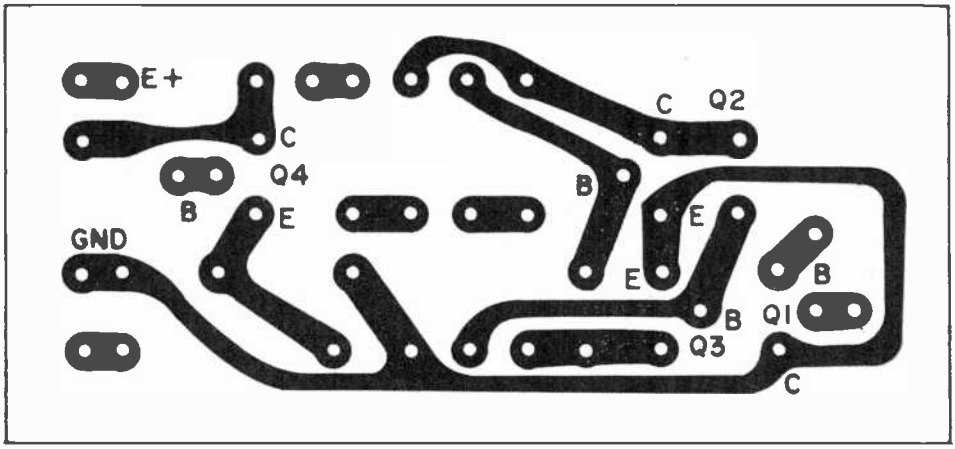
COMPONENT SIDE OF PC BOARD

Fig. 2. Be sure to observe polarities of diodes D1 and D2, and capacitor C4, as shown above. An actual-size photo of the foil side of the printed circuit board appears below.

PARTS LIST

B1—22½-volt battery
C1, C2—0.001-μf., 2% disc capacitor
C3—100-pf. disc capacitor
C4—10-μf., 25-volt electrolytic capacitor
D1—12-volt zener diode (Sarkes Tarzian 1'R12A or equivalent)
D2—1N457 diode
I1—10-volt indicator lamp (Sylvania 10 ES or equivalent)
Q1—2N404 transistor
Q2, Q3, Q4—2N697 transistor
R1—1500-ohm, ½-watt, 10% resistor
R2, R5—27,000-ohm, ½-watt, 10% resistor
R3, R4—698.000-ohm, ½-watt, 1% resistor
R6—250,000-ohm carbon potentiometer
R7—100,000-ohm, ½-watt, 10% resistor
R8—3900-ohm, ½-watt, 10% resistor
S1—2-pole, 3-position rotary switch
S2—S.p.s.t. momentary-contact push-button switch
1—5" x 4" x 3" utility cabinet (Bud C-1795 or equivalent)
*1—2¼" x 4" printed circuit board**
Misc.—Binding posts, battery holder, machine screws, solder, hookup wire

*Available from Fred Forman, 2421 West Berwin Ave., Chicago, Ill., for $2 drilled or $1.50 undrilled.



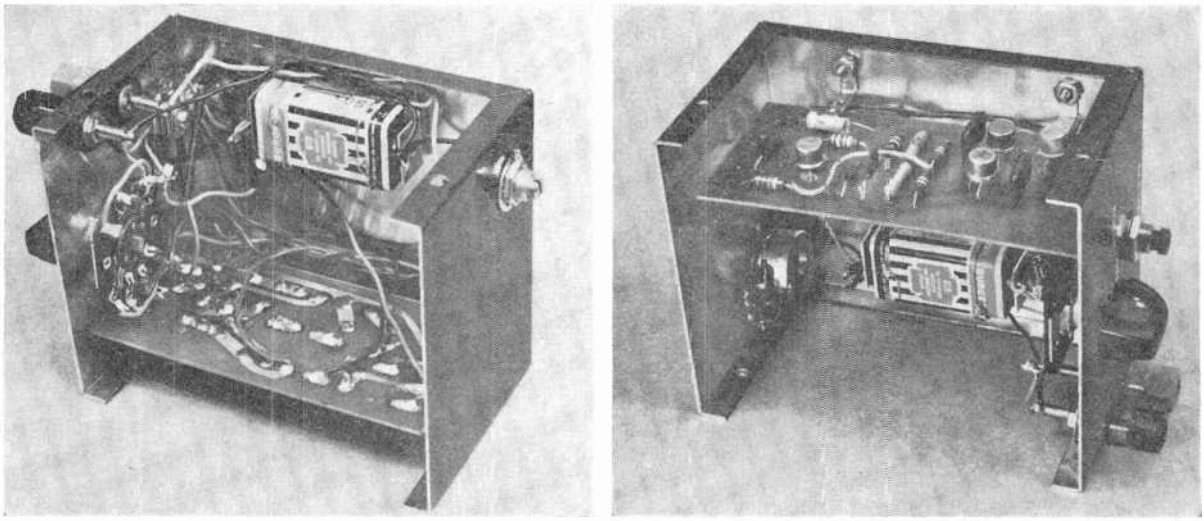


Fig. 3. The bottom cover has been removed to show how printed circuit board is mounted in the cabinet. In view at left, the unit is on its left side. In view at right, the unit is turned on its right side.

Series resistor *R1* drops the battery voltage to within 0.1 volt of the nominal 12-volt zener diode level.

The multivibrator square-wave output which appears at the collector of *Q3* measures approximately 12 volts. This is reduced to the required 10 volts by adjustment of *R6*. To produce the 50-μsec. pulse, the square wave at *Q3* is differentiated by *C3-R7*, and rectified by *D2* to remove negative overshoots. The output is switched to *Q4* by *S1*, and coupled to the external circuit through *C4*.

Construction. Although the model shown uses a printed circuit board (which the author sells for $2—less parts), you can lay out the circuit on a

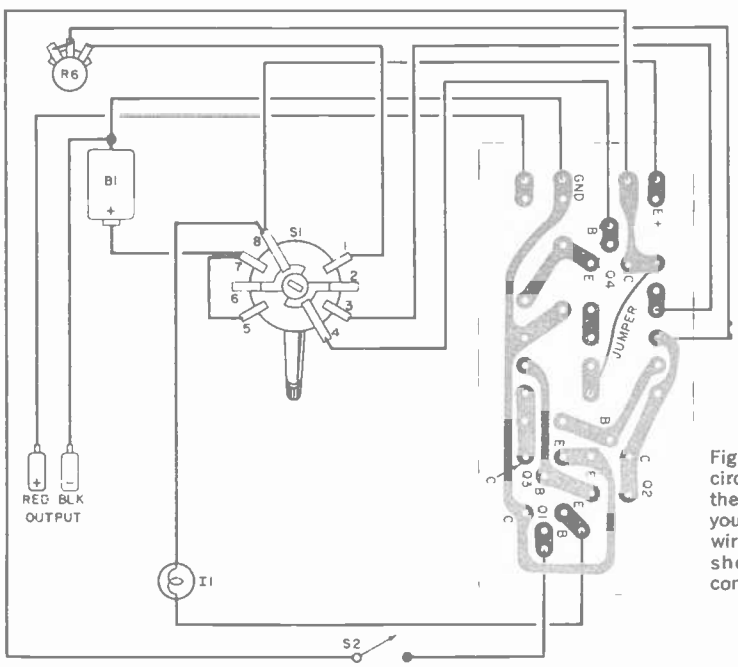
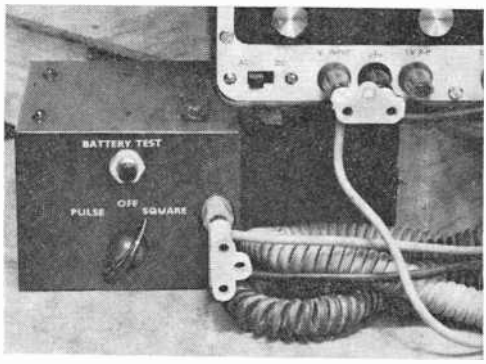


Fig. 4. If you use a printed circuit board, these will be the only wiring connections you will have to run. Jumper wire shown on the circuit board should be mounted on the component side of the board.

When you use the calibrator, connect its output to your oscilloscope's vertical input. Be sure to place a plastic graticule, ruled 10 lines to the inch, over the face of your scope for greater accuracy.



piece of 2½" x 4½" unclad perforated phenolic board if you wish. Use flea clips or solder lug strips for the connections.

The calibrator is housed in a 5" x 4" x 3" utility cabinet. The selector switch (*S1*), battery test switch (*S2*), and output binding posts are mounted on the front panel. You can also mount the battery test lamp on the front panel, to the left of the selector switch, although it is shown here mounted on the top of the unit. Calibration potentiometer *R6* is on the unit's back panel, and the battery can be secured at any convenient spot inside the cabinet.

Mount the parts on the component side of the circuit board in accordance with Fig. 2. Then install the circuit board in the cabinet (Fig. 3) and complete the wiring connections as shown in Fig. 4.

Adjustment. With the battery installed, adjust the amplitude of the square wave to exactly 10 volts, as follows:

(1) Set selector switch to *SQUARE* and connect a jumper between *Q3*'s base and ground to disable the multivibrator.

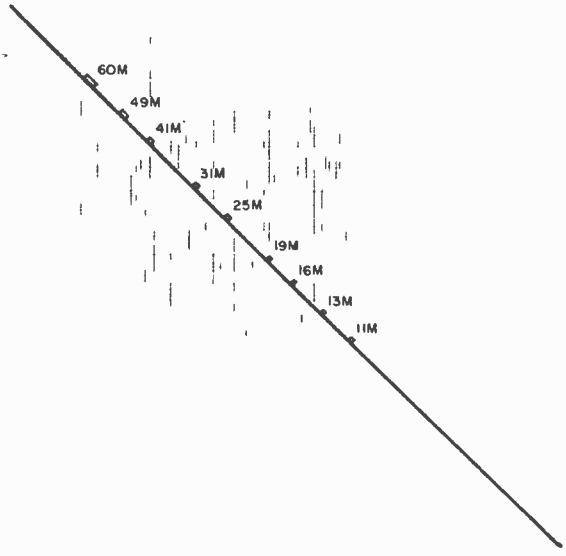
(2) Connect an accurately calibrated d.c. voltmeter across *R8* and adjust potentiometer *R6* (on the rear of the unit) for a 10-volt meter reading. Then remove the jumper and voltmeter.

After calibrating your scope, you can use it to measure the pulse at the calibrator's output. You cannot adjust the pulse amplitude independently since this is a function of the square-wave frequency. -30-

FREQUENCY-TO-METER CONVERSION CHART FOR HAMS & SWL'S

By **JAMES G. LEE,** W6VAT

WHEN you're planning to install antennas for various frequencies, it's useful to have a rough idea of the equivalent wavelengths. You could use the formula: wavelength (meters) equals 300 divided by frequency (megahertz), but this quick-look chart will give you almost as precise an answer. The formula is only necessary when you want to cut an antenna to the nearest fraction of a meter. Calibrated to cover the 3.0- to 300-MHz range, this chart makes it possible to convert from frequency to meters or vice versa. Read up and across for meters, across and down for MHz. -30-



ELECTROMAZE PUZZLE

By
ROBERT C.
RADFORD

Here's a new kind of crossword puzzle designed to test your knowledge of electronic terminology. Refer to the clues given and fill in the word called for by the first clue. Start at the arrow. Thereafter, fill in each new word called for by the following clues *perpendicular* to each preceding word. The first or last letter in each preceding word will be common to the first or last letter of each new word, and all words will read vertically downward or from left to right. The tenth word will have a letter in common with the word at the first *exit*. Nine more correct entries will take you to the word at the second *exit*, which will also share a letter with the last of these nine words. In each case, *the first or last letter of the exit word will be the first or last letter of the next word*. An additional nine correct entries will put you at the final *exit* for a perfect score. A correct entry may or may not fill up all of the white spaces available.

Solution appears on page 101

CLUES:

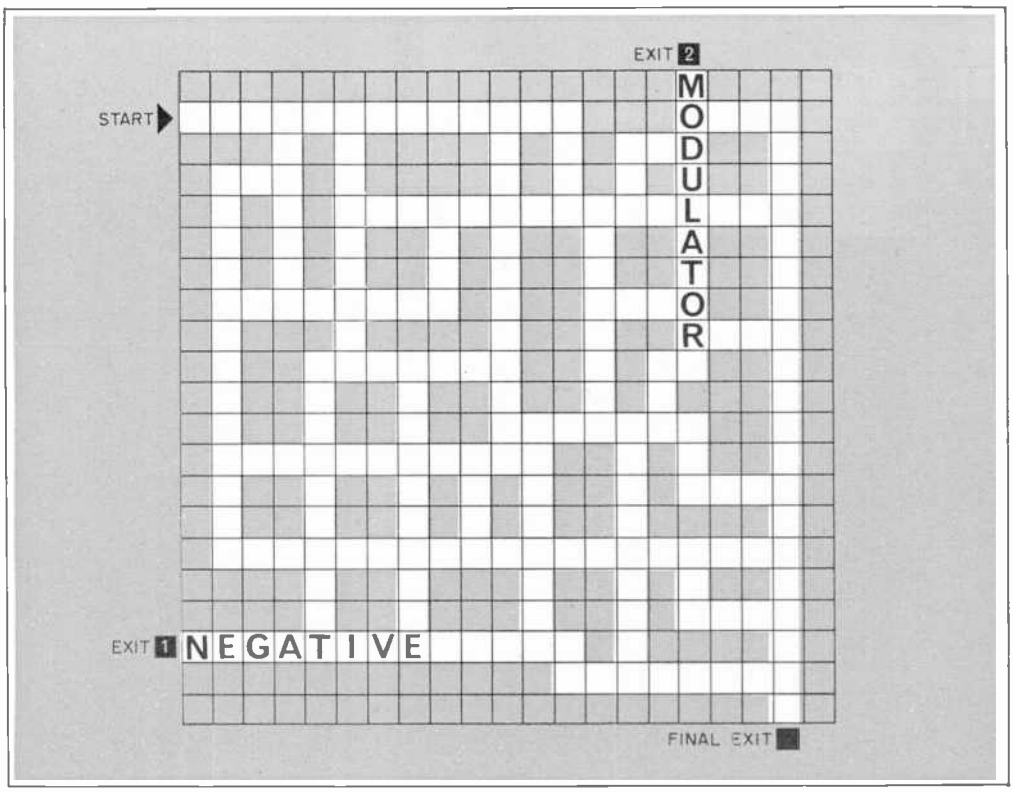
1 Noise in a radio receiver, sometimes coused by atmospheric conditions.
2 Metal surface on which electronic circuits are mounted.
3 Abbreviation for the effective value of an alternating current or voltage.
4 Instrument for electrical measurements.
5 Unit of resistance measurement.
6 Synonym for a sine-wave generator.
7 A revolvable device on which recording tape is wound.
8 Conductor used with test equipment.
9 To hinder or prevent oscillation or vibration, such as the quivering of a meter pointer.
10 One end of a bar magnet.

Exit 1. Polarity resulting from excess of electrons.

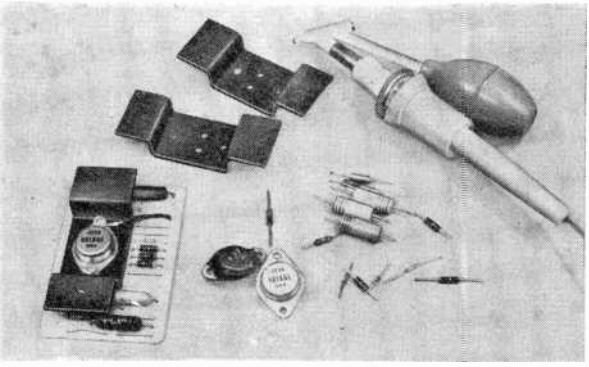
11 Voltage representing angular difference between shaft position and stator of a synchro control transformer.
12 Series-connected coil in an electron tube plate circuit, providing feedback to grid through inductive coupling.
13 Visible form of energy.
14 Thin sheet of copper or other metal, often bonded to phenolic boards.
15 To supply a signal to the input of a circuit.
16 A doughnut-shoped coil.
17 Circuit that rejects undesired signals.
18 Wood used for making speaker enclosures.
19 Signal reflected by a distant target to a rador screen.

Exit 2. Device for mixing carrier frequency and signal frequency to produce sideband frequencies.

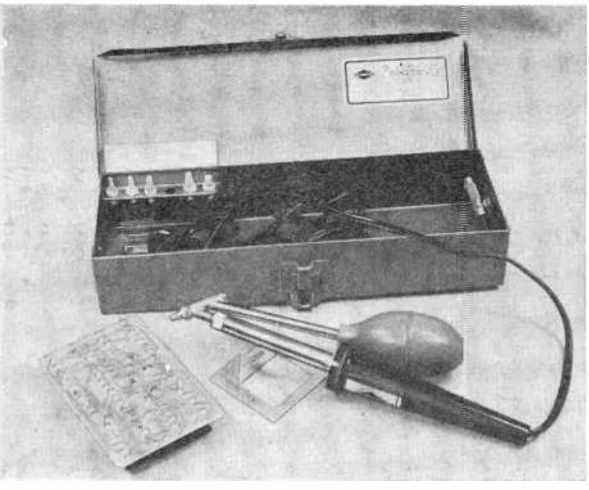
20 Negative or battery side of a telephone line.
21 A long, narrow channel or depression.
22 A transistor element.
23 Scientific research/development center (abbreviation).
24 Unit of length equal to one-thousandth of an inch.
25 Microwave amplification by simulated emission of radiation.
26 Undesired low-frequency vibration, usually associated with turntables.
27 May be transformed from one form to another, but usually cannot be created or destroyed.



COMPUTER PC SALVAGE



The printed circuit boards that provided these heat sinks were purchased in New York City for 30 cents each. Besides a sink and power transistor, each board produced several capacitors, 5% resistors, and silicon diodes. The desoldering iron shown above is the low-cost Ungar Model 7800 "Hot Vac."



Note that the reverse side of this printed circuit board was dip-soldered, indicative of the fact that hundreds of such boards are available in the "distress" market. The 300-K Endeco desoldering kit in this photograph contains a variety of tip sizes.

THE rapid advances in computer technology—being made almost on a weekly basis—are dumping thousands of dollars' worth of electronic components into the "distress" market. Practically all computer circuits are on printed circuit boards, and with a little care the experimenter can uncover a gold mine in reusable parts.

High-grade capacitors, precision resistors, and top-quality transistors and diodes are but a few of the components the author has salvaged from computer PC boards. The secret of a successful salvage operation lies in preventing the heat from reaching the components while desoldering. An obvious way to do it is to use one of the new desoldering irons with a rubber suction bulb attached to the iron. Another way is to prepare a bath to absorb the heat from the component leads before they get too hot.

An effective heat sinking bath can be set up by placing the PC board in a shallow, flat-bottomed pan of water—supporting the board so that the foil side with the soldered connections just breaks the surface. Desolder with a hot iron or gun and brush the molten solder aside with a small wire brush—or suck it up with a rubber suction bulb.

If you choose your computer PC board wisely, you will be astonished at the harvest you can reap. Recently the author worked over three boards that yielded 27 transistors, 48 diodes, and dozens of 5%—or better—resistors, at a total cost of only $1.50! —*Paul H. Fuge*

CHECK THESE COMPANIES FOR PC BOARDS
(a sampling)

ARROW SALES–CHICAGO
2534 S. Michigan Ave.
Chicago 16, Ill.

RADIO SHACK
730 Commonwealth Ave.
Boston, Mass. 02117

JOHN MESHNA, JR.
19 Allerton St.
Lynn, Mass.

POLY PAKS
P.O. Box 942
S. Lynnfield, Mass.

TRANSISTORS UNLIMITED CO.
462 Jericho Tpke.
Mineola, L.I., N.Y. 11501

VHF/FM MARINE RADIO SERVICE

More channels, less noise, smaller antennas, less crowding, and more reliable communications for pleasure boating

By RICHARD HUMPHREY

IF YOU, too, have shied away from marine radiotelephone gear because you just couldn't stand the sight of that awesome-looking 20-odd foot antenna drooping over on your boat, or your boat wasn't big enough to carry such a long antenna, why haven't you installed VHF/FM radio equipment? It requires no more than a 17-inch whip . . . and no ground plate at all!

Illustration by Andre Duzant

In spite of the fact that the VHF/FM Maritime Radio Service has been around since 1962, it was not until quite recently that this new service began to catch on, thanks mainly to the relentless efforts of the U. S. Coast Guard and the Federal Communications Commission. And, if the 1966 Boat Show at the New York Coliseum—with its impressive exhibit of two-way radio—is any barometer, VHF/FM marine radio has finally come into its own.

Aside from the wide variety of radio equipment the recreational boater has to choose from, he can, for a few extra dollars, boost the radiated signal of any equipment he selects by using one of the many high gain antennas that are available to him. Communications Products, GAM, Prodelin and White are but a few of the manufacturers who offer such units. In addition to the basic 17″ quarter-wave whip for the VHF marine frequencies, you can also get a 34″ whip with a 3-db gain which doubles the effective radiated power.

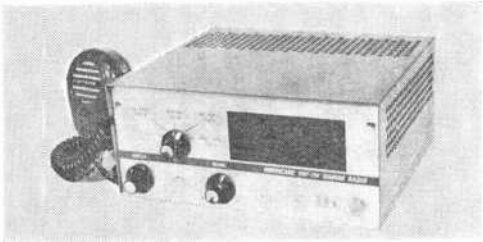
Frequencies Covered. The VHF/FM Maritime Radio Service covers 18 channels in the 156 to 174 MHz band. Specific frequencies, channel designations, points of communication, and authorizations that are available for assignments are listed below.

While the 2-3 MHz marine band was terribly overcrowded, as are the CB radio frequencies and the old VHF marine band with only eight assigned channels, the new 18-channel VHF/FM marine radio service includes ship-to-bridge and lock tender facilities in addition to a marina channel (channel 9, 156.45

VHF FREQUENCY ALLOCATIONS (156-174 MHz)

CHANNEL DESIGNATION	FREQUENCY (MHz)		COMMUNICATION POINTS	AUTHORIZED USE
	SHIP	SHORE		
6	156.3	.....	Ship-to-Ship	Safety Communications
7A	156.35	156.35	Ship-to-Ship Ship-to-Shore	Business & Operational
8	156.4	.....	Ship-to-Ship	Business & Operational
9	156.45	156.45	Ship-to-Ship Ship-to-Shore	Business & Operational
10	156.5	156.5	Ship-to-Ship Ship-to-Shore	Business & Operational
11	156.55	156.55	Ship-to-Ship Ship-to-Shore	Business & Operational
12	156.6	156.6	Ship-to-Ship Ship-to-Shore	Port Operational
13	156.65	156.65	Ship-to-Ship Ship-to-Shore	Business & Operational[1]
14	156.7	156.7	Ship-to-Ship Ship-to-Shore	Port Operational
16	156.8	156.8	Ship-to-Ship Ship-to-Shore	Safety-Calling[2]
18A	156.9	156.9	Ship-to-Ship Ship-to-Shore	Business & Operational
19A	156.95	156.95	Ship-to-Ship Ship-to-Shore	Business & Operational
20[3]	157.0	161.6	Ship-to-Shore	Port Operational
24[3]	157.2	161.8	Ship-to-Public Tel.	Public Telephone
25[3]	157.25	161.85	Ship-to-Public Tel.	Public Telephone
26	157.3	161.9	Ship-to-Public Tel.	Public Telephone
27	157.35	161.95	Ship-to-Public Tel.	Public Telephone
28	157.4	162.0	Ship-to-Public Tel.	Public Telephone

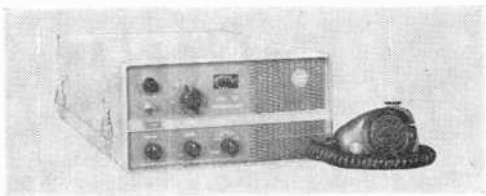
1. *Business and operational in the Great Lakes area; in other areas, navigational only.*
2. *Authorized for call, reply, and safety purposes; if necessary, for distress messages also.*
3. *Not available in Puerto Rico or Virgin Islands.*



Five channels and 35 watts of radiated power are features of Hartman's "Hurricane" transceiver.

MHz), the latter specifically requested by the U. S. Power Squadron.

Until quite recently, the most active promoter as well as user of the new VHF/FM facilities was the United States Coast Guard. Said Captain Charles Dorian, Coast Guard Chief of Communications, in a recent address before the North Atlantic SAR Seminar: "Every



Konigsberg Electronics' KR-53V transceiver features 10 message channels at 50 watts output power.

operational shore unit will have installed a four- or six-channel transceiver. Every Coast Guard vessel 16 feet long, and above, will have VHF/FM capability ranging from single-channel portable transceivers to 28-channel transceivers!"

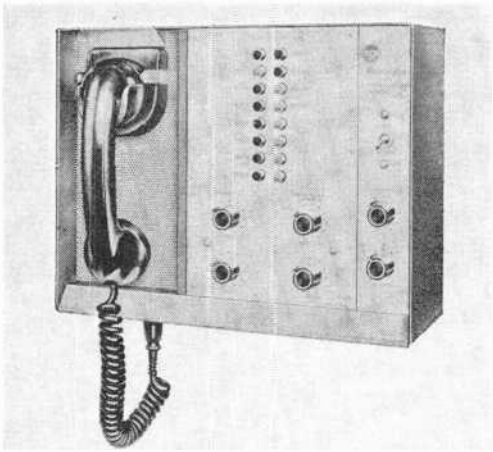
By all indications, the words of Captain Dorian are being fully implemented not only aboard ship, but also on shore. According to Commander H. J. LeBlanc, East Coast Area Communications officer, U. S. Coast Guard, who presented a comprehensive station list at the January 16th Maritime Communications Companies VHF Conference in New York, local Coast Guard communications facilities will gladly supply complete information. (Consult your nearest U. S. Coast Guard facility for a listing of stations in your area.)

Small Craft Users. According to James E. Barr, Chief of the FCC's Safety and Special Radio Services Bureau, there are approximately 5000 licensed transmitters at the present time, representing an increase of approximately 1000 over the 1964 total. Furthermore, the number of stations is increasing at a rate of over 30 per month. One conclusion that can be drawn from the rapid expansion of the VHF/FM Maritime Radio Service is that the recreational boatman has finally begun to make use of these radio facilities.

The U. S. Coast Guard Auxiliary, having been granted use of the Coast Guard primary VHF working frequency, 157.1 MHz, is offering free classes to train the pleasure-boater in the mysteries and wonders of the VHF/FM marine radio band. You can get more information on the classes offered from your nearest U. S. Coast Guard Station.

Also, the U. S. Weather Bureau has expanded its 5:30 a.m. to 10:30 p.m. taped weather forecast service on 162.55 MHz to an 18-station network, of which 16 stations will ring the eastern coast of the United States, from Boston to Brownsville, Texas, in time for the 1966 hurricane season.

Telephone Network. "So now," says the skipper of *Little Nell*, "I've got 156.3 MHz (safety) on channel 1 of my five-channel rig; 156.45 MHz (marina) on channel 2; 156.65 MHz (bridge-to-bridge) on channel 3; 156.8 MHz (Coast Guard and calling) on channel 4, leaving channel 5 unassigned. What do I put on



Although RCA Radiomarine's VHF P19A is essentially a commercial rig, it would be right at home aboard bigger yachts. Control head features push-button channel selection and telephone handset.

Aerotron's "Sea Line" transceiver delivers 35 watts to the antenna, has four channels, and is compact.

it?" Replied the skipper of the *Sea Wolf*: "For seven bucks a month, which entitles you to 120 message units, you can tie into the Bell System's worldwide telephone network. This is what you put on channel 5!"

If you've ever experienced a nerve-wracking fight to get a phone call through on the old 2-3 MHz band, you'll appreciate how nice it is to switch to VHF/FM and just tap that mike button *once* and hear your local marine operator come back at you loud and clear over static-free FM radio in a couple of seconds.

Unfortunately, the telephone companies have been slow to react to the "communications explosion" taking place under their very noses, and are therefore passing up a lucrative business to common carrier interests. Of the 79 stations publicly licensed for this service, 33 are common carriers. An FCC spokesman recently confirmed that, of late, the bulk of applications received for Public Correspondence, as the telephone service is called, are from common carriers.

Nor has the Bell Telephone Company shown any desire to expand beyond their present use of two channels out of the five which are available for Public Correspondence. "We are presently refusing service for *land mobile* stations aboard vessels," says E. F. Mattern, Communications Consultant for the New York Telephone Company, "since we feel that shipboard stations should properly use the VHF marine radio facilities that are available to them." This seems to indicate that land mobile stations aboard vessels will be using the VHF Marine Operator more and more—at least in the New York area.

In spite of the view expressed by Mr. Mattern, there is a strong possibility that the five channels authorized for Public Correspondence will be in full use in the not-too-distant future. For at this writing, the FCC has just approved

(*Continued on page* 92)

PARTIAL LISTING OF CURRENTLY AVAILABLE VHF/FM MARITIME RADIO EQUIPMENT

MANUFACTURERS	MODEL	TRANSMIT POWER (watts)	PRICE (tentative)
AEROTRON—SEA LINE	6W35/SLT	35	$495.00
AIRCRAFT RADIO CORP.	Bantam	75	440.00
	Cambridge	15	657.00
	Vanguard	60	994.00
FISHER RESEARCH LABS. INC.	FI50	50	.....
HARTMAN MARINE	Hurricane, 1 Channel	35	335.00
	Hurricane, 2 Channels	35	385.00
	Hurricane, 5 Channels	35	449.00
KAAR ELECTRONICS CORP.	Clipper I	25	575.00
	Clipper II	25	695.00
KONIGSBERG ELECTRONICS, INC.	KR-53V	50	525.00
RCA RADIOMARINE	CRM-P20A-15	7	710.00
	CRM-P19A-100	50	.....
RAYTHEON MANUFACTURING CO.		15	780.00
PEARCE-SIMPSON, INC.	MTR-50	12	600.00
COMMUNICATIONS CO. (COMCO)	682	50	.....
SONAR	FM-450	50	400.00

METER-READING QUIZ

By ROBERT P. BALIN

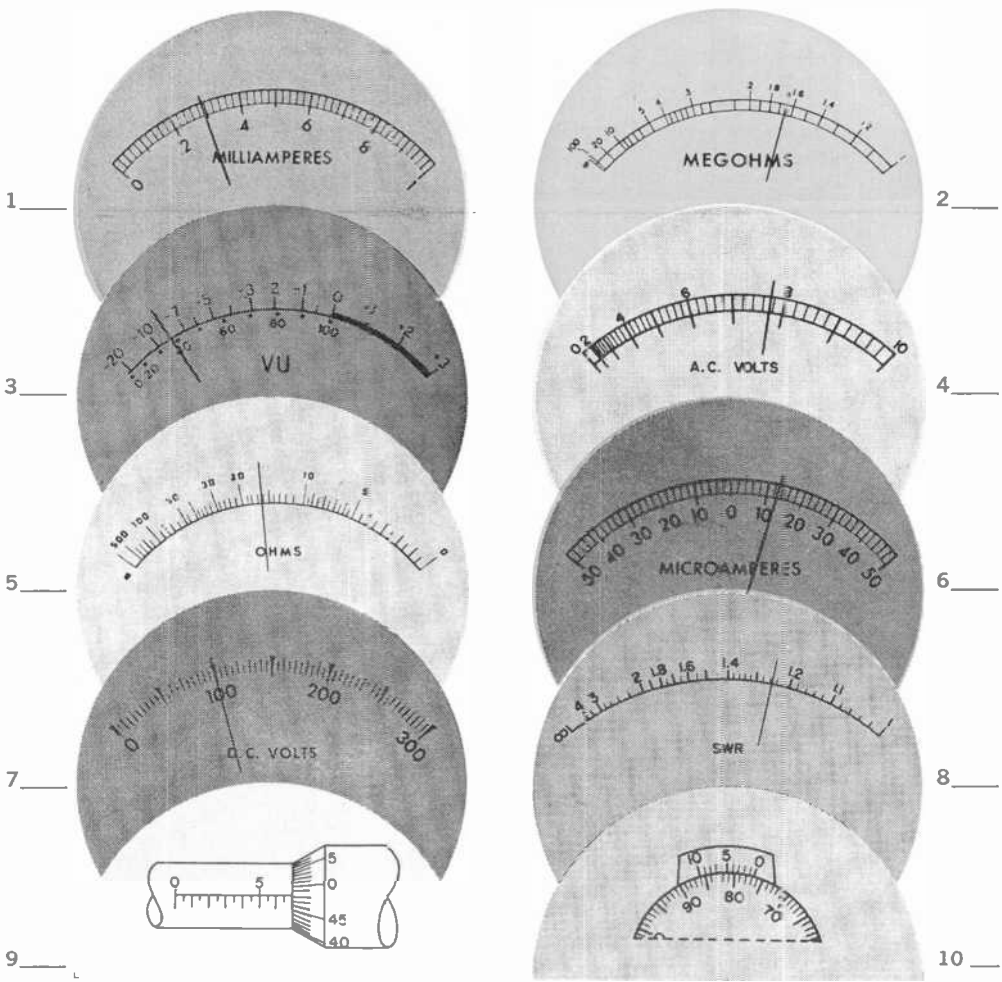
Electronic technicians, hobbyists, and experimenters are constantly required to make measurements using test instruments with a variety of dial calibrations. For in addition to the voltmeter, ammeter, ohmmeter, wattmeter, vu meter, etc., there are other instruments which, though seldom used by the average hobbyist, are of equal importance to the technician or experimenter. The micrometer is one of these.

(*Answers appear on page* 99)

Before testing your skill at reading meters, note the following useful procedures:

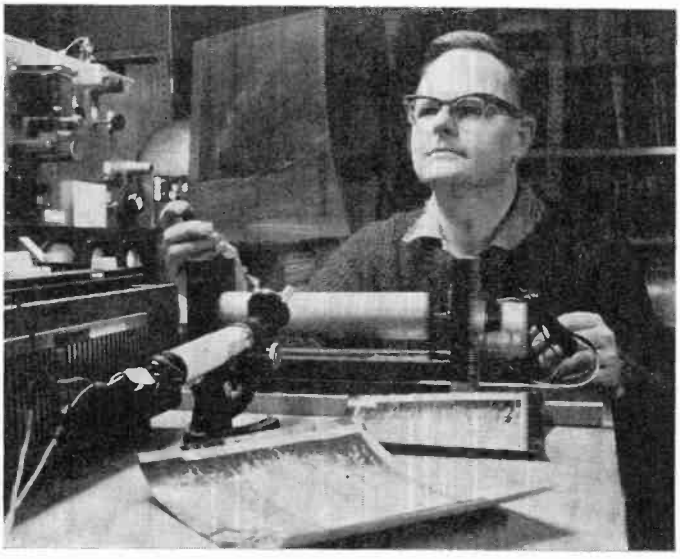
(1) Locate the zero index.
(2) Examine the scale to determine if it is linear or not.
(3) Determine the value of each major division and its subdivisions.
(4) Try to be as accurate as possible when approximating position of pointer or index within a scale division.

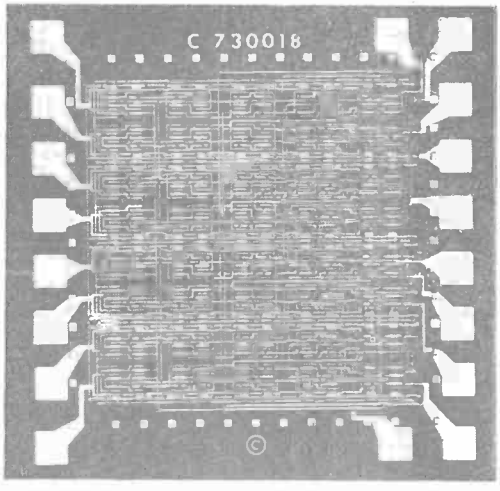
Now, see how accurately you can read the following meter scales, to the nearest tenths or hundredths.



ZERO-BEATING THE NEWS

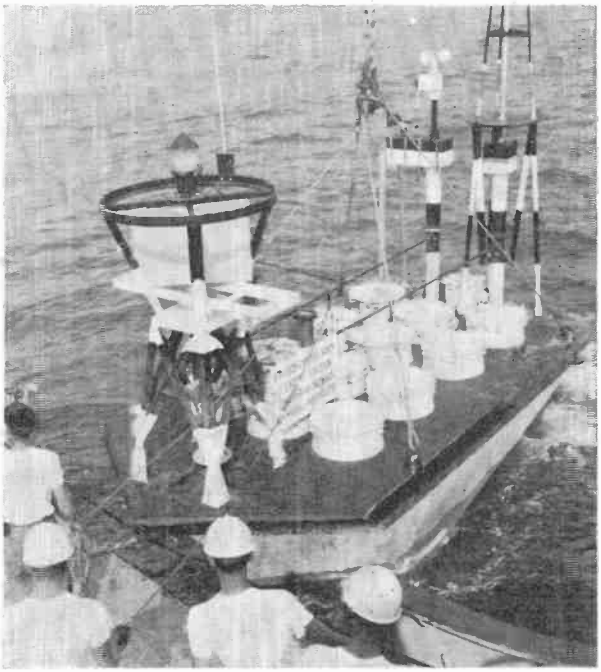
"HOME-BREW" WEATHER STATION—Wendell Anderson, RCA engineer and ham operator, holds up a weather picture transmitted from an orbiting satellite. Using a vintage ham receiver (1938) and $250 worth of such mundane parts as a rolling pin, an argon lamp, and a $15 microscope, he has been able to pull in signals from the NIMBUS and TIROS weather satellites and reproduce them as the U.S. Weather Bureau does. Said Anderson: "To build a TIROS ground station for a few hundred dollars, when commercial ones run $30,000 and more, shows that any country that wants TIROS weather data can get it."



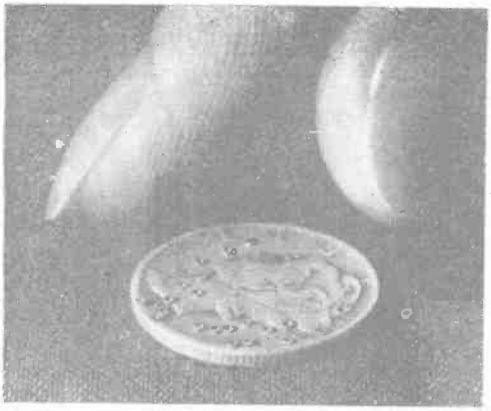


ELECTRONIC "BUILDING BLOCKS"—Only 1/8" square, this circuit array can contain as many as 1500 components, including up to 750 transistors. Developed by Fairchild Semiconductor, these silicon monolithic circuits are being standardized to make it possible to satisfy the needs of different users without having to design a new circuit for each application.

10,000 VOICES—Combat soldiers using Hughes Aircraft's lightweight "Man-pack" transceiver have 10,000 individual voice channels in the 2 to 12 MHz range to choose from in order to overcome enemy jamming. The SS8 transistorized unit can work on ordinary flashlight cells. In field tests, sets have operated efficiently between points 500 miles apart.

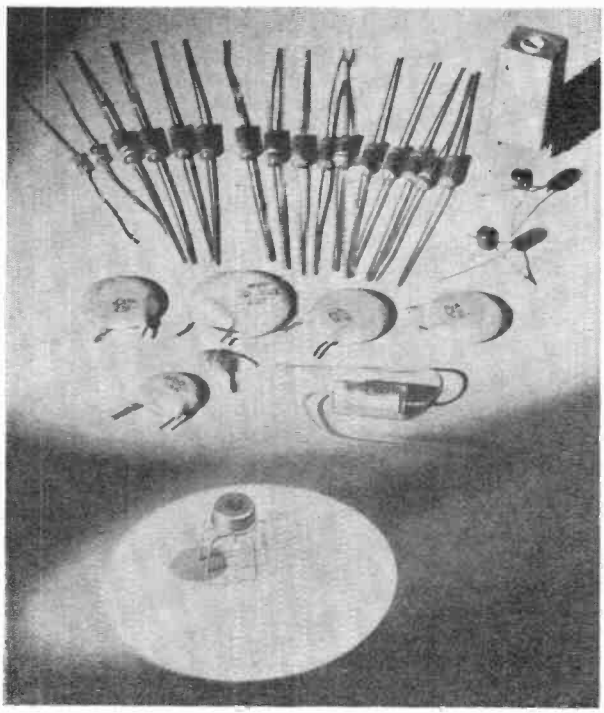


ATOM-POWERED WEATHER STATION—A nuclear-powered unattended weather buoy (NOMAD), developed by the National Bureau of Standards, broadcasts weather data from Gulf of Mexico to monitoring stations for protection of ships and aircraft.



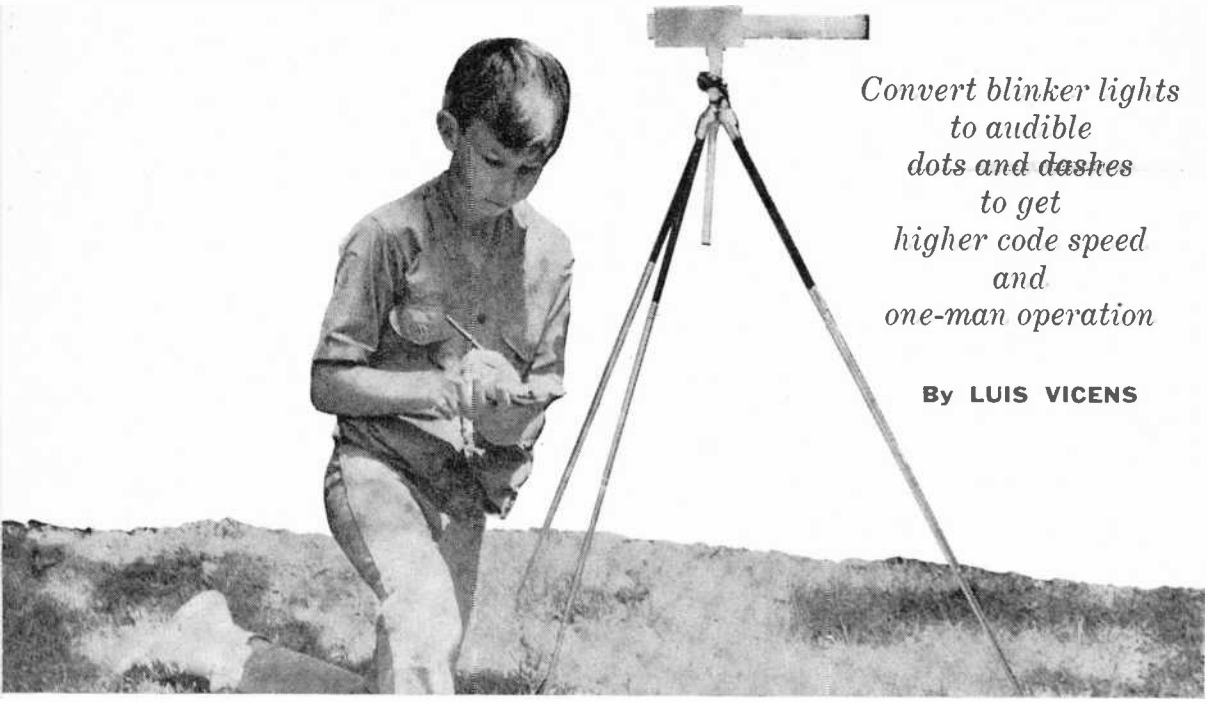
MICROMINIATURE CORES TO GUIDE SATURN—To get the most guidance information into the smallest possible space, IBM engineers designed microminiature cores for the Saturn IB launch vehicle's guidance computer. Some 545 cores fit on a dime.

COMPUTERS AT THEIR FINGERTIPS—Without having to leave the financial district, businessmen in the New York Wall Street area now have access to ITT's giant multi-purpose computer complex in Paramus, N.J., where their investment and other business problems will be analyzed in a matter of seconds.



ELECTRONIC INSECT? Not quite, but one of RCA's new integrated circuits intended for home entertainment equipment can perform functions of all 26 electronic components shown in the background. Units will sell for as little as $1.25 in production quantities.

BUILD **LIGHT-TO-SOUND**



Convert blinker lights to audible dots and dashes to get higher code speed and one-man operation

By LUIS VICENS

LIGHT-SIGNALED Morse code has many advantages, but as any scout or sailor will tell you, it can be downright tough to copy, and it is usually a two-man job . . . one man watches the blinking lights and calls out the letters, while another man writes them down. Eyeball response to speeds greater than 8 or 10 words a minute is extremely difficult. Audible dots and dashes, on the other hand, can be copied at much faster speeds, and it takes only one person to do it. For a few dollars' worth of parts, you can build this code translator to convert the blinking light to an audible tone.

Signals from an ordinary flashlight can be "seen" 50 feet away and more, depending upon focus, aim and ambient light conditions. Greater distances can be spanned with a brighter light source. The translator is an ideal science fair project to demonstrate communications by light, photocell operation, and transistor amplifier action. You can also use it in your auto as a light dimmer reminder.

How It Works. Figure 1 is the schematic diagram of the translator, which—in this application—serves as a receiver. It is a two-transistor direct-coupled amplifier that acts like a switch to turn the sounder on when a light strikes the silicon photocell.

In the presence of light, the cell puts out a small voltage (up to about 0.4 volt at 10 to 16 ma., in full sunlight)

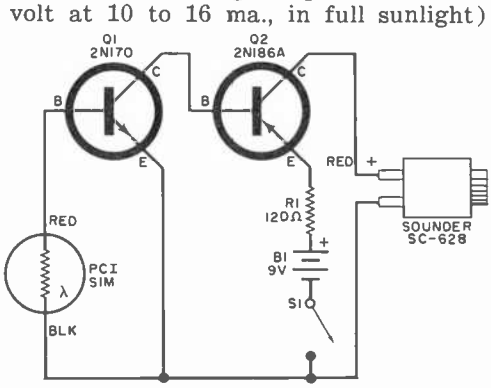


Fig. .. when the photocell is exposed to a small light, it generates a small voltage and causes the transistors to conduct and energize the sounder.

TRANSLATOR

and forward-biases *Q1*. Transistor *Q1* conducts through the base-emitter junction of *Q2* and forward-biases *Q2*. Transistor *Q2* conducts and energizes the sounder. Resistor *R1* serves as a current limiter.

A transistorized code practice oscillator can be "keyed" by this type of circuit, as can a relay and buzzer device. However, the sounder used here draws little current, and calls for a minimum number of parts. Sounder frequency is on the order of 2500 Hz and is sufficiently loud enough for most applications. No, it isn't as loud as an auto horn.

The transmitter can be any sharply focussed light source that can be keyed on and off easily. There is really no limit as to how elaborate or simple you can make a blinker. You can cover the light source with an infrared filter so as to make the light beam invisible to "eyes-droppers"; you can place a lens in front of the light to intensify the beam; and you can place a long cardboard tube in front of the light to obtain a very narrow beam to make the unit extremely directional.

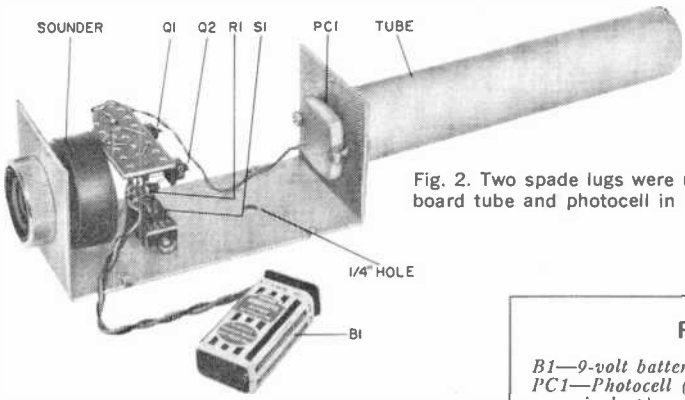


Fig. 2. Two spade lugs were used to hold the long black cardboard tube and photocell in place—cement would do as well.

Construction. All the translator components, including the battery, are housed in a Minibox measuring 5" x 2¼" x 2¼" as shown in Fig. 2. Drill a 1⁹⁄₆₄" hole in the center of one end of the

(*Continued on page* 93)

PARTS LIST

B1—9-volt battery
PC1—Photocell (International Rectifier S1M or equivalent)
Q1—2N170 transistor (or equivalent)
Q2—2N186A transistor (or equivalent)
R1—120-ohm, ½-watt resistor
S1—S.p.s.t. slide switch
1—Sounder (Sonalert SC-628 available from Newark Electronics Corp., 223 W. Madison St., Chicago, Ill.)
1—5" x 2¼" x 2¼" Minibox (Bud CU-3004A or equivalent)
1—Aluminum or cardboard tube, 6" to 12" long, 1¼" diameter
1—Small camera tripod (optional)
1—Military surplus signal lamp or sharply focused flashlight
Misc.—Small perforated phenolic board, screws, nuts, wire, solder, etc.

ON THE CITIZENS BAND

By **MATT P. SPINELLO,** KHC2060, CB Editor

THE Western New York Pioneer Citizens Band Association, Lockport, N. Y., has been reported to your CB Editor as being one of the most civic-minded CB organizations in the country. Its past record bears out the report. The achievements of this group might serve as a guideline to recently organized CB associations and to veteran clubs interested in working for the good of their own communities.

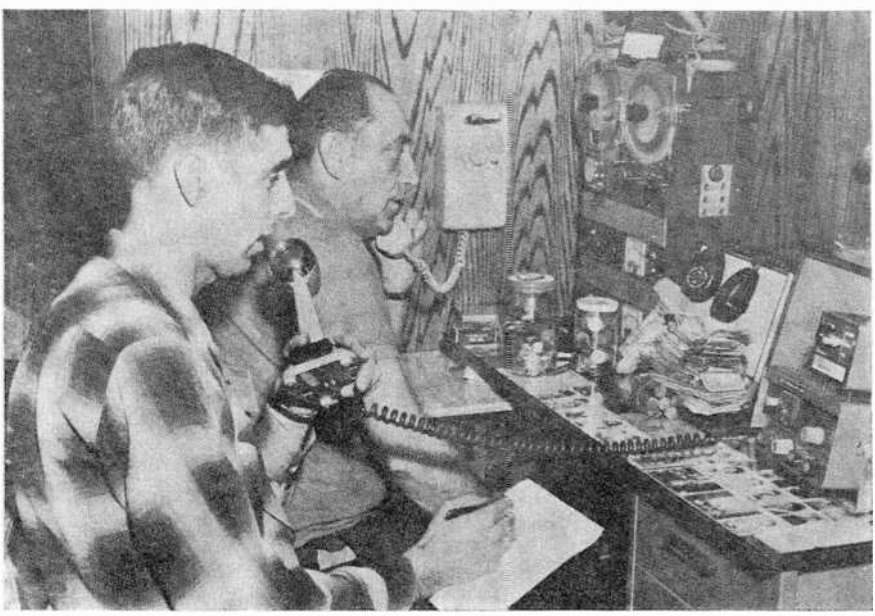
The PCBA had an unusual beginning. It was organized specifically to aid needy children. However, the first attempt at organization, in 1963, was nearly disastrous; as membership began to swell, some members lost sight of the original purpose of the club and concentrated more on social functions. Sound familiar?

CIVIC MINDED CB'ERS AID NEEDY CHILDREN

To avoid a permanent departure from their original plan, membership in the reorganized PCBA has been limited to 50. The purpose of the club is carefully explained to all applicants, and each application requires the approval of the board of directors. Many of the current members are businessmen using CB 2-way radio. Although the Pioneers are primarily interested in helping children, their services are offered to any charitable organization seeking aid.

The club's past performances are highly commendable—one might even say enviable! In February, 1965, for example, the club donated $100 to the Rehabilitation Center Fund for Children in Buffalo, N. Y. In April, members joined a drive to collect clothing for flood victims in Portland, Oregon; three tons' worth was collected.

At Eastertime the club bunny visits the homes of children in the area with candy baskets for all, and makes a similar visit to children confined in Lockport Memorial Hospital. And when the club held its jamboree last May, honored guests for the two-day event were children from St. Rita's Home for Retarded Children and Wyndham Lawn Home for Children. The guests were treated to a picnic lunch, and given free rides and entertainment, including a special



During telethon for a children's rehabilitation fund, Pete Russell, KIC1734, president of the Western New York Pioneer Citizens Band Association, handled the landline while club treasurer, Wally Rader, KIC5723, dispatched CB mobile units to collect some $3000 of the $250,000 pledged by New Yorkers.

celebration for those with birthdays that week.

Last December the Pioneers donated $50 to the Lockport Veterans of Foreign Wars for use at their children's Christmas party. A 19″ portable TV receiver was donated to St. Rita's Home the same month.

To kick off the new year, club president Pete Russell, KIC1734, reported the Pioneer group's donations for the month of January: Hope fund, $200; Salvation Army, $50; Rehabilitation Fund, $100. Total: $350. And in February members participated in an annual Children's Rehabilitation Fund Telethon broadcast aired over WKBW, Buffalo, N. Y., by picking up more than $3000 in pledges with their CB mobiles, then donating $100 on behalf of the club. The total pledged by New Yorkers during the drive amounted to more than $250,000.

Publicity director Vernon Batt, KIC5311, announces that the club's 1966 jamboree will be aimed at raising a net profit of $5000 for—you guessed it—needy children. As this column is being written, the event is tentatively set for June 12. One of the highlights on the bill will be a show from the Grand Ole Opry. Interested CB'ers should contact CB'er Batt at 321 Miller St., North Tonawanda, N. Y.

Yes, the club is CB-active, too. Members do have CB equipment and can be heard on the air, but mostly for business purposes, occasionally with a personal note. The important thing is that the members of the group were brought together through an interest in Citizens Band 2-way radio, and

(*Continued on page* 100)

1966 OTCB JAMBOREE CALENDAR

Planning a jamboree, get-together, banquet or picnic? Send the details to: 1966 OTCB Jamboree Calendar, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. For more information on the jamborees listed below, contact the clubs or club representatives at the addresses given.

New City, N. Y. — **June 6**
Event: Sixth Annual Jamboree. Sponsor: Citizens Radio Association of Rockland. Address: P. O. Box 295, Nanuet, N. Y. 10954.

Sioux Falls, S. D. — **June 18-19**
Event: Third Great Plains Citizens Band Radio Convention. Sponsor: Sioux Empire Citizens Communication Assn. Location: Sioux Falls Fairgrounds. Contact: Montie Horn, Chairman, 3013 E. 18 St., Sioux Falls.

Struthers, Ohio — **July 10**
Event: Third Annual Picnic and Roundup. Sponsor: Mahoning County CB Radio Club, Inc., of Youngstown, Ohio. Contact: D. C. Peloquin, 618 W. Heights Ave., Youngstown.

Warren, Ohio — **July 16-17**
Event: Annual National MCEU Convention and Jamboree. Sponsor: Mahoning Valley Chapter. Contact: Mike Davis, 5036 Alva Ave., N.W., Warren, Ohio 44482.

Painesville, Ohio — **July 30-31**
Event: 1966 Jamboree. Sponsor: Lake County Citizens Band Club. Contact: Frequency Beat, P. O. Box 489, Wifloughby, Ohio 44094.

Punxsutawney, Pa. — **July 30-31**
Event: CB Camp-Out. Location: Punxsutawney Sportsman Club. Sponsor: Punxsutawney CB Club. Contact: Paul Bosak, Delancey, Pa. 15733.

Defiance, Ohio — **August 14**
Event: CB Jamboree. Sponsor: Maumee Valley Emergency CB Radio Corps, Inc. Contact: Ed Morehouse, P. O. Box 303, Defiance.

Last Christmas, the PCBA president played Santa's helper at St. Rita's Home for Retarded Children, where he delivered a TV receiver on behalf of the club. Shown accepting the set are Robert Krueger, chairman of the home's advisory board, his daughter, Kelly, and Sister Raphiel Marie.

Photos by Al Shoen

SOLID STATE

By **LOU GARNER,** Semiconductor Editor

OVER THE YEARS semiconductor prices have followed a steady downward trend as production techniques have improved and more efficient manufacturing methods have been introduced. The original point-contact transistor (now obsolete) sold for well over $100. Today, however, a far superior transistor is available in small production quantities for less than 25 cents each.

An interesting example of how semiconductor prices can change over a few years is shown in a recent General Electric advertisement. The ad traces the cost of basic semiconductor devices used to control 600-watt loads, when purchased in quantities of 100 and up, from 1957 to 1965.

When the silicon-controlled rectifier (SCR) was first introduced back in 1957, a pair sold for $290. These early units, Type ZJ39A, were supplanted in 1958 by Type ZJ39L, priced at the much lower figure of $214 a pair. By March of 1959, the ZJ39L price had dropped to only $100 a pair. Later, in July of 1959, the C36B was introduced at $22.20 a pair and, later, in June, the C11B at only $20.00 a pair. The C15B was introduced in July of 1961 at $13 a pair, its price dropping to $9.50 by December, and then to $8.40 by January of 1962. Another small price drop came in January, 1963, when the ZJ265B was introduced at $7.80 a pair. Just about a year later, costs were cut almost in half with the production of the C22B at only $3.50 a pair. Finally, in February of 1965, GE introduced the SC41B Triac, a bi-directional control device capable of handling a 600-watt load, at only $2.75 each.

How about that! From $290 to $2.75 in eight years! Too bad automobile prices don't follow a similar trend—if they did, we'd all be driving Cadillacs!

Reader's Circuit. Ever wonder what makes your automobile directional signal flasher burn out so often? In a nutshell, it's because of the relatively large current required to operate the standard electro-mechanical flasher. To overcome this limitation, reader Emil E. Knospe (77 Laverack Ave., Depew, N.Y.) has come up with a design for an all-electronic flasher that he says is far superior to the ordinary flasher (See Fig. 1). Here are some of the advantages he lists: (1) variable load capability premitting its use for hazard light switching (*all* directional lights flashing at once); (2) a stable flashing rate not affected by load or battery voltage variations; (3) independently adjustable *on* and *off* cycles; (4) instant warm-up; (5) noiseless operation; and (6) long life.

Transistors *Q1* and *Q2* form an astable

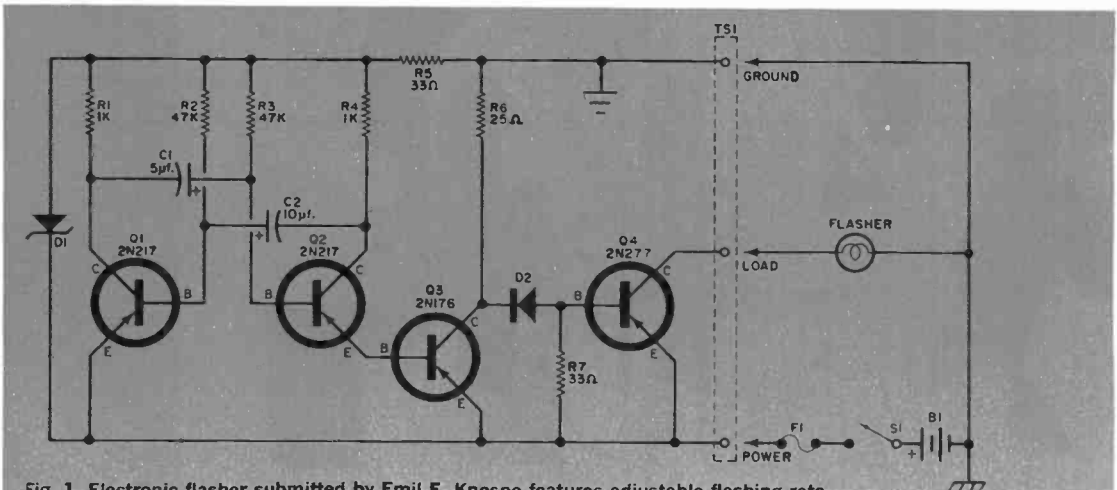


Fig. 1. Electronic flasher submitted by Emil E. Knospe features adjustable flashing rate.

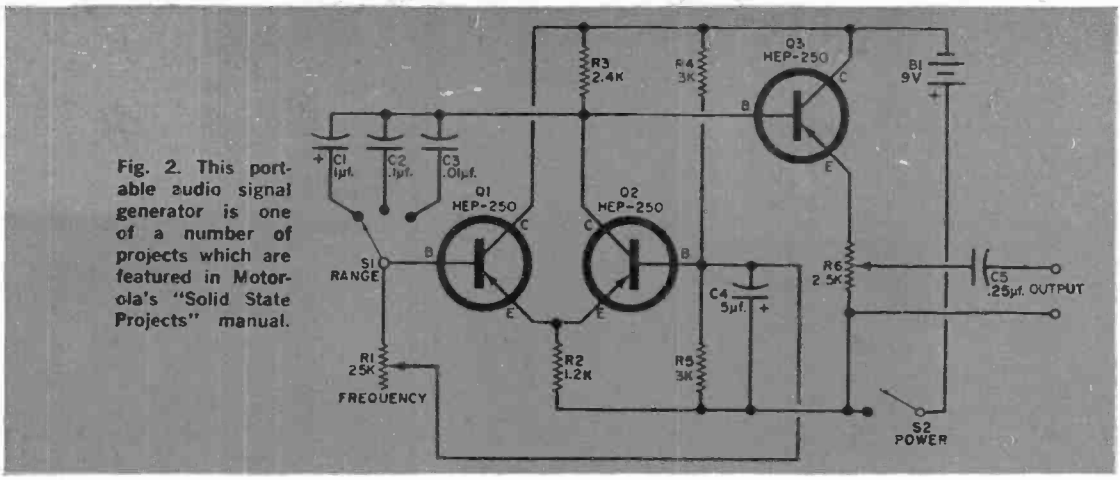


Fig. 2. This portable audio signal generator is one of a number of projects which are featured in Motorola's "Solid State Projects" manual.

multivibrator circuit, with *R1* and *R4* serving as respective collector loads, and *R2* and *R3* being the base bias resistors. Capacitors *C1* and *C2* provide cross-coupling feedback. The multivibrator's frequency, which establishes the flashing rate, is determined by the value of the base resistors (*R2* and *R3*), and the value of *C1* and *C2*. Zener diode *D1* and series resistor *R5* provide a regulated voltage to insure a stable multivibrator operation.

Transistor *Q2*'s output is emitter-coupled to buffer amplifier *Q3* which drives *Q4* acting as a power switch. In operation, *Q3* is saturated during the *off* cycle, dropping the full supply voltage across collector load *R6*, and applies only a fraction of a volt to *D2*, which acts as a high-resistance device. Thus, *Q4*'s base, returned to its emitter through *R7*, receives essentially zero bias and the transistor is cut off. With *Q3* at cutoff during the *on* cycle, a portion of the supply voltage is applied through *R6* to *D2*, causing this diode to conduct, and thus placing a forward bias on *Q4*'s base. With *Q4* now conducting, its collector current is limited only by the flasher load.

Transistors *Q1* and *Q2* are 2N217's, *Q3* is a 2N176 and *Q4* a 2N277. Diode *D1* is a 10-volt, 1-watt zener unit and *D2* is an ordinary rectifier with a 500-ma., 200-PIV rating. Except for *R6*, which is a 5-watt wirewound resistor, all resistors are ½-watt types. Both *C1* and *C2* are 10-volt electrolytic capacitors. Switch *S1* is a heavy-duty s.p.s.t. type, and *F1* is a 10-ampere fuse.

Emil used a Cordover HSD-2B combination heat sink and chassis to house the unit. He removed the inner fins to provide space for mounting the components. Neither layout nor lead dress should be critical, but be sure to observe the polarity of the battery, capacitors and diodes, and use relatively heavy wire for the power, load, and ground connections.

Designed for automobiles with negative-ground electrical systems, the flasher assembly can be mounted at any convenient point away from engine heat. Many users will prefer to mount the unit to the firewall under the car's dash. According to Emil, the circuit will handle load currents from a fraction of an ampere to as high as 10 amperes (maximum) without modification. The flashing rate, with the component values given, is about 60 flashes per minute, with the *on* cycle about one-half the *off* time (⅓ second *on*, ⅔ second *off*). The on-off ratio, as well as the flashing rate, can be changed by using different values for *C1* and *C2*; in practice, *C1* controls *on* time, *C2 off* time.

Manufacturer's Circuit. Figure 2 shows a simple audio signal generator suitable for servicing or testing intercoms, p.a. systems, record players and other types of audio amplifiers. The circuit was abstracted from Motorola's "Solid State Projects" manual. Priced at 50 cents a copy, the manual is available through all franchised Motorola semiconductor product dealers.

Transistors *Q1* and *Q2* comprise the basic multivibrator circuit, with *R2* common to both emitters. Resistor *R3* is the collector load for *Q2*, whose base bias is provided by voltage divider *R4*-*R5* and bypass capacitor *C4*. The signal generator's operating frequency is determined essentially by the feedback network comprising *FREQUENCY* potentiometer *R1* and one of the three capacitors (*C1*, *C2* or *C3*) selected by the *RANGE* switch (*S1*).

The output of transistor *Q2* is direct-coupled to emitter-follower *Q3* which serves as a buffer amplifier. A variable resistor,

(*Continued on page 98*)

ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

Prepared by Robert Legge

Best reception of the year becomes possible as stations utilize higher frequencies favored by warm weather propagation conditions. The latest addition to stations beaming broadcasts to North America in English is Radio Cairo, *as listed below.*

TO EASTERN AND CENTRAL NORTH AMERICA

COUNTRY	CITY	TIME—EST	TIME—GMT	FREQUENCIES (MHz)
		MORNING BROADCASTS		
AUSTRALIA	Melbourne	7:15-8:15 a.m.	1215-1315	9.58
CANADA	Montreal	7:15-8:15 a.m.	1215-1315	5.97, 15.32
DENMARK	Copenhagen	7:30-8 a.m.	1230-1300	15.165
FINLAND	Helsinki	7:15-7:45 a.m.	1215-1245	15.185 (Tues., Sat.)
GREAT BRITAIN	London	9:30-11:30 a.m.	1430-1630	15.35, 17.81
SWEDEN	Stockholm	7-7:30 a.m.	1200-1230	15.195
		EVENING BROADCASTS		
ALBANIA	Tirana	7-7:30 p.m.	0000-0030	7.265
BULGARIA	Sofia	7-8 p.m.	0000-0100	9.70
CHINA	Peking	8-10 p.m.	0100-0300	15.06, 17.68
CUBA	Havana	8-11 p.m.	0100-0400	6.17
CZECHOSLOVAKIA	Prague	8-9 p.m.	0100-0200	7.115, 9.795, 11.99
DENMARK	Copenhagen	9-9:30 p.m.	0200-0230	9.52
ECUADOR	Quito (HCJB)	9-11:30 p.m.	0200-0430	9.745, 11.915, 15.115
EGYPT	Cairo	8:30-10 p.m.	0130-0300	9.595
GERMANY	Berlin	8-9 p.m.	0100-0200	9.56, 11.875
	Cologne	8:30-9:50 p.m.	0130-0250	9.64, 11.795
GREAT BRITAIN	London	4:15-10:30 p.m.	2115-0330	9.51, 11.78, 15.30
HUNGARY	Budapest	8:30-9:30 p.m.	0130-0230	9.833, 11.91
ITALY	Rome	8-8:20 p.m.	0100-0120	11.77, 15.385
JAPAN	Tokyo	6:45-7:45 p.m.	2345-0045	15.135, 17.875
JORDAN	Amman	8:15-8:30 p.m.	0115-0145	9.565
LEBANON	Beirut	8:30-9 p.m.	0130-0200	11.76
NETHERLANDS	Hilversum	8:30-9:20 p.m.	0130-0220	9.59 (Bonaire Relay)
PORTUGAL	Lisbon	9-9:45 p.m.	0200-0245	6.025, 9.74, 11.925
ROMANIA	Bucharest	8:30-9:30 p.m.	0130-0230	9.57, 11.94
SPAIN	Madrid	8-9:30 p.m.	0100-0245	6.13, 9.76
SWEDEN	Stockholm	8:15-9:45 p.m.	0115-0215	11.88
SWITZERLAND	Berne	8:15-9:15 p.m.	0115-0215	6.12, 9.535, 11.775
U.S.S.R.	Kiev	7:30-8 p.m. (Mon. & Thurs.)	0300-0100 (Tues. & Fri.)	9.665, 11.955
	Moscow	5-5:30 p.m. and hourly to 12-1 a.m.	2200-2230 and hourly to 0500-0600	9.665, 9.685, 11.955
VATICAN	Vatican	7:50-8:10 p.m.	0050-0110	9.645, 11.74

TO WESTERN NORTH AMERICA

COUNTRY	CITY	TIME—PST	TIME—GMT	FREQUENCIES (MHz)
ARGENTINA	Buenos Aires	7-8 p.m. (Mon.-Fri.)	0300-0400 (Tues.-Sat.)	9.69
AUSTRALIA	Melbourne	5-7:45 p.m.	0100-0345	15.22, 17.84
BULGARIA	Sofia	8-8:30 p.m.	0400-0430	9.70
CHINA	Peking	7-9 p.m.	0300-0500	11.82, 15.095, 17.68
	Taipei	6:50-7:50 p.m.	0250-0350	11.86, 15.345
CUBA	Havana	9-10 p.m.	0500-0600	6.17
CZECHOSLOVAKIA	Prague	7:30-8:30 p.m.	0330-0430	7.345, 9.795, 11.99
GERMANY	Cologne	9-9:40 p.m.	0500-0540	9.605, 11.795
HUNGARY	Budapest	7-8 p.m.	0300-0400	9.833, 11.91
JAPAN	Tokyo	6-7 p.m.	0200-0300	15.135, 17.875
KOREA	Seoul	7-7:30 p.m.	0300-0330	15.125
PORTUGAL	Lisbon	8-8:45 p.m.	0400-0445	6.025, 9.74, 11.925
SWEDEN	Stockholm	7:15-7:45 p.m.	0315-0345	11.88
SWITZERLAND	Berne	8:15-9:15 p.m.	0415-0515	9.535, 11.865
THAILAND	Bangkok	8:15-9:15 p.m.	0415-0515	11.943
U.S.S.R.	Moscow	7-10:30 p.m.	0300-0730	9.735, 11.755, 11.85

SHORT-WAVE LISTENING

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wove Editor

STATION NEWS FROM AROUND THE WORLD

RADIO New York Worldwide (WRUL) will soon be the most powerful privately owned broadcast station in the country. The International Educational Broadcasting Company has been granted a construction permit by the Federal Communications Commission for a 700,000-watt transmission plant projected to cost in excess of $2,300,000. It will have an effective radiated signal equivalent to 5,000,000 watts.

The new plant is to be located on a 785-acre tract of land in the New Jersey Pine Barrens near Chatsworth. It will include two 250-kw., one 100-kw., and two 50-kw. transmitters that will beam programs directly to Europe, Africa, and Latin America through curtain and rhombic antennas which are to be the most modern in the world.

This is the second major expansion that has been announced recently for the station; in February, *Radio New York Worldwide* revealed that it had contracted for the entire third floor at 485 Madison Avenue in New York City for new studios and offices. The station currently broadcasts 17 hours daily on each of five overseas transmitters in English and Spanish, but plans to add Portuguese in a few months, and then German and French when the transmitting plant in New Jersey goes on the air in 1967.

Basutoland. The Lesotho Broadcasting Corporation started installing transmitters here earlier this year, and expects to be in operation by the end of 1966. Considerable competition is anticipated from the South African Broadcasting Corporation, which has transmitters at the doorstep of Maseru, and whose FM transmitter at Ladybrand can be heard all over Basutoland.

Philippine Islands. *Radio Veritas* is building three transmitters in the town of Malolos, 40 miles north of Manila—two 100-kw. units for the short waves, and one 100-kw. unit for the medium waves. The station, which is preparing to go on the air in July, will cost about 17 million dollars and will broadcast in 17 languages. Studios will be located in Manila's Pius XII Catholic Center.

Solomon Islands. The Solomon Islands Broadcasting Service is planning to erect a new 8-element antenna for use on 3995

(*Continued on page* 102)

At left: Bob Thacker, WPE8ISX, of Dayton, Ohio, uses two receivers—a Heathkit GR-64 and a Knight-Kit "Span Master." His record: 21 countries verified (28 logged) and 20 states verified (25 heard).

Below: Bertram Heiser, WPE8ITB, Ypsilanti, Mich., usually DX'es with a Hammarlund HQ-100A receiver; a Hallicrafters S-38E does standby service. To date, Bertram has 20 countries verified, 22 logged.

FOREIGN-LANGUAGE BROADCASTS TO NORTH AMERICA

Prepared by BILL LEGGE

The Editors of POPULAR ELECTRONICS would like to know how much interest there is in the publication of the schedules of broadcasts beamed to North America in languages other than English. A listing of these broadcasts, with the frequencies expected to be used during June, is given below. If you would like to see these foreign-language broadcast schedules published in the future, drop us a postcard and tell us so.

LANGUAGE	STATION	TIME—EST	TIME—GMT	FREQUENCIES (MHz)
ARABIC	Amman, Jordan	9-10:15 p.m.	0200-0315	9.565
	Cairo, Egypt	7-8:30 p.m.	0000-0130	9.595
	Damascus, Syria	8-9 p.m.	0100-0200	9.605
BULGARIAN	Sofia, Bulgaria	8-8:30 p.m.	0100-0130	9.70
CHINESE	Peking, China	8-10 p.m.	0100-0300	12.01, 15.095
		10-12 p.m.	0300-0500	12.01, 15.08
CZECH/SLOVAK	Prague, Czechoslovakia	8:30-9 a.m. (Sun.)	1330-1400	15.285, 17.825
		10:00-10:30 p.m.	0300-0330	7.345, 9.795, 11.99
DANISH	Copenhagen, Denmark	7-7:30 a.m.	1200-1230	15.165
		8-9 p.m.	0100-0200	9.52
DUTCH	Brussels, Belgium	6:15-8 p.m.	2315-0100	11.85
	Hilversum, Holland	9:30-10:50 p.m.	0230-0350	9.59
FINNISH	Helsinki, Finland	7:15-10:10 a.m.	1215-1510	15.185
FRENCH	Brussels, Belgium	6:15-8 p.m.	2315-0100	11.85
	Lisbon, Portugal	9:15-10 p.m.	0215-0300	5.985, 9.635, 11.925
	Paris, France	4-5 p.m.	2100-2200	11.885, 15.13
	Rome, Italy	8:20-8:35 p.m.	0120-0135	11.77, 15.385
	Vatican City	8:10-8:25 p.m.	0110-0125	9.645, 11.74
GERMAN	Berlin, Germany	8:30-9:30 p.m.	0130-0230	9.56, 11.875
	Cologne, Germany	7-10 p.m.	0000-0300	9.545, 11.945
		10 p.m.-1 a.m.	0300-0600	9.735, 11.795
	Vienna, Austria	7-9 p.m.	0000-0200	9.77
HUNGARIAN	Budapest, Hungary	7-7:30 p.m.	0000-0030	9.833, 11.91
		9-10:30 p.m.	0200-0330	9.833, 11.91
ITALIAN	Rome, Italy	5:30-8 p.m.	2230-0100	11.77, 15.385
JAPANESE	Tokyo, Japan	7:15-7:30 a.m.	1215-1230	9.505, 11.815
		8:30-9 p.m.	0130-0200	15.135, 17.875
NORWEGIAN	Oslo, Norway	8-9:30 a.m.	1300-1430	15.175
		6-7:30 p.m.	2300-0030	9.61, 11.87
PORTUGUESE	Lisbon, Portugal	7-9 p.m.	0000-0200	6.025, 9.74, 11.935
		9:45-11 p.m.	0245-0400	6.025, 9.74, 11.935
RUMANIAN	Bucharest, Rumania	6:15-7 p.m.	2315-2400	9.57, 11.94
		10:30-11 p.m.	0330-0400	9.57, 11.94
RUSSIAN	Moscow, U.S.S.R.	7 a.m.-12:30 p.m.	1200-1730	15.15
		6:30-7 p.m.	2330-0000	9.665, 11.715
		8:30-9 p.m.	0130-0200	9.665, 11.955
SPANISH	Buenos Aires, Argentina	8-9 p.m.	0100-0200	9.69
		11-12 p.m.	0400-2100	9.69
	Havana, Cuba	6 a.m.-4 p.m.	1100-2100	15.30
		5-11 p.m.	2200-0400	6.135, 15.23
	Quito, Ecuador	6-9 a.m.	1100-1400	9.745, 11.915, 15.115
		7:30-9 p.m.	0030-0200	9.745, 11.915, 15.115
SWEDISH	Stockholm, Sweden	8-8:45 p.m.	0100-0145	11.88
		9:30-10:15 p.m.	0230-0315	11.88
UKRAINIAN	Kiev, U.S.S.R.	7:30-8 p.m.	0030-0100	9,685, 11.79

AMATEUR RADIO

By **HERB S. BRIER,** W9EGQ
Amateur Radio Editor

CONTESTS, GRIPES, AND THE FCC

SUBJECTS of conversations in the amateur bands range from how to work new states to how to make money in the stock market to the airing of pet gripes. So far as the latter is concerned, you are liable to hear such remarks as "AM phone should be outlawed" . . . "SSB should be restricted to small segments of the phone bands" . . . "CW has too many frequencies" . . . "CW is more accurate than phone" . . ."Nets are a waste of time" . . . "All contests should be outlawed" . . . and so on and on.

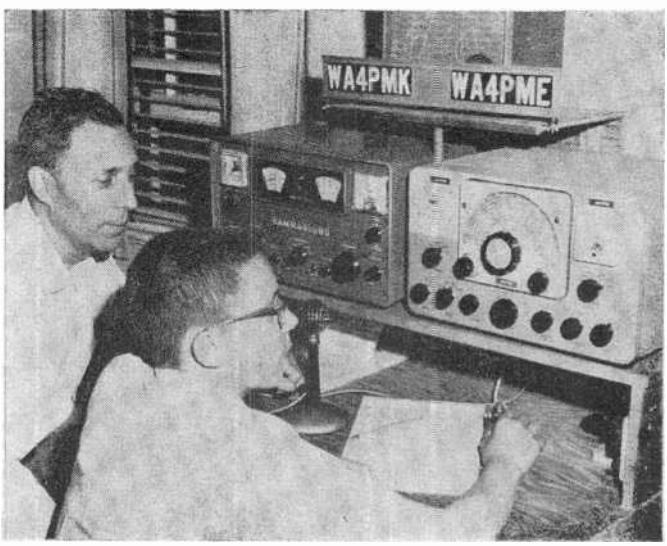
Actually, most gripes heard on the air are not intended to be taken seriously. Occasionally, however, someone becomes so convinced of his own wisdom that he petitions the Federal Communications Commission to make his whim the law for all amateurs. For instance, the FCC recently dismissed a rule-making petition—RM-562, dated January 23, 1964—aimed at outlawing all amateur awards and on-the-air contests, even though certificate chasing and contests are two of the more popular amateur radio activities.

In dismissing the petition, the FCC noted that contests may well help amateurs to attain the objectives of FCC regulation #97.1 (recognizing and enhancing amateur radio as a voluntary, noncommercial communications service in emergencies and encouraging amateurs to become better communicators and technicians to increase the nation's reservoir of trained operators, technicians, and electronics experts). "Field Day," for example, gives participants practice for communications emergencies and serves as a proving ground for emergency equipment. The FCC also stated that non-contest operators could always find available channels for their desired operations.

VHF QSO Party. There are two popular contests in June: the VHF QSO Party (June 11-12) and ARRL Field Day (June 25-26). To participate in the VHF QSO Party, you must be able to operate above 50 MHz. You get on the air at 2 p.m., local standard time, Saturday, June 11, and operate until 10 p.m., local standard time, June 12. Work as many different stations as possible; you earn one point per contact on 50 and 144 MHz,

(*Continued on page* 96)

AMATEUR STATION OF THE MONTH



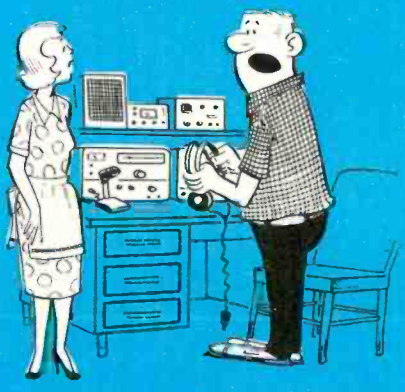
When John Hill, WA4PMK, Emory, Va., was 10 years old, he found the amateur exams a little too much for his fifth grade education, but he talked his father, Jim, WA4PME, into enrolling with him in an electronics course at Washington County, Va., Technical School. Upon completing the course, they both passed their General Class examinations. They share a Johnson Viking "Ranger II" transmitter and a Hammarlund HQ-100A receiver, and divide their time between 10 and 75 meters. Jim and John will receive a one-year subscription for submitting this winner in our Amateur Station of the Month contest. To enter the contest, send us a clear photo of your station with you at the controls, accompanied by some details on your ham career and on the equipment you use. Entries should go to: Amateur Photo Contest, c/o Herb S. Brier, P.O. Box 678, Gary, Ind. 46401.

THE UBIQUITOUS HAM

as seen by
WALT MILLER

"Finally got my own shack!"

"That one's from Ed Smith over on the north end of town . . . That one's from Bob Brown on the east side . . . That one's from Jim Duffy right near the city limits."



"But it's unnerving. Why can't he sign off with '73' instead of '88'?"

"I'll probably be back on the air by 0200 . . . . . dollars!"

"Oh, thank you! I don't know how I can ever repay you."

POPULAR ELECTRONICS REPORTS ON THE

HEATHKIT SB-100 TRANSCEIVER

By **HERB S. BRIER,** W9EGQ

TIME WAS—and not too long ago—when you paid for the operating convenience of an amateur SSB transceiver (unless it was a premium price unit) by sacrificing numerous features common to separate receiver-transmitter combinations. On "receive," some transceivers had marginal selectivity and sensitivity and poor a.v.c./a.g.c. characteristics; on "transmit," carrier and unwanted sideband suppression left something to be desired, the transmitted signal was wider than necessary, and output efficiency was low.

Today the gap between the performance of good CW/SSB transceivers and separate receiver-transmitter combinations has been significantly narrowed. And in any tabulation of transceivers based upon performance the new Heathkit SB-100 transceiver* would appear near the top of the list.

Features of the SB-100. This transceiver is the latest addition to the Heath Company's "SB" series of amateur equipment and matches other items in the line in size and appearance. Ready for work, the unit weighs 17½ pounds, its dark green panel measures 14¾" x 6¼", and it is packaged in a gray, perforated aluminum cabinet. A welcome feature of the cabinet is its full-size, hinged cover.

Reviewing the SB-100 specifications reveals that this 20-tube and 16-diode (12 of the tubes are multipurpose) transceiver will operate on any amateur band and closely adjacent frequencies between 3.5 and 30 MHz with CW and upper or lower SSB. Transmitter power is 170 watts, CW, and 200 watts, peak envelope power (PEP), SSB, to a pair of 6146's. Rated carrier suppression is 50 db, and unwanted sideband suppression is 55 db.

Rated receiver sensitivity is a 15 db signal-plus-noise to noise ratio for a 1-μv. signal at the antenna terminal. Selectivity, obtained by means of a hermetically sealed crystal lattice filter, is 2.1 kHz; this is also the transmitted SSB signal bandwidth.

Furnished as standard equipment with

**The Heathkit SB-100 transceiver and matching power supply kits are available by mail from the Heath Company, Benton Harbor, Mich. 49022.*

the kit are all crystals required for normal operation on any frequency within the transceiver's range, and the components for a 100-kHz crystal calibrator and smoothly functioning VOX control system.

Keying on CW is via grid-blocking. The key also controls an audio oscillator that delivers a keyed tone to the speaker or phones to permit the operator to monitor his sending. In addition, the tone is fed to the VOX system. When the key is first pressed, the VOX relay immediately switches the transceiver from "receive" to "transmit" and holds it in this condition during normal keying. But a slightly longer than normal pause allows it to revert to the "receive" mode.

The "hold-in" time is adjustable on both CW and phone; non-VOX operation is also available on both modes by turning the function switch to "Push to talk" (PTT).

Besides its normal VFO control, the SB-100 offers optional crystal control of the transmit mode only or of both transmit and receive by the use of crystals in the 5 to 5.5 MHz region. This optional crystal control permits the transceiver to be used by Novice operators in the 15-, 40-, and 80-meter Novice CW bands. (Reducing power to the 75-watt Novice limit is merely a matter of retarding the front-panel "drive" control so that the amplifier plate current does not exceed 100 ma.) In addition, the crystal-control feature allows the SB-100 to be operated on the MARS channels within 25 or 30 kHz of the various amateur bands—frequencies which cannot be reached with VFO control.

The SB-100 requires 700 to 850 volts @ 250 ma. and 300 volts @ 150 ma., d.c., and 12.6 volts @ 5 amperes, a.c. or d.c. These requirements are easily filled by the matching HP-25 120-volt, 60-cycle a.c. supply and the HP-13 12-volt d.c. supply.

Assembling the Transceiver. The Heath Company recommends assembling the SB-100 as a project for the experienced amateur. Maybe the word *patient* might be better than *experienced*, because assembling the kit is not particularly difficult for any person reasonably adept with a soldering iron who has the patience to follow the very clear instructions in the instruction/operating manual. Patience is a must, because there are over 550 components to be installed.

Your reviewer estimates that it will take the average constructor approximately 80 hours to complete the SB-100. Trying to rush the assembly could turn a pleasant task into a disagreeable chore, and it would increase the chances of making errors. No special tools are required.

Before the days of printed circuit boards, wiring the a.f., i.f., and r.f. circuits in a unit as complex as the SB-100 would demand considerable skill. With circuit boards, however, the builder preassembles each board in an hour or two and then places it aside until the time comes to install all of them in the chassis.

Another potentially difficult task—building and calibrating the VFO—is completely bypassed because the Heath Company furnishes a preassembled and calibrated "linear

(*Continued on page* 90)

Feature-loaded SSB transceiver includes a preassembled and calibrated linear master oscillator (LMO) to simplify task of calibrating the VFO. Use of printed circuit boards speeds and simplifies construction. As in any well-designed transmitter, the final stages are well shielded. You can even work some of the MARS frequencies with this rig. Barefoot, the pair of 6146 finals runs at 170 watts for SSB and 200 watts for CW. You can drive a linear amplifier to obtain maximum legal power, or cut back to permit Novice operation.

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PAYMENT MUST BE ENCLOSED WITH ORDER.

ASSIST (*Continued from page 26*)

Sansei Electronics "Zephyr" receiver; tunes AM & FM; has 6 tubes and 2 diodes. Schematic needed. (Lee P. Hunt, 463 Pammel Ct., Ames, Iowa 50012)

Knight transceiver, circa 1934; covers 5 meters; has 1 tube. Schematic needed. (Nick Mihu, 830 Almasy Dr., Campbell, Ohio 44405)

AM-864/U amplifier made by Federal TV Corp.; has 4 tubes. Schematic needed. (Arthur Karis, 14 Caldwell St., Fitchburg, Mass. 01420)

Atwater Kent Model 46 receiver, ser. 23 10954; has 8 tubes. Schematic needed. (Edward Elfstrom, 76 Waterworks Rd., Freehold, N.J. 07728)

Grundig Model 87USA receiver; tunes AM and FM; has 3 tubes. Schematic needed. (Howard Lyhte, 1700 Harrison Ave., Bronx, N.Y. 10453)

TCS-X transceiver, made by Collins. Schematic needed. **Superior** Model 600A multitester. Schematic, operating instructions needed. (J.J. Ullmon, 607 Aspen St., Vandenberg AFB, Calif. 93437)

National Union RK34 tube and **Hytron** HY31Z tube. Both tubes have 2 plate caps. Specification sheets needed. (David Hamilton, River Rd., Rt. 1, Paw Paw, Mich. 49079)

AN/PDR-27 Geiger counter surplus. Operating manual needed. (Armand J. Brucato, 73 Pleasant St., Lunenberg, Mass. 01462)

Transvision TV kit. Sources for T-2 or i.f. strip and brass escutcheon panel needed. (Robert F. Pierce, ET2-S2, USCG Loran Transmitting Sta., APO New York, N. Y. 09023)

Montgomery Ward Model W-1 receiver, ser. 638, circa 1926, made by Tri-City Electric. Schematic and two V199 tubes needed. (R. G. Whittier, 4055 W. 101 St., Inglewood, Calif.)

Heathkit Model QF-1 Q-multiplier; has 12AX7 multiplier tube; tunes 450 to 460 kHz. Assembly manual needed. (Robert Kort, 59 Glenwood Ave., Poughkeepsie, N.Y. 12603)

Hewlett Packard journals from 1949 to 1955 needed: Vol. 1, No. 3, 4, 7, 9, 12; Vol. 2, No. 4; Vol. 3, No. 2, 4, 9, 10; Vol. 4, No. 1, 2, 9, 10; Vol. 6, No. 10. (J. Landa, Route 2, Clayton, Ga. 30525)

Teletype Model 2B simplex printer. Operating manual, end of line indicator, and source for parts needed. (Donald Porter, 230 Merritt Dr., Oradell, N.J. 07649)

Wire for wire sound recorder needed. (David Reiland, 417 Strodman Ave., Wisconsin Rapids, Wis. 54494)

Royal Controls Model 16 and Model 24B garage door control; has 5 tubes. (E. B. Stark, 530 Bell Ave., Altoona, Pa.)

Browning Model R-2700A receiver and Model 23/S-nine transmitter. Operating manual needed. (Thomas Sedivy, R.R. #4, Box 238, Lockport, Ill. 60441)

Bosch Model 402-5 receiver; covers 0.55 to 1.7 MHz; has 5 tubes. Schematic needed. (Joe Pinner, 1349 Vinton, Memphis, Tenn. 38104)

Dumont cathode-ray oscillograph, type 322, circa 1952. Operating manual and schematic needed. (Bob Smicinski, 6 Carmichael St., Amsterdam, N.Y. 12010)

Motorola Model R-394-U receiver, part of AN/FRC-27 and AN/TRC-34 set; covers 152 to 174 MHz. Audio and squelch subassembly needed. (Robert W. Merdler, 916 S. Jefferson, Saginaw, Mich. 48601)

Westinghouse Model H-110P4 portable radio, circa 1949. Schematic and a.c. power supply H377 needed. (Nicholas Nicastro, 228 Park Ave., Hoboken, N.J. 07030)

E. H. Scott Model RCH receiver, ser. 2845, circa 1945, built for Navy; tunes 90 kHz to 23 MHz on 5 bands; has 11 tubes. Schematic needed. (Richard Szatkowski, 62 William St., Trenton 9, N.J.)

Link transceiver, type 2365-ED 3A, ser. 1467; has 2 tubes. Schematic and conversion data from 47.2 to 53.6 MHz needed. (K. R. McCardle, 3315 Oleanda Ave., Louisville, Ky. 40215)

Sperry Gyroscope portable engine analyzer, ser. 747. Schematic, instruction book, and connecting cables needed. (Ted A. Marti, Box 892, Balboa, Canal Zone, Panama)

Transvision Model H50A oscilloscope. Schematic and adjustment data needed. (James H. Henderson, 1535 Thelma Ave., Library, Pa.)

National Model NC-55 receiver, ser. 210 0024; has 9 tubes. Schematic and value of headphone output impedance needed. (Don Davis, 1217 Valencia, N.E., Albuquerque, N.M. 87110)

BC-624-A receiver, surplus, ser. 16909, has 11 tubes. Schematic and power requirements needed. (A. G. Rose, 123 Russell St., Kingston, Ontario, Canada)

Triplett Model 3212 tube tester, ser. 1946. Schematic, operating instructions, and tube adapters needed. (Don Ven Huizen, Wimbledon, N. D.)

Presto Model AN/TNH recorder-reproducer set, ser. 308. Schematic, service data, and parts source needed. (J. Frank Martin, Box 110, Franklin, N.C. 28734)

ARC4-RT19 2-meter transceiver, surplus. Schematic and operating manual needed. (Virgil K. Moore, 1973 Alvina Dr., Pleasant Hill, Calif. 94523)

BC-733 or RC-103-A receiver, circa 1942. Schematic and/or information on connections to power input plug needed. (Steve Gabriel, 22 W. Lakeland St., Bayshore, N.Y. 11706)

National Radio Institute Model 68 tube tester. Schematic and tube chart needed. **EICO** Model 145 multi-signal tracer. **Heathkit** Model S.G.8 r.f. signal generator. Operating manuals needed. (Harold G. Phillips, 1579 47 Ave., San Francisco, Calif. 94122)

Cub receiver, ser. 130986, circa 1931; has 4 tubes. Ballast tube 185-R8 needed. **Atwater Kent** Model 310 receiver; covers 2 bands; has 10 tubes. Tuning, volume, band selector knobs needed. (Jeff Aulik, 120 W. Main St., Huntley, Ill.)

BC-348-I receiver, surplus, has 9 tubes. Schematic and parts source needed. (Timothy Bedgood, 710 Woodward St., Lakeland, Fla. 33803)

Sonora Model E receiver, circa 1927; tunes AM. Schematic and tube location guide needed. **Western Air Patrol** Model 1587-67652 receiver, ser. 230634; tunes AM and s.w. on 3 bands; has 8 tubes. Schematic and power transformer needed. **Espey** receiver; tunes AM and FM; has 12 tubes. Schematic and source for tubes needed. (Ray Reese, 1706 Jacobson Blvd., Bremerton, Wash. 98312)

Loewe Opta Botschafter radio-phonograph, type 42239. Power transformer NT-11 needed. (Charles E. Wodenscheck, 504 Beetham Rd., Mineral Wells, Tex. 76067)

Admiral Model 69C19 receiver, circa 1949; tunes BC. Parts source needed. (Howard Silverstein, 6720 Calvert St., Philadelphia, Pa. 19149)

BC-455-B receiver, surplus, ser. 51455; tunes 6 to 9 MHz. Schematic, parts list, tube location guide, and power requirements needed. (Alan Barrey, 114 S.W. Isaac, Pendleton, Oreg.)

Music Master receiver, ser. 60H-46494, type 60; has 5 01A tubes. Schematic, voltage and battery hookup information, 2 tuning dials, and front panel needed. (John N. Dickerson, 4815 Craig Rd., South Bend, Ind. 46614)

BC-733D receiver, surplus; tunes 108 to 110 MHz. Schematic and source for 717A tubes needed. (Bill Shinko, 4478 W. 11 St., Cleveland, Ohio 44109)

Precision Model 660 tube and transistor tester. Transistor test data chart needed. (Richard List, 2104 Village Dr., Pittsburgh, Pa. 15221)

MN-26C receiver, surplus, made by Bendix; tunes 150 to 1500 kHz. Schematic and other data needed. (Allen Windhorn, Route 2, Box 138, St. Peter, Minn. 56082)

Stromberg-Carlson Model 340W, circa 1936; tunes BC and s.w.; has 9 tubes. Schematic and alignment data needed. (Jon Katz, Rt. 1, Box 213-D, Williamsburg, Va. 23185)

Motorola Model 47B11 receiver, chassis HS 72; tunes BC; has 4 tubes. Schematic and source for parts needed. (John L. Tucker, Hometown, W. Va. 25109)

Raytheon Model RPC-40 4-channel mixer. Schematic, operation manual, and controls needed. (Brent Gabrielsen, 7316 E. Vernon Ave., Scottsdale, Ariz.)

Federal Telephone and Telegraph Model 61 receiver, circa 1924, tunes BC; has 6 tubes. Operating manual and other data needed. (Bruce Seifried, 10 Kings Highway, New City, N. Y. 10956)

Stromberg-Carlson Model 16-C TV set, circa 1950. Source for ratio detector and horizontal oscillator transformers needed. (Frank L. O'Brien, 100 Seventh Ave., Lowell, Mass. 01854) —30—

HEATHKIT TRANSCEIVER

(*Continued from page 85*)

master oscillator" (LMO) as part of the kit. The builder simply removes the LMO from its box, bolts it to the chassis, and attaches it to the dial. Incidentally, the dial turns as smooth as butter and is calibrated in 1-kHZ increments; it can be read to within a few hundred hertz or better.

Aligning and adjusting the SB-100 is a straightforward operation, using just a VTVM and a 50-ohm dummy load capable of dissipating 100 watts for short periods of time. The receiver is adjusted first, then the transmitter. Assuming that there are no "bugs," the entire operation is easily completed in an evening. Unfortunately, we were temporarily slowed up by a defective crystal, which we tracked down by systematically following the troubleshooting procedures outlined in the SB-100 instruction manual. The Heath Company immediately sent a replacement, of course.

Test Results. In the transmit mode, the completed unit easily met its performance specifications. Phone quality was excellent, warm-up drift from a cold start undetectable in normal operation, and both carrier and unwanted sideband suppression extremely high. On CW, the signal was T9X and free of clicks and chirps.

These results were no more than we expected on "transmit" after inspecting the circuit diagram. What we wanted to do was to check how closely the SB-100 met the high claims made for it as a receiver. As its claimed 15 db signal-plus-noise to noise ratio for a 1-μv. input signal is the same as the verified performance of the Heathkit SB-300 receiver (see page 85, POPULAR ELECTRONICS, August, 1964), we arranged to switch from one unit to the other and started listening.

Any signal—no matter how weak—that could be copied on either the SB-100 or the SB-300 could be copied equally well on the other one using either a beam or a multiband doublet as an antenna. But the S-meter readings were far different; the SB-300 meter always read four to six "S" units higher than the SB-100 meter.

Most of the difference between the meter readings is due to the fact that the SB-100 has less absolute front-end gain than the SB-300 has. The only time that this lower gain might possibly be important would be if the SB-100 were used strictly as a receiver with an extremely inefficient antenna —maybe a piece of wire a foot long. Such

an antenna would be useless on "transmit," however.

Naturally, the SB-100's selectivity does not match the selectivity of the SB-300 when the latter's 400-hertz CW filter is switched into the circuit. But the Heath Company can supply a 400-hertz filter for CW buffs who want to use the SB-100 on CW only.

Conclusions. On performance, the SB-100 must be rated A+. Although it lacks provision for tuning the receiver a few kilohertz on either side of the transmitter frequency or for using an external VFO, these are minor disadvantages. The optional crystal control will take care of many of the conditions where a second VFO might be used; besides, many operators prefer to use a separate receiver in conjunction with a transceiver for split-frequency operation, such as DX chasing.

The SB-100's power on "transmit" is sufficient for successful work on both CW and SSB on all bands. And for future expansion, its power output will drive any "linear" amplifier to the full legal amateur power limit.

On a cost basis, the SB-100's $360 price tag (plus $39.95 for the matching HP-25 120-volt a.c. power supply or $59.95 for the HP-13 transistorized, 12-volt d.c. supply) should also be highly attractive to the amateur who is willing to invest 50 to 100 hours of his time in assembling the transceiver and power supply and save about $200. —30—

"Copied that solid, Bill, or my handle isn't Sue, 1816 Orange Terrace, Hagersville, Indiana, four blocks south of courthouse, turn right . . ."

VHF/FM MARINE RADIO

(*Continued from page 70*)

the application of the Florida Telephone Corporation to provide Public Correspondence service for channels 24 and 25 in the VHF/FM maritime radio band.

Equipment Offered. The fact that almost all tugs, tankers and commercial craft have VHF/FM radio communications equipment aboard should be the best recommendation for their use by the recreational boater. With Coast Guard installations ringing the country, the streamlining of FCC regulations, the Coast Guard Auxiliary training programs, and an industry awakening to the enormous potential of the pleasure boat VHF/FM radio equipment potential, manufacturers are beginning to have a field day.

Already in the race for the recreational boatman's dollar are Canadian Marconi through Kaar Electronics, its American subsidiary; Aerotron; Konigsberg Electronics; Aircraft Radio Corporation; Pearce-Simpson; Communications Company; Hartman Marine; Fisher Research Labs.; RCA Radiomarine; Raytheon; and many others. A partial listing of some currently available equipment is given on page 70.

Because more and more companies are entering the VHF/FM marine radio equipment market, the recreational boater will have the widest selection of radio gear to choose from, at the lowest prices ever, during the present boating season. —30—

CAR VOLTAGE REGULATOR

(*Continued from page 44*)

tween 14.2 and 15 volts, and at 100°F, the reading should be within the limits of 13.8 and 14.6 volts.

Adjust the potentiometer (*R2*) for an initial reading of 14.4 volts, and later readjust the potentiometer, as the battery becomes fully charged, to maintain the same nominal reading. Be sure to tighten the lock nut on the potentiome-

ter shaft after each adjustment to prevent the setting from shifting. If your car is equipped with an ammeter, it should read between 25 and 30 amperes during the charging period, and then settle down to between 2 and 7 amperes, indicating a charged condition.

When you have finished the checkout, your solid-state regulator will be ready to give you many years of trouble-free and reliable service. -30-

LIGHT-TO-SOUND TRANSLATOR

(*Continued from page 75*)

Minibox to accommodate the sounder. Drill or cut a hole in the center of the other end to conform to the size and shape of the photocell. The on-off switch (*S1*) and a ¼" hole for a tripod mount can be located approximately as shown, or in any other convenient place. The battery can be held in place by a battery holder or tape.

One of the sounder's terminals is used to support a small perforated phenolic board on which the two transistors and *R1* are mounted. (See Fig. 3.) Vector push-in terminals serve as wiring points. Resistor *R1* can be any value from 80 to 150 ohms, and almost any small-signal transistors can be substituted for those used here, provided that one is an *npn* and the other a *pnp* type. Also, an 'S3M" photocell can be used instead of the "S1M" to increase sensitivity.

You can boost both sensitivity and range by applying a bias voltage to the photocell. Connect a 50,000-ohm potentiometer across the B+ and B− points; disconnect *PC1*'s black lead from *Q1*'s emitter, and connect it to the center arm of the pot.

Mount a 6"- to 12"-long tube in front of the photocell to prevent ambient light from setting it off. A 1¼"-diameter aluminum or cardboard mailing tube painted black on the inside will do. Small angles, spade lugs, or cement can be used to hold the tube and photocell in place.

Operation. To use the translator, simply mount it on a tripod and align it with the light blinker. If you don't know the Morse code, you can do what Paul Revere did—one if by land and two if by sea. -30-

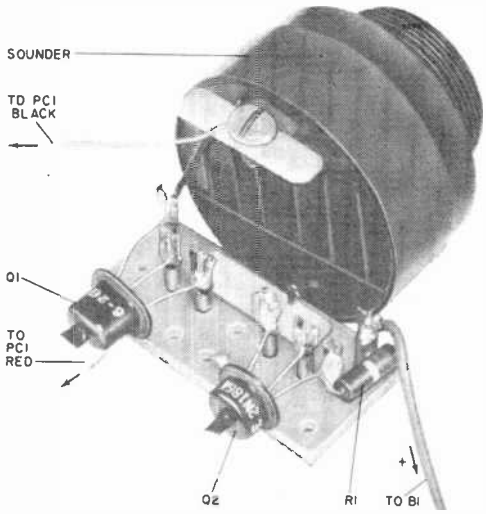


Fig. 3. A terminal strip can be substituted for the small perforated board, and mounted on one of the sounder's large lugs. Parts layout is not critical.

LOOK OUT! IT'S HOT!

(*Continued from page* 55)

is, at household frequencies, authorities say that a.c. is roughly three times as dangerous as d.c. at the same voltage, but d.c. brings about ventricular fibrillation in a much shorter period of time. You'll also find that as the frequency of an a.c. source increases, the injurious effects of shock decrease. Medical reports have shown that a person tolerates only 30 ma. at 11,000 hertz, but 500 ma. at 100,000 hertz. But now we're getting up into the r.f. regions. And r.f., as you know, can give you a nasty burn."

Ziggy finally finished my CB unit, plugged it in, and tried it out. The hum was gone. We listened as a waspy-voiced CB'er tried to reach her itinerant husband with a message to pick up his mother-in-law at the railroad station. Seems she decided to pay an extended visit. I thought I heard Ziggy mutter something about "poor guy."

"This time *you* test the rig for shock hazards." Handing me the voltmeter probe, he added thoughtfully: "If people used more common sense and took time out to make a simple test as you're doing, there would be a heap less accidents. Take ordinary house current, for instance. Many people still believe that the electricity entering their homes is confined to two or three wires. They don't realize that the earth or ground is an important part of the distribution system, as power companies connect the neutral wire to many places along the line. The earth can be looked upon as a third or neutral wire in a two-wire system in parallel with the neutral or ground wire."

"That's why it's just as easy to get a shock by coming in contact with a grounded pipe while touching a 'hot' chassis as it is if you simply put both hands across a line," I commented.

"Right. Best protection you have is to use a ground wire with your electrical tools and appliances to drain off stray current. Small appliances wear out in time and are frequently a source of trouble. In fact, the Underwriters Laboratory states that no tool or appliance

should be used in wet or other hazardous areas without special insulation and adequate grounding. It's also a good idea to buy only those appliances approved by the Underwriters Laboratory."

"Suppose your house hasn't a three-wire system?" I asked.

"That's no problem. A three-wire cord plugs into a two-slot receptacle using an adapter with its own ground wire. The wire is attached to a ground screw on the faceplate of the outlet box."

"How's to tell you have a grounded faceplate?"

"Easy. Normally a receptacle box is grounded if the house wiring is armored cable or rigid metal conduit. If it isn't, use a simple neon indicator—the type found in most hardware shops—to check. Touch one lead of the indicator to the faceplate screw and insert the other lead into each slot. If the indicator lights when contact is made on either slot, you have a ground. If you're using two-wire cord tools, make your own ground. Attach a length of No. 18 insulated single-conductor stranded copper wire to a screw on the tool's shell. The other end is tied to a grounded screw. It's not hard."

He went on to say that workshops, ham shacks and the like with damp concrete floors should be covered with wood or rubber mats as added protection. "Safety is largely a matter of habit. Learn to use common sense. Stay away from grounded pipes and other metal fixtures when near voltage. Always pull the plug out of a unit before doing anything to it, and use an isolation transformer when working on line-operated equipment. Make it a practice to consider all leads as hot leads until you have determined otherwise."

"I just thought of something," I interrupted. "How about a lecture for our CB club members on shock hazards. We could use some pointers."

Ziggy laughed. "I did give a little talk —at the last meeting. But, of course, you wouldn't know—you weren't there."

"I couldn't make it. I had a blind date that was supposed to be something special," I admitted, somewhat embarrassed.

"What happened?" Ziggy grinned.

"It turned out to be quite a shock."

His laugh followed me all the way up the stairs. -30-

AMATEUR RADIO

(*Continued from page* 83)

two points per contact on 220 and 420 MHz, three points per contact on the higher frequencies. The same station can be worked once per band, and your total score is the sum of your contact points multiplied by the sum of the different ARRL sections worked on each band.

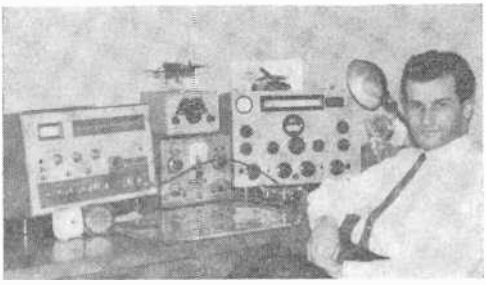
You can operate from your home or pile your VHF equipment into a station wagon and head for a mountain in the nearest "rare" section. This is a move sure to please all other contestants. Either way, you will have fun.

For complete rules on the VHF QSO Party, and for the ARRL Field Day which is discussed below, see the June issue of *QST*, or write to the Amateur Radio Relay League, 125 National Ave., Newington, Conn. 06111, for official log sheets.

ARRL Field Day. The basic rules for Field Day are simple: you set up a complete, emergency-powered amateur station in a temporary location and work as many stations as possible. The affair starts at 2100 GMT, June 25, and ends at 2400 GMT, June 26. You can operate during any consecutive 24-hour period.

Of course, the serious purpose behind Field Day is to demonstrate the amateur's ability to supply communications under conditions closely approaching those that would prevail in an actual emergency. To emphasize this point, bonus points are given for low-power operation and the use of completely battery powered gear.

But Field Day is also a lot of fun, as attested by the thousands of amateurs who participate in it each year. Most participation is a cooperative club or other group effort. Each member contributes to the success of the operation by finding a suitable



Frank Micallef, VE3FNO, Toronto, Ontario, operates his Heathkit "Apache" transmitter, ex-Navy receiver, and simple antennas mostly on 20 meters. He has QSL cards from all continents and 50 states.

Field Day site, lending equipment, erecting antennas, operating, keeping logs, feeding the crew, etc. Small groups keep a few transmitters in simultaneous operation, while large clubs frequently keep 12 or more transmitters in simultaneous operation on the different amateur bands during the contest period.

If your club has a club call-sign, use it. But if your group does not have a club station, you may use the call letters of any member of the group who has the authority to operate on all the bands and modes your group intends to use and who will remain at the operating site during the entire operation.

NEWS and VIEWS

To describe all the equipment in the father **(Armand Lowell, WB2TEP)** and son **(Abbe, WB2TEO)** ham station, 2536 Hyacinth St., Westbury, L.I., N.Y., would take up half our space. But in eight months the team has worked over 25 states on two and six meters, plus what they have worked on the lower frequency bands with a 75-watt transmitter. Armand reports that being a ham and running up high Novice VHF scores in several contests, studying for his General ticket, and building a 220-MHz transmitter and converter has not hurt Abbe's school work; he maintains an "Honors" average . . . **Rodney Harmon, WA9OGD,** Box 5, Lane, Ill., has packed a lot of operating into his first year on the air. In five months as a Novice, he made 600 contacts in 49 states, running 50 watts to a Johnson "Adventurer" transmitter feeding a 40-meter dipole antenna. The hold-out state was Alaska. As a General, Rod has moved up to a Johnson Viking-II transmitter running up to 180 watts. For antennas, he has a Mosley TA-33-Jr. tri-band beam and 40- and 80-meter dipoles, and he receives with a Hallicrafters SX-140. Of course, he now has his WAS certificate and has worked over 41 countries.

Joseph G. Palsa, K3WRY, 60 Tapered Oak Lane, Levittown, Pa., is also NØWOW in Navy MARS, and has a CB license, too. Joe is a member of the Levittown Fire Company I and of the Falls Township Civil Defense Net. Among his ham equipment is a Johnson Viking 6N2 with home-brew modulator and power supply and a home-brew 1-kw., 6-meter amplifier. A 50′ tower supports beam antennas for six and two meters and one end of a "long wire" for the lower frequencies. A Hammarlund HQ-110, a Hallicrafters SX-140 and a S-95, plus a couple of AMECO converters, give him lots of things to listen to. Putting them all together resulted in 32 states and 3 countries worked and confirmed . . . **Walter** and **Irene Hryniewicki, W9LAG/K9CCS,** Route 2, Box 101A, Chippewa Falls, Wis., have been on the air for 20 years. They have a 500-watt "Globe-King" transmitter and a 1000-watt, home-built transmitter, a Model 19 RTTY set, and a National NC-183 receiver. Walter flies his own plane—an "Aeronca Chief"—and is on 24-hour-a-day-seven-day-a-week call as an installer and maintenance engineer for Wisconsin's microwave radio system. In addition, he is a member of MARS, RACES, and the Civil Air Patrol. In his spare time, he just "hams." Make your own guess as to when Irene gets on the air.

Alberto Carrizosa Alajmo, HK3BAE, P. O. Box 584, Bogota, Colombia, received his third class license (40 meters only) and took second place in the Colombian Independence International Contest on July 20, 1965. On August 31, he qualified for his second class amateur license, which allows him to work 10, 15, 20, and 40 meters. Using a Heathkit "Apache" transmitter and an SB-10 SSB adapter, a Lafayette HA-350 receiver, and a Hallicrafters SX-99 receiver, Alberto has worked 31 countries in five continents and 36 states of the U.S.A. His antenna farm has sprouted a 40-meter dipole and a 3-element ground plane antenna for 10, 15, and 20 meters. Then there is his prize exhibit: the HK3BAE special, a home-brew, 9-element, 3-band, directional, vertical ground plane, which certainly sounds impressive . . . **Marc S. Webb, WB2PHO,** 645 Arnow Ave., Bronx, N.Y., considers the 21-MHz band as home, from which he makes excursions up and down in frequency—to 40 meters, 10 meters, and 2 meters. On the lower frequencies, Marc uses an EICO 720 transmitter to feed a "long wire" antenna via an antenna coupler and a National NC-109 receiver, and has nine countries and 30 states worked. On two meters, he uses a war-surplus ARC-5 transmitter running 20 watts to feed a home-built, 3-element beam.

Philip Tucker, WA5FIT, 12834 Flagstaff, Houston, Texas, receives on a Collins 75S1 and transmits on a Johnson Viking "Valiant" running about 300 watts on phone and CW. Combining them with a 3-element beam and some sharp operating has produced a country total of 80 and all states worked. Alaska was the 50th state. Check with Phil if you need a Texas QSL card . . . **John Gussman, WB6PBI,** 612 Miller Ave., Pacifica, Calif., started his radio career as WPE6GAU, held a Novice license for four months, and is now a General. He uses a Heathkit DX-100B transmitter, which he holds down to 100 watts or less input, because he is a member of the QRP (low-power) club, and he receives on a Hallicrafters SX-140. The WB6PBI antenna is a 40-meter dipole, 15′ high. So far, John has worked 20 states and 3 Canadian provinces .

Will we be reading *your* "News and Views" next month? The first step is up to you; write that letter and send that picture. (And thanks for having your club send us your club paper.) The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana 46401.

73, *Herb, W9EGQ*

SOLID STATE

(*Continued from page 79*)

R6, is used as *Q3*'s emitter load and acts as an output level control. Capacitor *C5* serves as an output coupler and d.c. blocker. Operating power is furnished by a 9-volt battery, *B1*, controlled by switch *S2*.

Readily available low-cost parts are used throughout the design. The three transistors are all Motorola HEP-250's. Except for the potentiometers (*R1* and *R6*), all resistors are ½-watters. Capacitors *C1* and *C4* are 15-volt electrolytic types, while *C2*, *C3* and *C5* are 200-volt tubular paper types. Switch *S1* is a single-pole, 3-position rotary unit, and *S2* is a simple toggle or slide switch. Standard binding posts are used as output terminals. The power supply is a standard 9-volt transistor battery.

The circuit can be assembled on a conventional chassis or on a perforated phenolic chassis board, as preferred. If a perforated board is selected, push-in Vector terminals can be used for individual connection points. After wiring the unit and checking it for errors and accidental shorts, mount it in a plastic or wooden case or in a standard metal Minibox.

The audio signal generator operates in the frequency range of from approximately 7.5 Hz to 20 kHz in three ranges, and the instrument can be used for both signal injection and frequency response tests of audio amplifiers. The output signal is essentially a square wave, so the instrument must be employed in conjunction with an oscilloscope for transient response tests. If desired, the *FREQUENCY* control can be calibrated against a known standard. A multiplier switch, *S1*, provides multiplying factors of X 1, X 10 and X 100 as *C1*, *C2* and *C3* are alternately switched.

Transitips. Noise in any form can be annoying. Unfortunately, there are no sure methods for eliminating *all* noise from any high-gain circuit. If the noise—whether it be hum, hash, cracks and pops, or steady "rushing"—is from an external source, then shielding, bypass filtering, and line filtering (if line power is used) may be required to block out the undesired signals. In some cases, it may be necessary to install filters at the source of the noise (as on a motor). In receivers, more selective (higher *Q*) circuits and wave traps can be used to reduce external noise.

If the noise is generated internally, circuit and/or layout redesign may be needed. The layout should be modified as necessary

to eliminate feedback paths and undesired interstage coupling.

As a general rule, most of the noise will start in the input stages. Once these stages are properly isolated by shielding and interstage filter networks, the final step is circuit redesign. Use special premium-priced low-noise transistors where possible, adjusting bias currents and load values for optimum low-noise performance rather than maximum gain. The following observations, based on practical experience, should help:

(1) Low-gain circuits are less noisy than high-gain designs.

(2) Low-impedance circuits develop (and pick up) less noise than high-impedance circuits.

(3) Low temperatures are preferred—keep the input stages away from power transistors, high-wattage resistors, and other heat sources.

(4) In general, the lower the bias currents and supply voltages, the lower the noise level . . . but some low-noise transistors require an optimum bias, with higher (or lower) values generating more noise.

Until next month—may your amplifiers be both noise-free and distortion-free.

—*Lou*

METER QUIZ ANSWERS

(*Quiz appears on page* 71)

The meter pointer (or index) indication is determined partly by counting the number of divisions—which is exact—and partly by estimating. Therefore, you may come up with a slightly different reading than the answers given below:

1	0.29 ma.	5	16.3 ohms
2	1.65 megohms	6	13.0 μa.
3	−8.4 db (38%)	7	102 volts
4	7.7 volts	8	1.25

9 6.984 mm. The smallest division on the sleeve (stationary part) of this metric micrometer is 0.5 mm.; therefore, the reading is 6.500 mm., plus the reading of the thimble (rotating part). The smallest division on the thimble is 0.01 mm., giving a reading of 0.484 mm. for a total of 6.984 mm.

10 76.7 Reading from the zero index mark on the vernier (stationary tab), the indication is between 76 and 77 on the dial. Observe that the seventh division mark on the vernier is the only mark that coincides precisely with a dial scale division mark. This indication adds 0.7, for a readng of 76.7.

ON THE CITIZENS BAND

(*Continued from page 77*)

have found a worthwhile way to use their "off-the-air" time collectively!

CB Bullseye. Citizens Band operators around Fairfield, Calif., are still smiling about a medieval robbery attempt that was staged in their area. The proceedings came to an abrupt halt when modern-day CB radio came to the rescue.

A CB'er, stopping to refuel his auto, was asked by the attendant to notify the police that he was being held up. The CB'er flipped the switch and placed the call while gasoline still poured into his tank (a dangerous practice—whew!)

In short order, a nearby police squad apprehended three youths who had been trying to rob the station attendant with a hunting bow and a steel-tipped arrow. Back to Sherwood Forest with 'em!

Jamboree Coming Up? Don't forget to let us know well in advance if you're planning a special event or get-together so we can list it in the OTCB Jamboree Calendar.

1966 OTCB CLUB ROSTER

The following clubs are represented on the OTCB Club Roster for the first time. Active CB clubs not yet registered with this column are urged to fill us in on their operation, giving us the club history, membership totals, public service assists that have been made, and a listing of current officers. Include a good, clear photograph if you can shake your publicity chairman loose, and we'll show the rest of the CB world what your operation really looks like. Send all material to Matt P. Spinello, CB Editor, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016.

Machias, Maine—*Machias Valley CB Club.* Organized in November, 1965, this club boasts 40 members to date. Meetings are held bi-weekly, and the club members are available to assist in emergencies. Most members are connected with Civil Defense. Present officers are: Mrs. Agnes Johnson, KKA7344, president; Mrs. Lee Clemmons, KMA2542, vice president; Mrs. Esther Johnson, KMA4079, treasurer; and Mrs. Effie Drisko, KKB1534, secretary.

Bronx, New York—*Inwood-Bronx Chapter of the Citizens Band Radio Relay League.* Current officers recently elected are: Marvin White, KLP1531, president; Wm. Robson, KKD9533, first vice president; George N. Raybin, KBI0854, second vice president; Josephine Litvinoff, KKD8242, secretary/treasurer; Elizabeth White, KLP1531, corresponding secretary; and Cecil Ramsey, 2Q2124, business manager. Club meets on the second Friday of each month.

Brooklyn, New York—*Brooklyn REACT Squadron.* Entire squadron of 70 participated in aiding New Yorkers during the Eastern Seaboard power failure last November. Members directed traffic, placed flares at intersections to prevent accidents, and took people who had been stranded in total darkness to their homes. They drove doctors and nurses to emergency cases, patrolled streets to

discourage looting, tried to keep people calm and off the streets. One of their more important assignments during this emergency was a request to procure dry ice, as inoperative refrigeration units threatened to ruin supplies of rapidly warming blood plasma. Mobile units delivered the goods. In addition, several mobiles delivered such items as batteries, flashlights, drugs, and candles to those in need. Captain of the group is Lewis Frumoff, KKE0195.

Portland, Oregon—*Oregon Citizens Band Association.* Organized in the fall of 1962, and incorporated in March, 1964, this group has been active in helping people left homeless by fire, collecting food for the hungry, and assisting Toy & Joy makers in collecting toys and groceries to be delivered to the needy on Christmas morning. The OCBA was recently honored by the Red Cross for blood donations given in 1965: the club received an award certificate and was told that it was the only CB club in the area to have formed its own blood bank.

Many thanks this month to W. Don Curtis and members of the GBRCCA for a personal *lifetime* membership in the Greater Baton Rouge (La.) Citizens Communications Association, Inc.

I'll CB'ing you,

—Matt, KHC2060

ELECTROMAZE SOLUTION

(*Puzzle appears on page* 65)

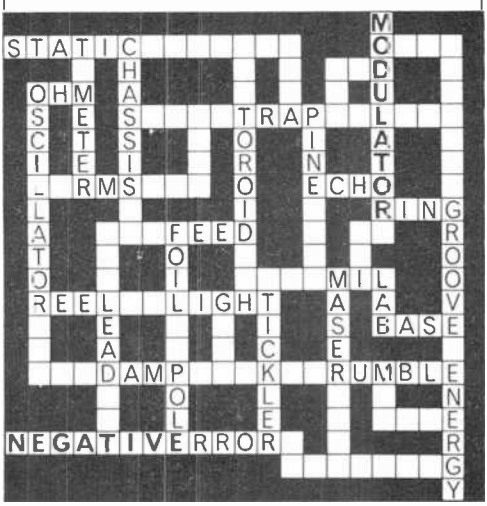
1 Stotic
2 Chossis
3 RMS
4 Meter
5 Ohm
6 Oscillotor
7 Reel
8 Lead
9 Domp
10 Pole

Exit 1. Negative

11 Error
12 Tickler
13 Light
14 Foil
15 Feed
16 Toroid
17 Trop
18 Pine
19 Echo

Exit 2. Modulotor

20 Ring
21 Groove
22 Base
23 Lob
24 Mil
25 Maser
26 Rumble
27 Energy



SHORT-WAVE LISTENING

(*Continued from page 81*)

kHz. The antenna will *reduce* signals outside of 700 miles. Present schedule: VQO3, 3205 kHz, 500 watts, and VQO4, 3995 kHz, 5 kw., at 0725-1130 Monday to Friday, 0755-1130 Saturdays, and 0835-1120 Sundays.

The World. For the newcomer to the hobby, as well as for the old-timer who wants to be brought up to date, Gilfer Associates is now offering a special SWL package. Included is a copy of the *1966 World Radio TV Handbook*, the *New Guide to Short-Wave Listening (How to Listen to the World)*, the *North American Radio TV Guide*, reporting letters (in pad form), and a 100-sheet package of SWL log sheets. Purchased individually, these items would cost $13.43. As a package, you can obtain them for only $12.00. The address is: Gilfer Associates, P.O. Box 239, Park Ridge, N.J. 07656.

CURRENT STATION REPORTS

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Greenwich Mean Time (GMT) and the 24-hour system is used. Reports should be sent to SHORT-WAVE LISTENING, P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver.

Albania—English is scheduled from *R. Tirana* at 0000-0030 on 7265 kHz, and at 0600-0630, 2000-2030, and 2200-2230 on 7265 and 9390 kHz.

Australia—Utility station enthusiasts will be interested in knowing that VLN25, the Overseas Radio Terminal in Sydney, will verify correct reports. The station operates single sideband on 10,420 kHz with 30-kw. power. Reports go to Overseas Radio Terminal, Third Floor, G.P.O., Sydney, Australia.

Austria—*R. Austria*, Vienna, is broadcasting to the east coast of N.A. on 6155 kHz at 2300-0430 and on 9770 kHz at 2200-0200 and 0200-0400. Broadcasts to the northeast coast of South America are on 11,785 kHz at 0000-0200, 9525 kHz at 0200-0500, and 15,240 kHz at 1700-1900. These are all-Eng xmsns. Another Eng. period, beamed to S. Africa, is heard at 1640-1650 on 17,750 kHz (this may be on Mondays, Wednesdays, and Fridays only).

Brazil—*R. Jornal do Comercio*, Recife, has replaced 15,145 kHz with 11,825 kHz, where it is heard until 0130 s/off. *R. Guaiba*, Porto Alegre, has be-

SHORT-WAVE ABBREVIATIONS

anmt—Announcement
BBC—British Broadcasting Corporation
Eng.—English
ID—Identification
IS—Interval signal
kHz—Kilohertz
kw.—Kilowatts
N.A.—North America
QRM—Station interference
QRN—Atmospheric disturbance
QSL—Verification
R.—Radio
s/off—Sign-off
s/on—Sign-on
xmsn—Transmission
xmtr—Transmitter

come active on 11,785 kHz. *R. Sociedad da Bahia*, Salvador, is now on 11,871 kHz.

Canada—*R. Canada* has begun a new and experimental xmsn beamed to the BBC, London, for simultaneous rebroadcast to West African listeners. On 5955 kHz, at 0730-0815, this "feed" will consist of the first 45 minutes of the daily Australasian Service which operates on the same frequency.

Colombia—*Una Voz de Cultura en el Sur de Colombia, Emisora Mariana*, Pasto, has moved from 4761 to 4707 kHz, where it is noted around 0200; it still gives an ID only for HJHZ, 1250 kHz. *R. Nacional*, Bogota, 4935 kHz, is generally excellent from 0321 to 0358 s/off with symphonic music, the next day's schedule, then s/off; the ID seems to indicate HJCT for this frequency and HJCQ for 49 meters.

Cyprus—The BBC relay, Limassol, 17,885 kHz, was heard (not well) ending the BBC news at 1710; s/off was at 1745. This is reportedly a 100-kw. outlet beamed to E. Africa.

Egypt—Cairo has Eng. to N.A. from 0130 to 0300 on 9595 kHz with news at 0145 and 0230. English to Europe is given at 2130-2315 on 9470 kHz, with news at 2146. Another outlet on 9550 kHz carries the "Sawt el Arab" program at 2120-2140, dual to 9495 kHz.

Gabon—The station on 6030 kHz is located at Franceville, not Libreville. The only channels now in use are 4777 and 6030 kHz; 7270 kHz is no longer utilized. And the s/on time is now 0530 instead of the listed 0500.

Bill Bordes, WPE4IGW, Somerset, Ky., DX'es with a National 121 receiver. He also uses a Westinghouse "Portatape" tape recorder. Bill's record to date: 20 countries logged, and 16 of them verified.

Germany (East)—*R. Berlin International* is now operating on 11,875 kHz for the 1600-1645 Eng. xmsn to Africa although the xmsn is buried after 1630 by *R. Vaticano;* this xmsn is listed for 11,795 kHz but that channel is already covered. The schedule for the east coast of N.A. is 0100-0130 and 0230-0300 on 9560 and 9650 kHz; for the west coast of N.A., 0345-0415 on 9600 and 9650 kHz.

Guatemala—Station TGBA, *R. Maya*, Santa Cruz Barillas, 2360 kHz, is noted at 0230-0254 with hymns in Spanish, closing anmts at 0255, and s/off at 0257 with "The Lord's Prayer" sung in Spanish.

Honduras—Station HRVC, *La Voz Evangelica de Honduras*, has an Eng. xmsn on Mondays at 0300-0330 on 4820 kHz which is evidently beamed to the Caribbean. S/off time is 0330. This station is having QSL cards printed, and reports are requested.

Station HROE, *La Voz de las Fronteras*, Ocotepeque, 5035 kHz, cuts off immediately following a clear and complete ID at 0103 in Spanish.

India—English for Europe from *All India Radio*

is now aired at 1945-2045 only on 7255 and 9915 kHz.

Iran—Still wandering, *R. Iran,* Teheran, has been logged on 11,742 kHz around 1728 and again at 1930. The first xmsn opens in Persian and goes into Russian; the latter is in French. Do not confuse the 1930 xmsn with the Arabic xmsn from Cairo on 11,745 kHz. The IS, on a plucked instrument, is "sol do do re mi fa mi re mi do re."

Ireland—DX'ers needing this country should try for *Shannon Air Radio*'s weather and meteorological reports on 8820 kHz (approx.) at 15 and 45 minutes past each hour. They operate 24 hours daily on 3820 kHz (approx.) and 5559 kHz, at 2200-1000 on 3001 kHz, and at 1000-2200 on 13,264.5 kHz. Reports go to Shannon Aeradio, Ballygirreen, Newmarket-on-Fergus, County Clare, Ireland.

Japan—*Nippon Hoso Kyokai,* Tokyo, is now on 9700 kHz (replacing 6140 kHz) at 2300-0000 and 0000-0030; the dual channels are still 15,105 and 15,425 kHz.

Lebanon—Beirut has returned to 9710 kHz for its N.A. programs, where it is noted at 0300 in Arabic. The 5980-kHz outlet, with Koran chanting, has been noted at 0440—badly mixed with a transmission from Moscow.

Mexico—Station XEJNOP is definitely located at Huayacocotla, Vera Cruz. It operates on 2390 kHz.

Peru—Station OAX4H, *R. Mundial,* Lima, has been found on 6115 kHz with an excellent signal from 1100 s/on in Spanish. Programs consist of music and commercials.

The station noted on 6241 kHz around 0415-0430 with anmts between nearly every selection is *Viva America, Radio Universidad.* This is apparently OAX6U, listed for 6235 kHz. Do not confuse it with another Peruvian operating near 6250 kHz.

Poland—English is broadcast from Warsaw to Europe at 1830-1900, 1930-2000, and 2130-2200 on 6135 and 7125 kHz, at 2030-2100 on 5950 and 7145 kHz, and at 2230-2300 on 5950 and 9540 kHz; to Africa at 1200-1230 and 1300-1330 on 7125, 11,840, and 15,120 kHz, at 1900-1930 on 6005 and 7285 kHz, and at 2200-2300 on 6005, 7125, 7145, 7285, and 11,840 kHz; to Australia and New Zealand at 0730-0800 and 0830-0900 on 9675, 11,840, and 15,120 kHz.

Portugal—Station CSA75, Lisbon, 15,044 kHz, has been heard with pop music at 1755 and to 1856 with talks.

Medium-wave DX'ers might try for the Europe-beamed Eng. "Voice of the West" program on 755 kHz at 2230. However, keep in mind that the station will not verify reception reports for this frequency except those from European points.

The listening post of Robert Culbertson, WPE3GRX, Seneca, Pa., features a Hallicrafters WR-600-W receiver. Bob has 30 countries heard, 28 verified.

Reunion—St. Denis, 2446 kHz, signs on at 0230 with an anthem. It was noted in French with light pop music until fade-out around 0245. The station was not audible on any of the known parallel channels (3250, 3380, 4807, and 4820 kHz). Reception of St. Denis is generally poor and during the summer months, with the ever-present QRN, it will present a challenge to even the most experienced SWL's.

South Africa—The South African Broadcasting Corp., Paradys, is heard well on 7270 kHz from 0300 to 0400 with news, variety music, many U. S. commercials, and time checks. The station has moved from 4895 kHz to 4875 kHz, where it is heard at 0438-0525 with concert music, setting-up exercises, talks, weather reports, and, at 0515, Eng. news. The Commercial Service on 3250 kHz is noted some nights at 0330 s/on with music, ads, and anmts in Afrikaans; the Eng. commercials provide the only Eng. in this xmsn.

St. Pierre et Miquelon—*R. St. Pierre,* 1375 kHz, 4 kw., may be audible at times to DX'ers in northeastern N.A. Programs are in French and the schedule is: Mondays, Tuesdays, Wednesdays, and Fridays at 1000-1130, 1500-1630, and 2130-0100; Thursdays at 1000-1130, 1500-1700, and 2130-0100; Saturdays at 1000-1130, 1500-1800, and 2130-0130; Sundays at 1230-0200. You'll probably need a crystal filter to cut through into this split channel.

Sweden—Current Eng. xmsns from Stockholm are scheduled to Europe at 1100 and 1400 on 9620 kHz and at 2200 on 6065 kHz; to the Far East at 1100 on 15,195 kHz, at 1230 on 15,195 and 11,810 kHz, and at 2345 on 11,810 kHz; to S. Asia at 1445 on 15,315 kHz; to the Middle East at 1615 on 15,240 kHz; to Africa at 1945 on 11,705 kHz; to the east coast of N.A. at 1400 and 1445 kHz, and at 0145 on 9705 kHz; to the west coast of N.A. at 0315 on 9705 kHz.

Uruguay—*R. Sarandi,* CXA68, Montevideo, operates on 11,885 kHz at 2100-0200 and 0300-0500. This station is also using a new channel, 9885 kHz, (CXA71), at 2000-2300 (varies) on Saturdays, Sundays, and holidays.

U.S.A.—*Voice of America* reception is not always routine. Some relatively low powered xmtrs, which make good DX targets, are still in operation. Following is a schedule for those xmtrs which have less than 30-kw. power: Munich, 8 kw., at 0200-0730 and 1400-2345 on 3980 kHz; Philippines, 7.5 kw., at 1000-1600 on 6125 kHz, and 15 kw., at 2200-0100 on 6185 kHz; Okinawa, 15 kw., at 1000-1600 on 7125 and 9740 kHz; Colombo, Ceylon, 10 kw., at 1200-1500 on 15,285 kHz and at 1530-1800 on 7275 kHz. It might be a good idea to log and verify these xmtrs since they will all eventually be replaced by more powerful stations.

Venezuela—Station YVNK, *R. Juventud,* Barquisimeto, 4900 kHz., is good at 2230-0115 with news, sports, and many musical programs, all-Spanish.

HOW SHARP A DX'ER ARE YOU?

The following stations have all been heard at various points in the continental United States. But it takes a good bit of ingenuity and lots of patience to dig some of them out of the air waves. Try your hand at locating these stations and let us know what kind of results you get. They are listed by frequency in kilohertz.

9710 Forest Side, Mauritius (0400-0420/fade; Eng. news at 0400)
7104 *Stani Withayu Thoraphap Hang Prathet Thai,* Bangkok, Thailand (1140-1200 with Oriental music and some Hawaiian music)
5949 YNRG, *R. Zelaya,* Bluefields, Nicaragua (0100 with Latin American programming; s/off at 0204; also heard around 1145)
5041 Rangoon, Burma (1200-1245, all-Burmese; also at 1430 in English)
4220 Urumchi, China (1155 in native language; 1200 with time pips; weak)
4165 Ulan Bator, Mongolia (1100-1130 in unidentified language and at poor level)
4020 Peking, China (IS at 1100, anthem, then native language)
3900 Inner Mongolia (1115 in Asian language; short march at 1130; may possibly be Huhehot)
3385 VL9CD, *R. Wewak,* New Guinea (1150 with South Seas music; Eng. ID and time given at 1200; Western pop music in local language until 1230 s/off)
3277 Srinigar, Kashmir (*All India Radio* IS at 0159; opening in Indian language; Eng. news at 0230 but signal fades before that time)
3232 Tananarive, Malagasy Republic (around 0305 with pop music and native language)

Vietnam (North)—Hanoi, 4680 kHz, is good at times around 1207 with Vietnamese news. The items are given alternately by a man and woman, and there are some bits of music.

Vietnam (South)—A returned veteran from this country reports that Saigon operates 24 hours daily on 6165, 7245, and 9620 kHz. Best reception on our west coast is between 0900 and 1600. Programs are mostly in Vietnamese, and return postage must be sent with your reception report.

Unidentified—A west coast monitor reports frequent reception of an Armed Forces Radio & Television Service station on 860 kHz. It is heard on Sundays only with an ID at 0430 during the silent hour of XEMO, Mexico. Any ideas, anyone?

Clandestine—*R. Espana Independiente* is noted on 17,696 kHz at 1408 and on 9429 kHz at 1815-2000. Both xmsns are all-Spanish.

R. Euzkadi, La Voz de la Resistencia Vasca, is a

DX STATES AWARDS PRESENTED

To be eligible for one of the DX States Awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in 20, 30, 40, or 50 different states in the U. S. The following DX'ers have qualified for and received awards in the categories indicated.

FIFTY STATES VERIFIED

Dennis Ashworth (WPE7BZB), Corvallis, Oreg.
Charles J. Matterer (WPE6DGA), San Leandro, Calif.
Steve Solo (WPE8BHU), Detroit, Mich.
P. Kilroy (WPE3FOB), Washington, D. C.
Robert Lauzon (WPE2MWS), Pittsford, N. Y.

FORTY STATES VERIFIED

Randy Burg (WPE6GAR), Beverly Hills, Calif.
Louis Votto, Jr. (WPE1GAI), Miami, Fla.
Soward Benefield (WPE4GPO), Heflin, Ala.
Phil Raczka (WPE8IRL), Cleveland, Ohio
Jack Page, Jr. (WPE5DXH), Pontotoc, Miss.
Robert Astmann (WPE2LWS), Kenmore, N. Y.
Walter N. Pratt (WPE1FHE), Shrewsbury, Mass.
Stuart Grade (WPEØDDO), Sioux City, Iowa
Jim Smedley (WPE3BSB), Sykesville, Md.
Arthur W. Peterson (WPE6FMV), San Pablo, Calif.

THIRTY STATES VERIFIED

Alan Burnley (WPE2MRJ), Westfield, N. J.
John Brush (WPE3FZD), Coraopolis, Pa.
Bill Block (WPE7BZY), Portland, Oreg.
Pete Glenn (WPE2JMT), Morristown, N. J.
John Thompson (WPE9HMW), Wilmette, Ill.
Philip R. Garvey (WPE2MQD), Poughkeepsie, N. Y.
Lawrence Bennett (WPE2NEU), Forest Hills, N. Y.
Gary G. Sanford (WPE7CFA), Fairfax, Va.
Ed Rudder (WPE4EXY), Halifax, Va.
David R. Oester (WPE7CEZ), Deer Island, Oreg.
James P. Foley (WPE9GOI), Milwaukee, Wis.
Bill Jarvis (WPE1GEP), Lebanon, N. H.
Richard and John Haneiko (WPE3GKC), Pittsburgh, Pa.
Dale Meyer (WPE8IIV), St. Clair Shores, Mich.
Richard F. Jemison (WPE9HLZ), Des Plaines, Ill.
Paul E. Petosky (WPE8ASF), Pickford, Mich.
John Creamer (WPE2OCT), Syracuse, N. Y.

TWENTY STATES VERIFIED

Richard Fisher (WPE2NUB), Whitestone, N. Y.
Patrick Chick (WPE8DZK), Mayfield Heights, Ohio
Ed Schuller (WPE6FXB), Inglewood, Calif.
Ralph Irace (WPE1GJN), Avon, Conn.
Wayne Harrell (WPE5EKB), El Dorado, Ark.
Norman Bullen (WPE9ICC), McFarland, Wis.
Paul W. Baker (WPE3FWO), Waynesboro, Pa.
Ronald D. Miller (WPE9HCG), Peoria, Ill.
Steve Smay (WPEØEAW), Springfield, Mo.
Barton Cox (WPE3GFA), Bryans Rd., Md.
Curt Fredrickson (WPE9GPZ), Chicago, Ill.
David E. Shell (WPE4INB), Staunton, Va.
Eric Nelson (WPE5EDQ), Tulsa, Okla.
Richard Houlis (WPE3GOK), Monessen, Pa.
Steven Carter (WPE1GKH), Reading, Mass.
Michael Gikow (WPE2OMB), West Long Branch, N. J.
Glen Charnock (WPE8HMF), Cleveland, Ohio
Robert Mark (WPE9HWY), Chicago, Ill.
Douglas Kelch (WPE5EFC), Las Cruces, N. M.
Patrick O'Connell (VE4PE6P), Winnipeg, Manitoba, Canada
John M. Drueke (WPE9GUA), Belleville, Ill.
Stephen McIntire (WPEØENL), Des Moines, Iowa
Carl Ervin (WPE9GEL), Chicago, Ill.
David Strieter (WPE9GWU), Chicago, Ill.
Donald Herbert (WPE3GGZ), Philadelphia, Pa.
Peter Orlando, Jr. (WPE1FRZ), Concord, Mass.
Tony Lizardi (WPE6GBX), Chula Vista, Calif.
Donald Reggio (WPE5EHB), New Orleans, La.
Bob Burgert II (WPEØEJA), Grandview, Md.
Bob Beran (WPE7CFF), Salt Lake City, Utah
Steven Levine (WPE1GKI), West Hartford, Conn.
Fred Keller (WPE9GTW), Indianapolis, Ind.
Stuart Miller (WPE1GMF), Marblehead, Mass.
Gary L. Phillips (WPE8HND), Dearborn Heights, Mich.
Donald J. Wagner (WPE9HDH), Chicago, Ill.
Phil Raczka (WPE8IRL), Cleveland, Ohio
John Ragaisis (WPE2NZG), Rochester, N. Y.
Paul Akers (WPE1GIP), Hartford, Conn.
Kenneth E. Turner (WPE4IUN), Fulton, Ky.
Joseph Lopez (WPE2NYN), New York, N. Y.
Tom Wosniewski (WPE8IHW), Manistee, Mich.
Lee Freshwater (WPE9ICX), Muncie, Ind.
Gary A. Anderson (WPE4IOI), Cynthiana, Ky.
Paul Silver (WPE1GPY), Providence, R. I.
John McWhirter (WPE6GFR), Los Angeles, Calif.
J. H. Cate (WPE1GGO), Dover, N. H.
Billy Richard All (WPE4HWT), Cayce, S. C.
Robert Clauser (WPE3GBW), Lebanon, Pa.
Norm Szydlowski, Jr. (WPE9HEL), Hammond, Ind.
Paul H. Henning (WPE9HLC), Hartford, Wis.
Ed Cuttle (WPE9JAF), Rolling Meadow, Ill.
William Lavick (WPE2OHJ), West Islip, N. Y.
Paul Baker (WPE3FWO), Waynesboro, Pa.
Mike Finigan (WPE4ISQ), Monroe, N. C.
Westwood Holliday (WPE8HZY), Beckley, W. Va.
John G. Flynn (WPE2NME), Brooklyn, N. Y.
William Brunner (WPE2NTE), West Islip, N. Y.
R. C. Hagerman (WPE8INH), Hemlock, Mich.
James Neumeister (WPE8IPX), Upper Sandusky, Ohio
Max Ramsey (WPE5EEP), Checotah, Okla.
Mike Jungman (WPE5DQM), Randolph AFB, Texas
Pat Laird (VE5PE5F), Swift Current, Sask., Canada
Lothar H. G. Koenig (WPE2NTB), Brooklyn, N. Y.
Leon Kirschemann (WPEØENW), Regent, N. D.
John M. Swenson (WPE4ITV), Annandale, Va.
Dave Miller (WPE3GHK), Erie, Pa.
J. E. Sills (WPE6GGE), San Diego, Calif.
Robert Shankle, Jr. (WPE8HVN), Youngstown, Ohio
Thomas Olshark (WPE3GJT), Luzerne, Pa.
Norman Wald (WPE9IAC), Skokie, Ill.
Sinai Putter (VE2PE1IT), Montreal, Que., Canada
Richard A. Spritz (WPE3GGE), Elkins Park, Pa.
Richard Gurwin (WPE8IIK), Detroit, Mich.
Larry Heaton (WPE4IVB), Weaver, Ala.
Michael Paetz (WPE5EFV), Galveston, Texas
Bill Jones (WPE8IUW), Marion, Ohio
Mark Dokulil (WPE6GCI), Reseda, Calif.
Calvin Bright (WPE8ISA), Grass Lake, Mich.
R. J. Chenier (YE6PE6Z), Edmonton, Alberta, Canada
Steve Courts (WPE8IUB), Milton, W. Va.
James A. Whitworth (WPEØBZQ), Colorado Springs, Colo.
Paul Johnson (WPE9GYP), Monmouth, Ill.
David Scholz (WPE2MUG), Allendale, N. J.
Marc Shaw (WPE2NAN), Audubon, N. J.
Andy Moznick (WPE9HQE), Evanston, Ill.
John Scheckter (WPE2LOB), Mt. Holly, N. J.
Robert Wavra (WPE2ODD), Irvington, N. J.
R. Watling (VE4PE4H), Winnipeg, Manitoba, Canada
Francis Hyatt (WPE2IJT), Wayne, N. J.
Bob Zwier (WPE8ILZ), Holland, Mich.
Roger Matus (WPE2OBQ), Lido Beach, N. Y.
Neil Zank (WPEØAII), Lincoln, Nebr.
Charles Harris, Sr. (WPE1GKN), Watertown, Conn.
Kenneth Bernacky (WPE1GMK), Hartford, Conn.

DX AWARDS PROGRAM RULES

Here's an easy way to get a copy of the rules and regulations for each of the three phases of the DX Awards Program to date (Countries, States, and Provinces). Just supply a postage stamp or return envelope, and your Short-Wave Editor will send you a leaflet containing the rules for all three phases—plus a copy of the official Countries List for DX Awards. The stamp or envelope, with your request, should go to: DX AWARD RULES, P. O. Box 333, Cherry Hill, N. J. 08034.

powerhouse on 13.214 and 11,277 kHz from 2145 to 2202/close. Basque and Spanish are used alternately; the s/off anmts are given twice in both languages. Tune for the musical ID of "do re do ti do re sol do" on chimes.

Recent reports to *R. Libertad* at Miami Beach have been returned with the postal notation "Box closed by order of Post Office Department." The Miami Beach address, however, is still being given over the air. -30-

SHORT-WAVE CONTRIBUTORS

Terry Henry *(WPE1GCC)*, Keene, N. H.
Christopher Lobdell *(WPE1GCI)*, Reading, Mass.
Ronald Boisvert *(WPE1GTB)*, Manchester, N. H.
Eric Lebowitz *(WPE2JJY)*, Jackson Heights, N. Y.
Paul Goodman *(WPE2LTE)*, Oneonta, N. Y.
Robert Harris *(WPE2MHG)*, Syosset, N. Y.
John Sgrulletta *(WPE2MXF)*, Bedford Hills, N. Y.
Allan Kachel *(WPE2NBH)*, New York, N. Y.
Alan Coles *(WPE2NUV)*, Leonia, N. J.
Bob Hurwitt *(WPE2NVP)*, Plainview, N. Y.
Stephen Toder *(WPE2NYK)*, Kingston, N. Y.
Ray Schlegel *(WPE2OAO)*, Rochester, N. Y.
Richard D'Angelo *(WPE2OHK)*, Brooklyn, N. Y.
John Zapisek *(WPE2OKD)*, Wading River, N. Y.
Bob Hejl *(WPE2OMD)*, Farmingdale, N. Y.
Peter Macinta, Jr. *(WPE2ORB)*, Kearny, N. J.
N. S. Jortner *(WPE2OUR)*, New York, N. Y.
Michael Mattes *(WPE2YS)*, East Williston, N. Y.
Ed Kowalski *(WPE3AK)*, Philadelphia, Pa.
William Larkin III *(WPE3GBO)*, Philadelphia, Pa.
George Sprout *(WPE3GMW)*, Reading, Pa.
Eugene Radice *(WPE3GXX)*, Bloomsburg, Pa.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
Chuck Edwards *(WPE4BNK)*, Fort Lauderdale, Fla.
Steve Jones *(WPE4IOW)*, Lawrenceburg, Ky.
Jack Keene *(WPE5BMP)*, Houston, Texas
Del Hirst *(WPE5CFU)*, Snyder, Texas
John Callarman *(WPE5JH)*, Pampa, Texas
Jack Stephenson *(WPE5XX)*, Oklahoma City, Okla.
Stewart Mac Kenzie *(WPE6AA)*, Huntington Beach, Calif.
Shaler Hanisch *(WPE6BPN)*, Pasadena, Calif.
Clifford McKinstry *(WPE6CXS)*, San Bernardino, Calif.
Trev Clegg *(WPE6FAF)*, Fresno, Calif.
John Starley *(WPE7CHO)*, Ogden, Utah
Joseph Arndt *(WPE8CQN)*, Lima, Ohio
Scott Krauss *(WPE8ITZ)*, Clyde, Ohio
S. L. Smothers *(WPE9HYS)*, Kankakee, Ill.
A. R. Niblack *(WPE9KM)*, Vincennes, Ind.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Clarence Wahl *(WPEØEQI)*, Wichita, Kan.
Luis Baco *(KP4PE1B)*, Mayaguez, P. R.
Harold Allen *(VE2PE1JM)*, St. John's, Newfoundland, Canada
Robert Jones *(VE3PE2IV)*, Belleville, Ontario, Canada
Ron Hopkins *(VE7PE7P)*, Trail, B. C., Canada
E. J. Chapman, Pierrefonds, Quebec, Canada
Jeo Esser, Arlington, Va.
Joel Glass, New York, N. Y.
Glenn Hauser, Albuquerque, N. M.
Bob Hill, Washington, D. C.
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Tony Tittle, Dallas, Texas
Doug Waller, Richmond, Va.
Canadian Broadcasting Corp., Montreal, Quebec, Canada
Sweden Calling DX'ers Bulletin, Stockholm, Sweden
Radio Sweden, Stockholm, Sweden

INDEX

TO VOLUME 24

JAN.—JUNE 1966

AMATEUR RADIO

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-30-

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WANTED

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	3.50	6AC7	1.75	6J7	1.88	7R7	2.25	14Q7	2.25
01A	2.75	6AF3	1.25	6J7G/GT		7S7	1.75	14R7	2.50
0C3-D3	.85	6AG5	1.03		1.75	7V7	1.74	14S7	1.95
0D3	.75	6AG7	2.25	6J8	2.50	7W7	2.49	14W7	1.85
1A7	1.75	6AH4	1.10	6K6GT	.93	7X6	1.35	14X7	1.75
1AX2	.95	6AK5	.80	6K7	1.90	7X7	2.85	14Y4	1.75
1B3	.88	6AL3	1.05	6L6G	1.15	7Y4	2.35	19	1.00
1H5	1.50	6AL7	2.40	6L6GC	1.50	7Y7	1.79	22	1.15
1LA4	1.30	6AN8	1.15	6L7M	2.58	7Z4	2.35	24A	1.50
1LA6	1.98	6AN8	1.43	6N7M	.90	8AU8	1.63	25C5	.75
1LC5	1.95	6AQ7	1.33	6P5	2.50	8BQ5	1.18	25CD6	1.94
1LC6	1.80	6AR5	.88	6Q7	2.05	8CG7	.99	25DN6	2.40
1LD5	1.95	6AS5	.95	6S7	1.95	8FQ7	.99	25L6	.80
1LE3	1.25	6AS7	3.15	6S8GT	1.60	8GJ7	1.38	25Z5	1.15
1LH4	2.80	6AT6	.72	6SA7M	1.60	8GN8	1.59	25Z6	1.10
1LN5	2.25	6AT8	1.25	6SB7Y	2.25	8JN8	1.59	26	1.60
1N2A	1.60	6AU4	1.28	6SD7	1.49	9A8	1.59	27	1.75
1N5	1.85	6AU5	1.60	6SF5	.98	9U8	1.30	30	1.40
1P5	2.00	6AU6	.68	6SF7	2.40	10DE7	1.14	32	1.25
1R4	.80	6AU8	1.50	6SG7	1.60	10DR7	1.76	32ET5	.88
1R5	1.10	6AW8	1.35	6SH7	1.50	10KR8	1.86	33	1.15
1S5	1.10	6AX4	.96	6SJ7GT	1.49	12A8	1.95	33GT7	3.00
1T5	.80	6AX5	1.10	6SJ7M	1.65	12AH7	1.99	34	1.25
1U4	1.05	6AX7	1.25	6SK7M	1.60	12AT6	.59	35A5	2.10
1U5	.98	6B4	5.95	6SL7GT	.80	12AT7	.74	35L6	1.05
1V	2.00	6B8	1.95	6SN7GT	.90	12AU6	.65	35W4	.47
1W2	.83	6BA7	2.75	6SQ7GT		12AU7	.74	35Y4	1.62
2A3	3.75	6BB	2.66			12AV6	.56	35Z3	1.54
2A5	2.50	6BR6	.68	6SR7	1.33	12AX4	.84	35Z5	.82
2A6	4.50	6BA8	1.35	6SS7M	1.50	12AX7	.87	36	1.50
2B7	1.95	6BE6	.81	6T8	1.15	12BA6	.59	37	1.25
2HA5	1.49	6BH6	.95	6TP9	1.20	12BE6	.59	38	1.25
2X2A	1.95	6BH8	1.35	6U5	2.75	12BH7	.96	39/44	1.25
3A3	.75	6BK5	1.35	6U8	1.00	12BQ6	1.35	41	1.50
3A5	1.10	6BK7	1.20	6V6GT	.76	12BR7	1.08	42	1.94
3AU6	.82	6BQ6	1.42	6V6M	2.25	12BY7	1.09	43	2.75
3B7	2.39	6BQ7	1.18	6W4	.86	12CU5	.95	45/2A3	3.25
3BN4	1.08	6BX7	1.95	6W6GT	1.05	12K7	2.49	46	.95
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