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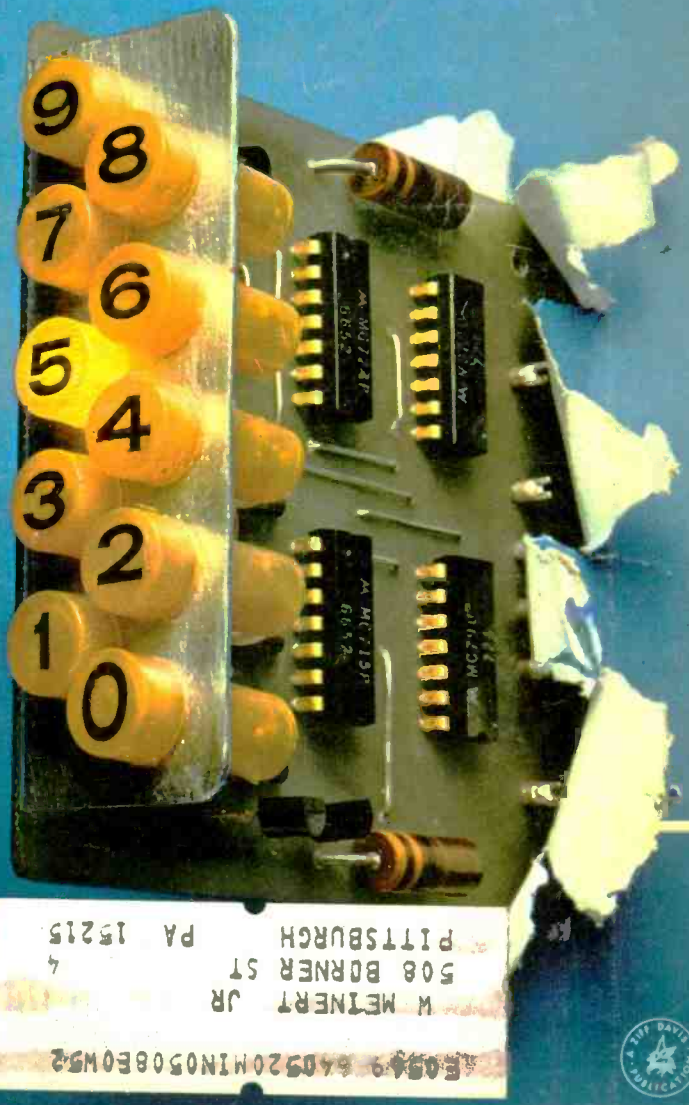

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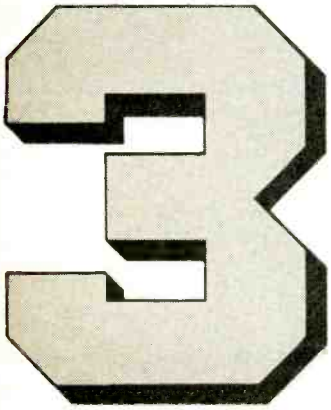

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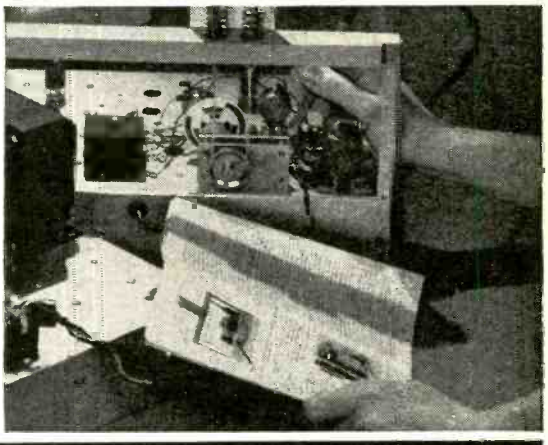

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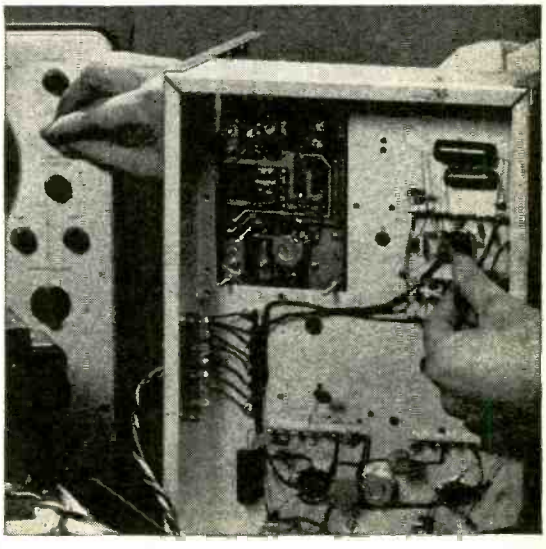

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VOLUME 28 NUMBER 2 **FEBRUARY, 1968**

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

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LOW-COST COUNTING UNIT 27 DON LANCASTER
EXCLUSIVE: This project opens up a whole new era for the hobbyist

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ADD "COMPLY" TO YOUR TAPE RECORDER 47 CHARLES CARINGELLA, W6NJV
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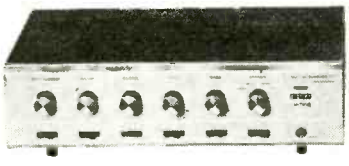

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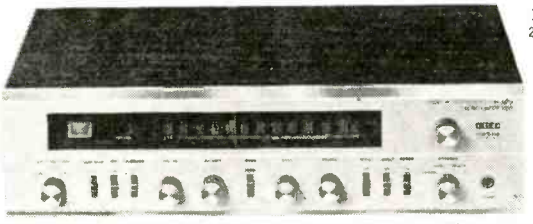

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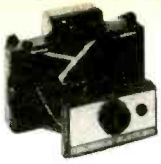

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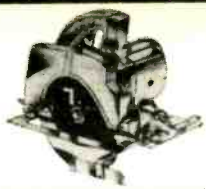

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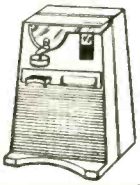

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CIRCLE NO. 39 ON READER SERVICE PAGE

letters
FROM OUR READERS

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York, N. Y. 10016

THEREMIN ACTS UP

I bought the entire kit for the theremin ("Music A La Theremin," November, 1967) from Southwest Technical Products and carefully assembled the unit, using all the precautions of good workmanship. Now what do I have? At different points in the process of trying to tune it, my theremin is a very sensitive microphone, or it pulls in the local radio station beautifully, or it starts every dog in the neighborhood barking furiously! My wife threatens to break it over my head and throw me out, theremin and all.

I just can't get my theremin to operate properly by following the instructions in the

article. At no point is it even necessary for me to approach *both* antennas to get weird squeals; and usually *either* antenna affects the pitch, and *neither* affects the volume. Would it be possible to obtain some better tuning instructions?

J. C. DEMUNTER
Oak Park, Mich.

Troubleshooting by mail is, at best, a hazardous business. Assuming that none of the components you used was defective and that your wiring is letter-perfect, the theremin should operate as described in the article. In fact, the best results will be obtained only if you follow the tuning procedure given. The unit we checked out here lived up to its name in the best tradition.

ATTENTION: PARTS DISTRIBUTORS

I've been interested in electronics for about eight years, and I enjoy experimenting and building projects. One problem has continually plagued me, however, and that is the difficulty of obtaining components. A typical

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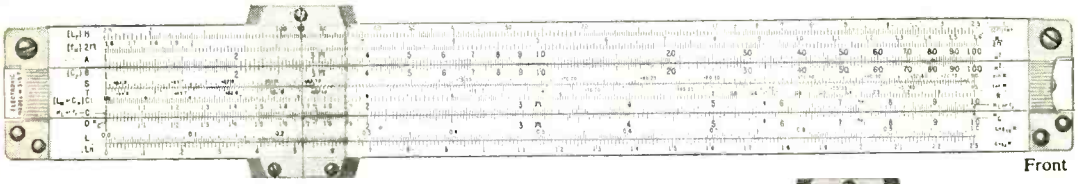

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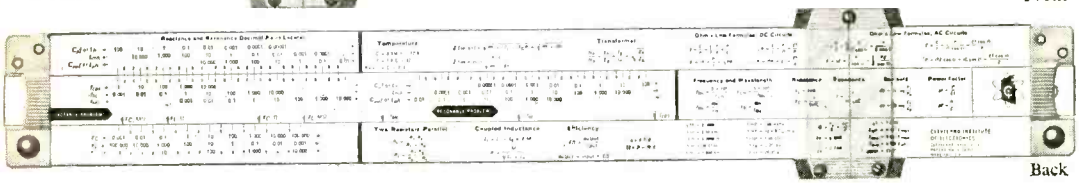

Back

This amazing new "computer in a case" will save you time the very first day. CIE's patented, all-metal 10" electronics slide rule was designed *specifically* for electronic engineers, technicians, students, radio-TV servicemen and hobbyists. It features special scales for solving reactance, resonance, inductance and AC-DC circuitry problems . . . an exclusive "fast-finder" decimal point locater . . . widely-used formulas and conversion factors for instant reference. And there's all the standard scales you need to do multiplication, division, square roots, logs, etc.

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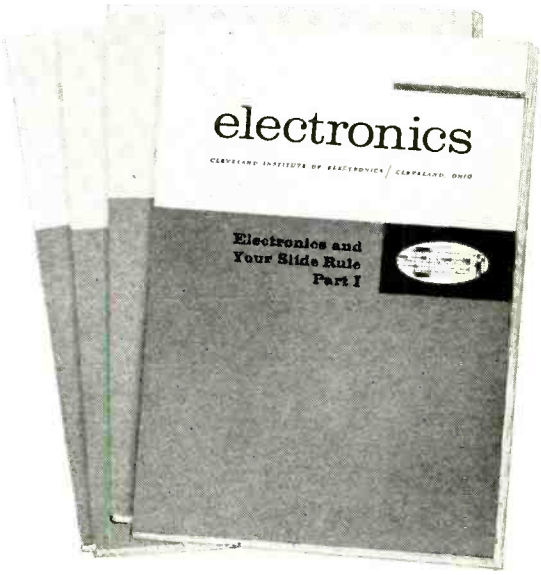

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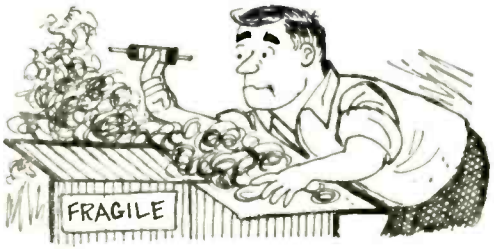
CIRCLE NO. 11 ON READER SERVICE PAGE

LETTERS (*Continued from page 8*)

project may entail orders to several mail order houses for as much as $20 or $30 worth of components and ten or so different items. When I receive my orders, I find that only about half of the parts are there. Almost invariably, I receive parts I have not ordered, or I do not get parts I have ordered because of a backlog or unavailability.

Of course, since the entire order isn't filled at once and packed economically, I get stuck for additional postage when and if the stuff is sent. It sometimes takes months to accumulate the components for a project. I



don't know what annoys me more: the errors, or the fact that the mail order houses don't have the products they advertise.

I was under the impression that the electronics industry in general was encouraging the experimenter, but it doesn't seem so. Am I the only person having this kind of trouble, or are there others?

ROY V. CHILDS
San Francisco, Calif.

You are not alone. Perhaps there are valid reasons for such mix-ups and partial orders, but it seems to us that the situation could be rectified easily enough. The most obvious reason for foul-ups would appear to be the large volume of orders mail order houses must fill. Mistakes are inevitable, but they could be minimized if inspectors were used to doublecheck filled orders for errors.

As for out-of-stock or out-of-production parts, the mail order houses cannot possibly list each item as it assumes either status. An answer—at least partially—to this problem would be a check box on the order form, by means of which you could tell the person filling your order whether or not you wish to accept a partial shipment. It is possible, also, that many errors can be eliminated if you double-check the catalog part numbers you list before sending in your order.

DON'T KNOCK AMATEUR RADIO

I nearly choked on my lunch when I read Herb Brier's "Amateur Radio" column entitled "How To Service Your Own Equipment" (December, 1965). Imagine an article in an electronics magazine—under the head-

(*Continued on page 14*)

DOES YOUR CB RADIO HAVE A BUILT-IN "TACHOMETER"?

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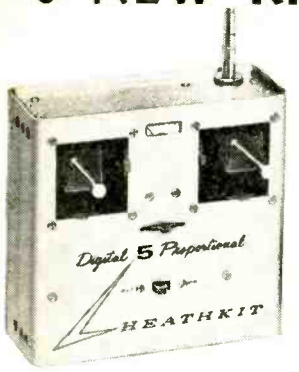
CIRCLE NO. 19 ON READER SERVICE PAGE

8 NEW KIT IDEAS FROM HEATH . . .



Complete System
Transmitter, 4 servos,
2 rechargeable batteries,
all cables & connectors.
$219.95

NEW! For Radio-Control Modelers . . . The Heathkit Version Of The Famous Kraft 5-Channel Digital Proportional System With Revolutionary Variable Capacitor Servos . . . Save Over $200!

Time proven circuitry, rugged and reliable, in easy-to-build kit form that saves you over $200. That's the new Heathkit R/C Proportional System. Use it to control planes, boats, cars.

Transmitter: 12 silicon transistor, 10 diode fixed frame rate pulsed circuit on fiberglass board with 9.6v., 500 mah rechargeable battery plus built-in battery charger and meter, operates up to 5 hrs. per charge; 54" telescoping antenna; 0.8 watt input, 0.4 watt output for long range command; 4 channels with trim adjustments, 5th channel is thumb-type control, right stick controls elevator and ailerons, left stick controls rudder and throttle, 5th channel for retractable gear, etc.; factory assembled RF section, specify frequency: 26.995, 27.045, 27.145, or 27.195 MHz.

Receiver: highly sensitive reception, virtually immune to noise or temperature variations; 11 transistors, 5 SCS devices, 7 diodes on 2 fiberglass boards powered by 4.8v., 500 mah rechargeable battery; specify frequency: 26.995, 27.045, 27.145, or 27.195 MHz; measures just 2⅞" H. x $2\frac{3}{16}$" W. x 1⅝" D.; weighs only 5 oz.

Servo Mechanisms: sealed variable capacitor feedback eliminates failure due to dirty contacts, vibration, worn wire elements improve resolution; three outputs: two linear shafts travel ⅝" in opposite directions simultaneously, one rotary wheel travels over 100°; 3.5 lb. thrust, 9 transistor circuit on fiberglass board; nylon gears, shafts, case; all cables, connectors, grommets included; measures just $1\frac{7}{16}$" H. x $1\frac{5}{16}$" W. x $2\frac{9}{16}$" L.; weighs only 2.5 oz.

System Kit GD-47, transmitter, receiver, 4 servos, 2 rechargeable batteries, all cables & connectors (specify frequency)...5 lbs., no money dn., $21 mo...Save $12.45 with system **$219.95**

Kit GDA-47-1, transmitter, battery, cable (specify frequency)...3 lbs., no money dn., $9 mo. **$86.50**

Kit GDA-47-2, receiver only (specify frequency)...3 lbs., no money dn., $5 mo. **$49.95**

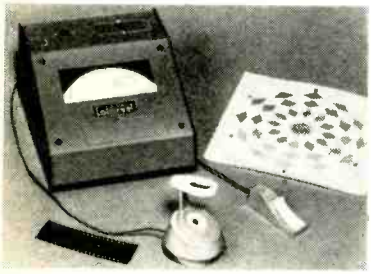
GDA-47-3, receiver rechargeable battery only, 1 lb. **$9.95**

Kit GDA-47-4, one servo only, shipping wt. 1 lb. **$21.50**

NEW Heathkit 5 MHz 3" 'Scope — Only $79.95

Here is the wideband response, extra sensitivity and utility you need, all at low cost. The Heathkit IO-17 features vertical response of 5 Hz to 5 MHz; 30 mv Peak-to-Peak sensitivity; vertical gain control with pull-out X50 attenuator; front panel 1 volt Peak-to-Peak reference voltage; horizontal sweep from internal generator, 60 Hz line, or external source; wide range automatic sync; plastic graticle with 4 major vertical divisions & 6 major horizontal; front mounted controls; completely nickel-alloy shielded 3" CRT; solid-state high & low voltage power supplies for 115/230 VAC, 50-60 Hz; Zener diode regulators minimize trace bounce from line voltage variations; new professional Heath instrument styling with removable cabinet shells; beige & black color; just 9½" H. x 5½" W. x 14½" L.; circuit board construction, shipping wt. 17 lbs.

Kit IO-17
$79.95



NEW Heath/Mitchell COLORVAL Darkroom Computer

Now amateur and professional photographers alike can quickly produce beautiful color prints right in their own darkroom with no waste, no color cast, no guessing. The new factory assembled Colorval takes the work out of color printing, leaves the creativity to you. Colorval is easy to set up . . . you "program" the scan filter pack for the type of film, paper, and equipment you use . . . we show you how.

Unique Color Probe allows visual determination of ideal enlarger filter combination. Color Wheel and table shows what filter changes are needed. Exposure Probe scans shadows and highlights; exposure scale on Computer indicates proper contrast for color and b/w printing. Get started in color the right way, quickly, easily.

Assembled PMW-17, 6 lbs...no money dn., $13 mo. **$125.00**

NEW Low Cost Hi-Fi Speaker System $39.95

Always a series outstanding in performance and value, and now this improved model has improved components yet costs no more than the original model. New polyester covered wood cabinet has durable, fade-free finish with walnut grain that resists abrasion, stains and heat. New 10 oz. ceramic magnet for 8" woofer. Compression-type exponential horn tweeter, 50-12,000 Hz response; 25 watt power rating. 27 lbs.

Kit AS-37
$39.95

USE COUPON TO ORDER NOW!

TO-68

$349.95

$35 dn., $30 mo.

NEW! VOX "Jaguar" Transistor Combo Organ By Heathkit

Save Up To $150 on the world's most popular combo organ with this new Heathkit version. Features the most distinctive sound of any combo organ. Has a special bass output that gives a brilliant stereo bass effect when played through a separate or multi-channel amplifier, 4 complete octaves, vibrato, percussive effects and reversible bass keys. Includes hand crafted orange and black cabinet, fully plated heavy-duty stand, expression pedal and waterproof carrying cover and case for stand. Requires a bass or combo amplifier like Heathkit TA-17 (opposite page).

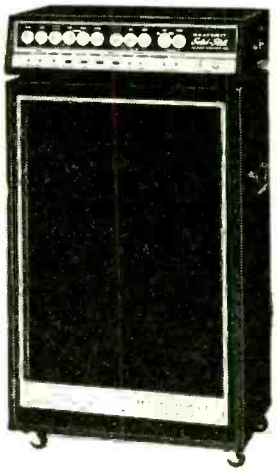
Kit TO-68, 80 lbs. . . . $35 dn., $30 mo. **$349.95**

NEW! Deluxe Solid-State Combo Amplifier & Speaker System . . . Choose Kit Or Factory Assembled

Amplifier
Kit TA-17
$175
$17 mo.
(Assembled
TAW-17 $275)

Speaker System
Kit TA-17-1
$120
$11 mo.
(Assembled
TAW-17-1 $150)

Special Combination Offer
Amplifier & Two Speaker Systems
Save $20
Kit TAS-17-2
$395
$40 dn.
$34 mo.
(Assembled
TAW-17-2 $545)



All the "big sound" features every combo wants . . . tremolo, built-in "fuzz", brightness, reverb, separate bass and treble boost and more. Delivers a shattering 120 watts EIA music power (240 watts peak power) through two TA-17-1 speakers . . . or 90 watts through one TA-17-1 speaker. Features 3 independent input channels, each with two inputs. Handles lead or bass guitars, combo organ, accordion, singer's mike, or even a record changer. All front panel controls keep you in full command of all the action.

Speaker system features two 12" woofers, special horn driver and matching black vinyl-covered wood cabinet with casters & handles for easy mobility.

Kit AR-17
$72.95
(less cabinet)
$8 mo.

NEW! Lowest Cost Solid-State Stereo Receiver

Features wide 18-60,000 Hz response @ ±1 db at full 5 watts RMS power per channel . . . 14 watts music power . . . inputs for phono and auxiliary . . . automatic stereo indicator . . . outputs for 4 thru 16 ohm speakers . . . adjustable phase for best stereo . . . flywheel tuning . . . and compact 9¾" D. x 2⅞" H. x 11½" W. size. 12 lbs. Optional factory assembled cabinets (walnut $7.95, beige metal $3.50).

Kit AR-17, (less cab.) 12 lbs. . . . no money dn., $8 mo. . **$72.95**
Kit AR-27, 7-Watt FM Mono Only Receiver (less cab.)
9 lbs. . . . no money dn., $5 mo. **$49.95**

Kit IM-17
$19.95

NEW! Solid-State Portable Volt-Ohm-Meter

So Handy, So Low Cost we call it "every man's" meter. Just right for homeowners, hobbyists, boatowners, CBer's, hams . . . it's even sophisticated enough for radio & TV servicing! Features 12 ranges . . . 4 AC & 4 DC volt ranges, 4 ohm ranges; 11 megohm input on DC, 1 megohm input of AC; 4½" 200 uA meter; battery power; rugged polypropylene case and more. Easy 3 or 4 hour kit assembly. Ideal gift for any man! 4 lbs.

NEW FREE 1968 CATALOG!

Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, electric guitar & amplifier, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

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CIRCLE NO. 20 ON READER SERVICE PAGE

LETTERS (Continued from page 10)

ing of Amateur Radio—telling so-called hams how to fix their transmitters! This is akin to an article in a plumber's journal that tells how to unjam an adjustable wrench. When articles like Mr. Brier's appear in your magazine, it's time for Yank hams to re-examine what their licenses stand for. There are, I believe, roughly 250,000 American W and K call-signs. How many of those who hold them are really worthy of them, based on CW and technical competency?

ROBERT RONAI, VK2ZRZ
St. James N.S.W., Australia

In your answer to Don Chester's letter ("Letters From Our Readers," October, 1966) you stated that many hams want to get on the air as expeditiously as possible. How can you say that? The fact that prospective hams take the time and effort to learn code and electronics theory means that they are serious about this amateur radio business—and are not looking for an "expeditious" way out. Anyone who doesn't want to work for his license can take advantage of the 27 MHz band the FCC has set aside.

So don't knock amateur radio.

JOHN BRY, WB2QLG
Cherry Hill, N.J.

Bob, a lot of electronics enthusiasts who are studying for their ham tickets read POPULAR ELECTRONICS *to see what's going on and pick up a few pointers. There are also many newly ticketed hams who have had no trouble with their store-bought equipment, and therefore no servicing experience. These are the people Mr. Brier's article was aimed at. John, you'll have to admit that many people in this modern age just don't have the time that they would like to devote to a given job. "Expediency" in our answer to Don was not meant in any way to knock amateur radio. It merely served to point out that there are other means of putting an amateur station together than the build-it-from-ground-up technique.*

IC SUPPLIER WANTED

The TAA103 IC (Project #4) in "Linear IC Applications" (December, 1967) is just what I need. However, you didn't list a distributor for this subminiature audio amplifier. Could you please tell me where I can buy it. Also, if the TAA103 is smaller than the head of a 2-56 screw, how do you make connections to it?

DAVID A. DEWEY
Orinda, Calif.

The TAA103 integrated circuit is available from Newark Electronics Corp., 500 North Pulaski Rd., Chicago, Ill. 60624. If you have a franchised Amperex dealer near you, you might try there; since the TAA103 is a new

(Continued on page 111)

READER SERVICE PAGE

free information service:

Here's an easy and convenient way for you to get additional information about products advertised or mentioned editorially (if it has a "Reader Service Number") in this issue. Just follow the directions below... and the material will be sent to you promptly and free of charge.

1. Print or type your name and address on the lines indicated. Circle the number(s) on the coupon below that corresponds to the key number(s) at the bottom of the advertisement or editorial mention(s) that interest you. (Key numbers for advertised products also appear in the Advertisers' Index.)

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ELECTRONICS library

QUIET

ABC'S OF HI-FI AND STEREO, Second Edition

by Hans Fantel

This book can be a valuable aid in selecting, using, and maintaining hi-fi and stereo equipment. It discusses the nature of sound and the meaning of "hi-fi," then tells how to set up a hi-fi system and how to get the most out of it. The reader is told what to look for in virtually every type of device used in modern hi-fi systems, and information on the most up-to-date systems and components available is also presented—all in straight-from-the-shoulder, non-technical language.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis, Ind. 46206. Soft cover. 112 pages. $2.25.

ELECTRONIC COMMUNICATION, Second Edition

by Robert L. Shrader

Written for anyone with an electronics background who desires an FCC license, either commercial or amateur, via home study, this second edition has been brought up to date to reflect the latest in electronic communication techniques and the latest in FCC license questions. General coverage of communication electronics is also provided for pre-enginering students down to the high-school level. The book is divided into 34 chapters, with each one covering a different element of communication electronics. Every chapter includes practice problems, with solutions.

Published by McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. 10036. Hard cover. 682 pages. $9.50.

HOW TO USE SIGNAL GENERATORS IN COLOR TV SERVICING

by John D. Lenk

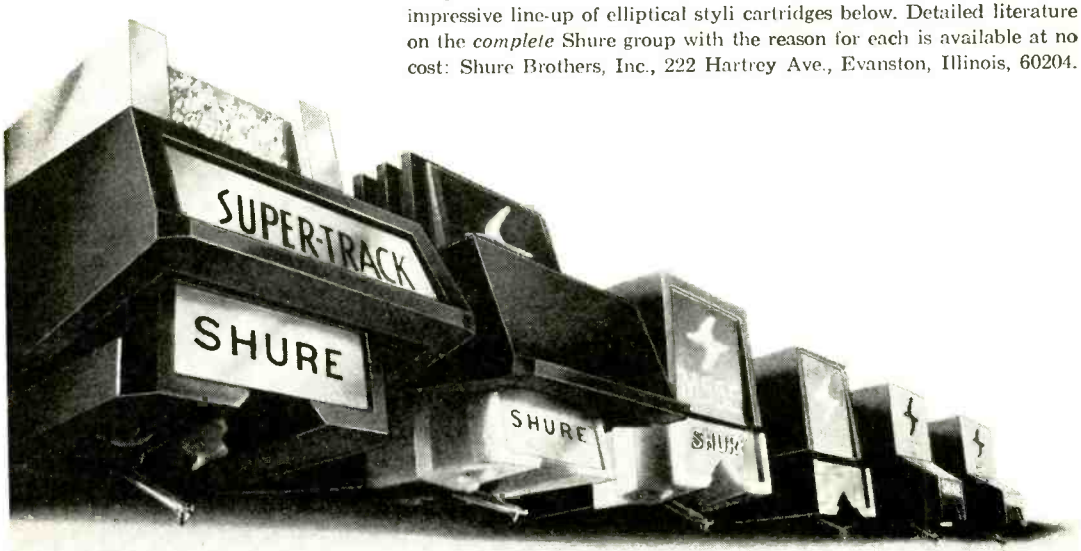
The author of this book assumes that the reader is familiar with color TV fundamentals and basic troubleshooting techniques. Yet the book ranks among the clearest written and easiest to use and understand of all the troubleshooting guides available for color TV servicing. The first half of the book contains a lucid discussion of keyed and unkeyed rainbow and NTSC generator theory, and the second half tells you how to use these generators.

Published by John F. Rider Publisher, Inc., 116 West 14 St., New York, N.Y. 10011. Soft cover. 97 pages. $3.25.

Now...in every price range, every tracking force range

from $67.50 to $25.00...
from ¾ grams to 5 grams

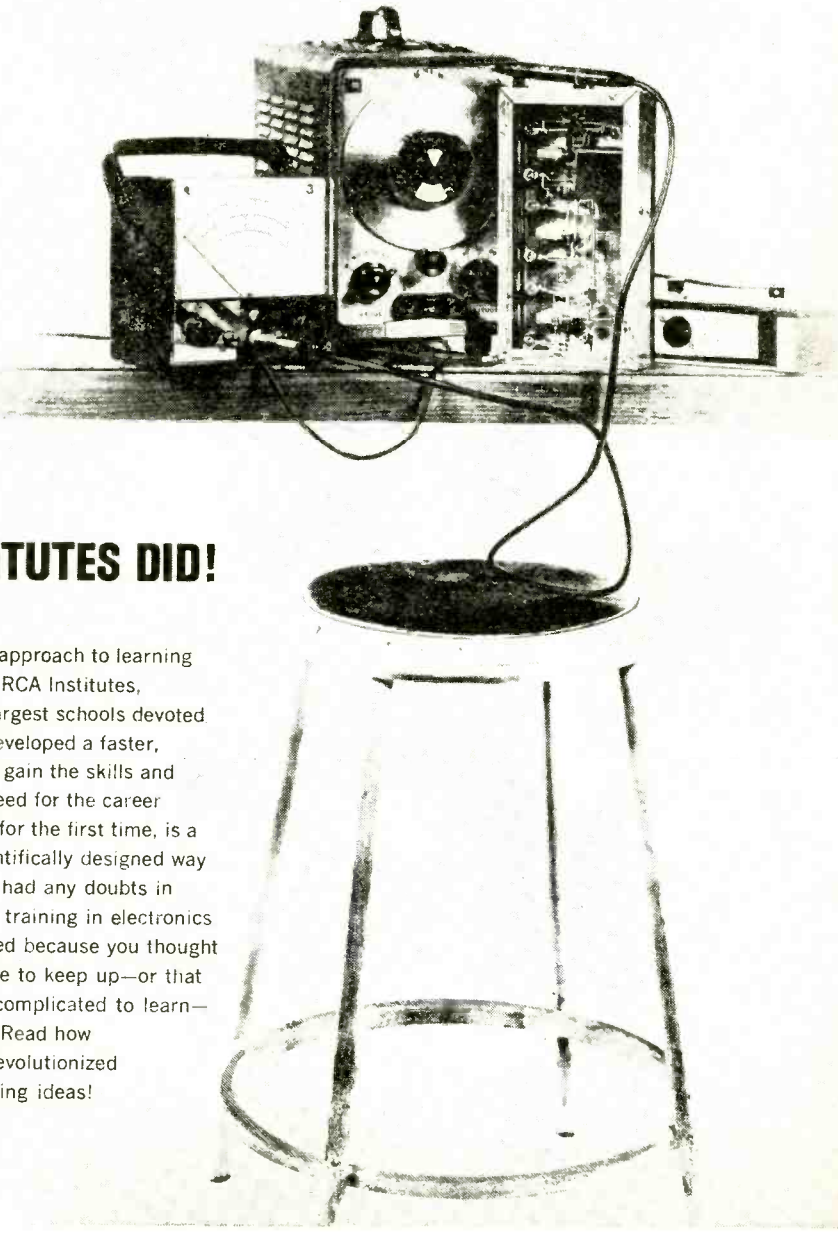
With the introduction of our extremely low cost new M32E elliptical stylus cartridge ($25.00 net, 2½ to 5 gms. tracking, 20 to 17,500 Hz), and M31E elliptical stylus cartridge ($27.50 net, 1 to 2 gms. tracking, 20 to 18,000 Hz), you can now get Shure quality in the broadest possible spectrum of prices and specifications. Given our "druthers", we would prefer you bought the Shure V-15 Type II Super Trackability cartridge at $67.50. We feel it's the world's finest cartridge, and independent critics the world over agree with us. However, if your equipment or your exchequer dictates another cartridge, be assured that Shure makes a really complete line of best-in-their-price-class cartridges. Note for instance, the impressive line-up of elliptical styli cartridges below. Detailed literature on the *complete* Shure group with the reason for each is available at no cost: Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Illinois, 60204.



V-15 TYPE II	M75E	M55E	M44E	M31E	M32E
$67.50	$39.50	$35.50	$34.50	$27.50	$25.00
¾ to 1½ gms.	¾ to 1½ gms.	¾ to 1½ gms.	1¾ to 4 gms.	1 to 2 gms.	2½ to 5 gms.

CIRCLE NO. 33 ON READER SERVICE PAGE

SOMEONE SHOULD DEVELOP AN EASY WAY TO LEARN ELECTRONICS AT HOME



RCA INSTITUTES DID!

Here is a whole new approach to learning electronics at home! RCA Institutes, one of the nations' largest schools devoted to electronics, has developed a faster, easier way for you to gain the skills and the knowledge you need for the career of your choice. Here for the first time, is a student-proved, scientifically designed way to learn. If you have had any doubts in the past about home training in electronics —if you have hesitated because you thought you might not be able to keep up—or that electronics was too complicated to learn—here is your answer! Read how RCA Institutes has revolutionized its entire home training ideas!

NEW CAREER PROGRAMS BEGIN WITH "AUTOTEXT" INSTRUCTION METHOD!

Start to learn the field of your choice immediately!

No previous training or experience in electronics needed!

With this new revolutionized method of home training you pick the career of your choice—*and RCA Institutes trains you for it.* RCA's Career Programs assure you that everything you learn will help you go directly to the field that you have chosen! No wasted time learning things you'll never use on the job! The Career Program you choose is especially designed to get you into that career in the fastest, easiest possible way!

And each Career Program starts with the amazing "AUTOTEXT" Programmed Instruction Method—the new, faster way to learn that's almost automatic! "AUTOTEXT" helps even those who have had trouble with conventional home training methods in the past. This is the "Space Age" way to learn everything you need to know with the least amount of time and effort.

CHOOSE A CAREER PROGRAM NOW

Your next stop may be the job of your choice. Each one of these RCA Institutes Career Programs is a complete unit. It contains the know-how you need to step into a profitable career. Here are the names of the programs and the kinds of jobs they train you for. Which one is for you?

Television Servicing. Prepares you for a career as a TV Technician/Serviceman; Master Antenna Systems Technician; TV Laboratory Technician; Educational TV Technician.

FCC License Preparation. For those who want to become TV Station Engineers, Communications Laboratory Technicians, or Field Engineers.

Automation Electronics. Gets you ready to be an Automation Electronics Technician; Manufacturer's Representative; Industrial Electronics Technician.

Automatic Controls. Prepares you to be an Automatic Controls Electronics Technician; Industrial Laboratory Technician; Maintenance Technician; Field Engineer.

Digital Techniques. For a career as a Digital Techniques Electronics Technician; Industrial Electronics Technician; Industrial Laboratory Technician.

Telecommunications. For a job as TV Station Engineer, Mobile Communications Technician, Marine Radio Technician.

Industrial Electronics. For jobs as Industrial Electronics Technicians; Field Engineers; Maintenance Technicians; Industrial Laboratory Technicians.

Nuclear Instrumentation. For those who want careers as Nuclear Instrumentation Electronics Technicians; Industrial Laboratory Technicians; Industrial Electronics Technicians.

Solid State Electronics. Become a specialist in the Semiconductor Field.

Electronics Drafting. Junior Draftsman, Junior Technical Illustrator; Parts Inspector; Design Draftsman Trainee Chartist.

SEPARATE COURSES

In addition, in order to meet specific needs, RCA Institutes offers a wide variety of separate courses which may be taken independently of the Career Programs, on all subjects from Electronics Fundamentals to Computer Programming. Complete information will be sent with your other materials.

LIBERAL TUITION PLAN

RCA offers you a unique Liberal Tuition Plan—your most economical way to learn. You pay for lessons only as you order them. No long term contracts. If you wish to stop your training for any reason, you may do so and not owe one cent until you resume the course.

VALUABLE EQUIPMENT

You receive valuable equipment to keep and use on the job—and you never have to take apart one piece to build another. **New—Programmed Electronics Breadboard.** You now will receive a scientifically programmed electronic breadboard with your study material. This breadboard provides limitless experimentation with basic electrical and electronic circuits involving vacuum tubes and transistors and includes the construction of a working signal generator and superheterodyne AM Receiver.

Bonus From RCA—Multimeter and Oscilloscope Kits. At no additional cost, you will receive with every RCA Institutes Career Program the instruments and kit material you need to build a multimeter and oscilloscope. The inclusion of both these kits is an RCA extra.

CLASSROOM TRAINING ALSO AVAILABLE

RCA Institutes maintains one of the largest schools of its kind in New York City where classroom and laboratory training is available in day or evening sessions. You may be admitted without any previous technical training; preparatory courses are available if you haven't completed high school. Coeducational classes start four times a year.

JOB PLACEMENT SERVICE, TOO!

Companies like IBM, Bell Telephone Labs, GE, RCA, Xerox, Honeywell, Grumman, Westinghouse, and major Radio and TV Networks have regularly employed graduates through RCA Institutes' own placement service.

SEND ATTACHED POSTAGE PAID CARD FOR COMPLETE INFORMATION, NO OBLIGATION.

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The Most Trusted Name in Electronics

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 or 115.

TWO-SPEED CARTRIDGE RECORDER

In addition to performing all standard reel recording functions, *Rheem Roberts'* Model 778X integrated cartridge and reel recorder is capable of recording stereo 8-track cartridges from sound transferred from the reels, or from plugged-in external audio sources. This model is believed to be the only cartridge recorder on the market that incorporates two speeds of stereo cartridge play, permitting a "fast forward" for rapid position finding as well as a higher speed for better duplication. The 778X also has built-in cartridge erase.

Circle No. 75 on Reader Service Page 15 or 115

AUDIBLE CONTINUITY TESTER

CalComp Consumer Products has announced an audible continuity tester that tests delicate electronic circuits without danger to components, and can take the place of expensive ohmmeters which require visual checking. It also can replace buzzers and bells which have higher voltage drain and possible inductive kickback. Continuity is indicated by clear tone and pitch changed with resistance (0 to 50 ohms). Open circuit voltage (at probes) is 2.5 volts and short circuit current is 6 mA. The tester is powered by a 9-volt d.c. battery, and the probes have 30" leads.

Circle No. 76 on Reader Service Page 15 or 115

5-WATT WALKIE-TALKIE

Switch-selectable crystal control on any six of twenty-three channels is featured in the 5-watt "Dyna-Com 6" walkie-talkie available from *Lafayette Radio*. This unit also has integrated circuits in the transmit, receive and audio limiting stages, an automatic compressor range-boost circuit, pi-network antenna output, and battery condition/automatic relative r.f. indicator. A variable squelch control and a push-pull audio/modulator circuit are incorporated for better quality speech transmission and reception. Sensitivity of the receiver section is better than 1 μV. The "Dyna Com 6" is supplied with transmit and receive crystals for channel 10, a telescoping whip antenna, and a shoulder strap.

Circle No. 77 on Reader Service Page 15 or 115

CAPACITIVE-DISCHARGE IGNITION SYSTEM

Gregg Electronics' "Mod-U-Mag" capacitive-discharge ignition system is said to out-perform all other similar type systems now on the market. The solid-state unit is unaffected by heat or vibration, can be installed in five minutes, and can boost engine efficiency up to as much as 20%. An optional Light Pulsed Module replaces breaker points by optoelectric switching, extending the operational range of the engine to more than 20,000 r/min. With the "Mod-U-Mag," the need for ignition tune-ups is virtually eliminated, and gasoline mileage may be increased up to 20%. Systems are available for 6-, 12-, or 24-volt positive or negative ground installation.

Circle No. 78 on Reader Service Page 15 or 115

CARDIOID MICROPHONES

Featured in *Turner's* Model 700 and 701 cardioid microphones are an on/off switch and an internal foam pop and blast filter. The Model 700 offers a choice of high- or low-impedance output, and is recommended for night club and recording uses. The Model 701 is a high-impedance-only public address and recording microphone, with a frequency response of 100 to 13,000 Hz and a −56 dB output signal level. Both microphones are modern in design, finished in attractive satin chrome.

Circle No. 79 on Reader Service Page 15 or 115

TEST INSTRUMENTS

Included in the new *RCA* line of test instruments is a transistor tester, voltmeter/ohmmeter, and audio generator. The Model WT-501A transistor tester can check virtually every type of transistor both in and out of circuit for d.c. *beta* from 1 to 1000, out-of-circuit collector-to-base leakage as low as 2 μA, and out-of-circuit collector-to-emitter leakage from 20 μA to 1 ampere. The Model WV-500A solid-state "VoltOhmyst" has seven overlapping resistance ranges, eight overlapping d.c. voltage ranges (including a spe-

the finest CB Base Station transceiver...first all solid state design with professional 2 way features!

THE ADMIRAL... The luxurious new 23 channel CB base station transceiver from Squires-Sanders... features normally only found in professional two way communications equipment: highest power transmitter with Speech Compression • matching +2 microphone with built in transistor pre-amplifier • exclusive Space Spanner receiver with adjustable Pulse Eliminator • dual antenna switch • Hi/Lo sensitivity control • Public Address function • separate PA volume control • sharp Delta Tuning • receiver volume independent of power switch • adjustable squelch • ON-THE-AIR light • illuminated S meter and channel readout • digital panel clock • earphone jack • electronically regulated AC power supply • rich olive homespun vinyl cabinet, natural teakwood panel, gold trim

Made in U.S.A.—$329.95

Squires Sanders

See your distributor or write today for details. SQUIRES SANDERS, INC., Box A, Liberty Corner, N. J. 07938

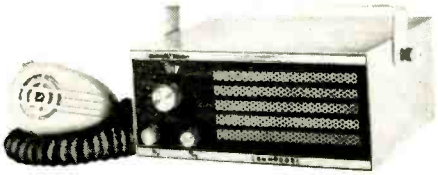
CIRCLE NO. 36 ON READER SERVICE PAGE

cial 0.5 d.c.-volt range), and measures a.c. peak-to-peak and a.c. r.m.s. voltages; all measurements are made with a single wired-in probe (WG-410A), but an optional slip-on high-voltage probe (WG-411A) can be used to make possible measurements up to 50,000 d.c. volts. The Model WA-504A all-transistor sine/square wave generator, whose frequency range is 20 to 200,000 Hz, provides a stable signal with an amplitude variation of less than ±1.5 dB, and sine wave harmonic distortion of less than 0.25%.

Circle No. 80 on Reader Service Page 15 or 115

"EXCLUSIVE" CB TRANSCEIVER

Excellent reception of signals as weak as ½ μV is claimed for the *Squires-Sanders* "Commodore," a 23-channel, crystal-controlled solid-state transceiver designed especially for mobile communications. An exclusive "Pulse Eliminator" (pre-i.f. silencer) enables such signals to be heard

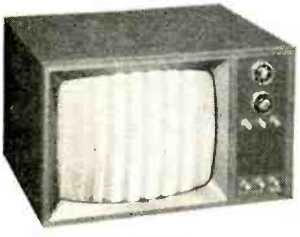


clearly, and without distortion, in the presence of extremely bad interference from engine ignition, electric motors, appliances, or fluorescent lights. There is only a 4 dB maximum rise in audio for r.f. input signals from 1.0 μV to 0.1 volt, a constancy made possible by the Commodore's effective a.g.c. system. The full 5-watt transmitter is 100% modulated.

Circle No. 81 on Reader Service Page 15 or 115

COLOR TV KIT

Designed primarily as a training aid, *Conar*'s Model 600 color-TV receiver kit utilizes "modular" design, making it perhaps the easiest yet developed for the kit builder to complete.

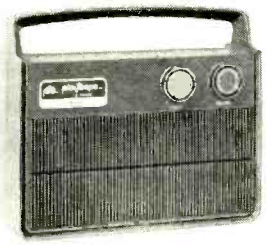


The set is a table-model unit with 180-square-inches of picture area. Printed circuit boards are used throughout. The design incorporates 21 electron tubes, a solid-state UHF tuner, a noise-cancellation circuit, and 16 semiconductor diodes. Separate gun killer switches and a cross-hatch generator are built-in for ease and convenience of maintenance. No special tools are needed to put the Model 600 together.

Circle No. 82 on Reader Service Page 15 or 115

PRERECORDED PLAYBACK SYSTEM

Pick—push—play. When you select a prerecorded Playtape™ tape cartridge, and push it into the slot of the Model 1320 *Playtape* Music Machine™, you can hear your favorite artists or music—continuously. When you remove the cartridge, the machine automatically turns itself off. Powered by four "D" cells, the portable tape unit can be carried anywhere as you listen to it. An adapter is available for plug-in use.



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FET VOLT-OHM-MILLIAMMETER

Latest entry in the TVM field is *Sencore's* Model FE14 portable solid-state volt-ohm-milliammeter. With 15-megohm input resistance on d.c., and 10-megohm input impedance on a.c., the FE14 accurately measures voltages with a minimum of circuit loading and is constant on all ranges. Seven a.c. and d.c. voltage ranges are provided, from 1 to 1000 volts full scale (an optional high-voltage probe extends the d.c. measuring capability), and five d.c. current ranges. There is no need to determine polarity in testing transistor circuits. Housed in a non-breakable vinyl-clad all-steel case, the unit operates on 9-volt transistor radio batteries and a 1.5-volt "C" cell.

Circle No. 84 on Reader Service Page 15 or 115

DELUXE HEADSET

According to *Pioneer Electronics*, its Model SE-30 hi-fi headset boasts a number of features never before incorporated in headsets. It comes in a black Scotch-grain box with satin lining in which it can be displayed and permanently stored. The head-band ear cushions are kid-soft and comfortably thick, washable and easily sanitized. Light in weight, the SE-30 is styled in black, white, and chrome, and provides an "outstanding" frequency response over the entire audio range.

Circle No. 85 on Reader Service Page 15 or 115

THE MOST SPECTACULAR SOUND EXHIBITION OF STEREO FIDELITY EVER AVAILABLE ON ONE DISC.

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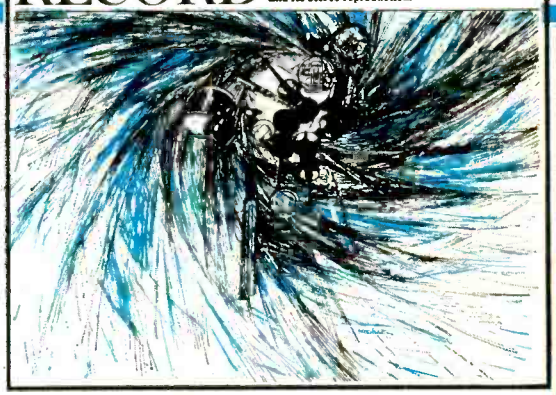

This record is the result of two years of intensive research in the sound libraries of several of the world's leading record companies. The Editors of HiFi/Stereo Review have selected and edited those excerpts that best demonstrate each of the many aspects of the stereo reproduction of music. **The record offers you a greater variety of sound than has ever before been included on a single disc.**

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The HiFi/Stereo Review Stereo Demonstration Record is a series of independent demonstrations, each designed to show off one or more aspects of musical sound and its reproduction. Entirely music, the Record has been edited to provide self-sufficient capsule presentations of an enormous variety of music arranged in a contrasting and pleasing order. It includes all the basic musical and acoustical sounds that you hear when you listen to records, isolated and pointed up to give you a basis for future critical listening.

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13 SUPERB SELECTIONS

STRAUSS: Festive Prelude, Op. 61 (excerpt) Deutsche Grammophon Gesellschaft • Scored for full symphony orchestra plus organ with prominence to the brass instruments. Remarkable for the impressive sense of depth it reproduces.

DEBUSSY: Feux d'artifice (excerpt). Connoisseur Society • Virtually the entire range of the piano is used, including the full force of the bass notes. This is the sound of a piano in reverberant surroundings heard fairly close-up.

BEETHOVEN: Wellington's Victory (Battle Symphony) (excerpt from the first movement) Westminster • The recording emphasizes extreme directionality. It is a dramatic presentation engineered specifically for stereo reproduction.

MASSAINO: Canzona XXXV à 16 (complete) DGG Archive • Performed on old instruments, and recorded with techniques that combine directionality with depth and ambiance, this band reproduces the sound of the music in its original environment, a large and reverberant cathedral.

CORRETTE: Concerto Comique Op. 8, No. 6, "Le Plaisir des Dames" (third movement) Connoisseur Society • Recording demonstrates the sound and special layout of a small performing group (harpsichord, cello and flutes) in fairly resonant surroundings.

KHAN: Raga Chandranandan (excerpt) Connoisseur Society • This classical Indian music provides some of the most exciting musical experiences imaginable. Directionality between vastly different instruments is the point here, as well as the sheer sound of the instruments themselves.

RODRIGO: Concert—Serenade for Harp and Orchestra (excerpt from the first movement) Deutsche Grammophon Gesellschaft • This excerpt provides a wealth of instrumental color behind a harp solo. The music is clear, colorful, rather classical, and immensely entertaining.

MANITAS DE PLATA: Gypsy Rhumba (complete) Connoisseur Society • The recording puts the listener in the center of a flamenco party by precisely transmitting the directionality, depth and ambiance of this completely impromptu recording session.

MARCELLO: (arr. King): Psalm XVII "The Heaves are Telling" (complete) Connoisseur Society • This arrangement of the brief Marcello Psalm is for brass, choir and organ, who answer one another antiphonally.

PRAETORIUS: Terpsichore: La Bourrée XXXII (complete) DGG Archive • A musical gem played by a raft of renaissance instruments including recorders, viols, lutes, harpsichord, small kettle drums, chimes, bells, and triangle.

BERG: Wozzeck (excerpt from Act III) Deutsche Grammophon Gesellschaft • The acknowledged masterpieces of modern music incorporating the use of many unusual and extraordinary musical devices, including dramatic crescendos for full orchestra.

BARTÓK: Sonata for two pianos and Percussion (excerpt from the first movement) Cambridge • The work is a stunning exploration of percussive sounds used as the basic material of the composition.

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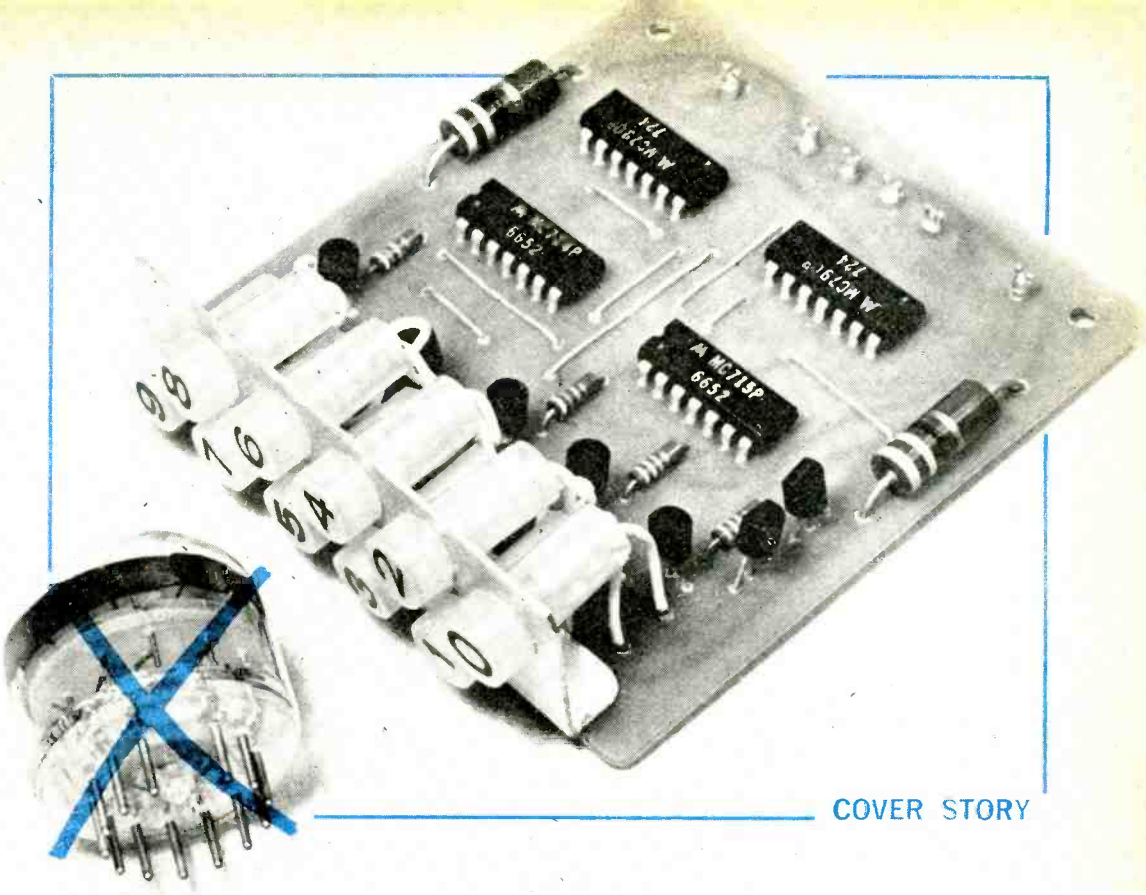


COVER STORY

BUILD A

Low-Cost Counting Unit

YOU CAN ASSEMBLE TRUE DIGITAL READOUT AT $12 PER DECADE

BY DON LANCASTER

FROM THE EDITOR

This may well be the most important construction project to be published in POPULAR ELECTRONICS in 1968. The DCU ("Decimal Counting Unit") will open the door to a whole new era of project building. Because of its low cost, easy construction, and use of readily available components, Don Lancaster's DCU will encourage the development of unusual Science Fair projects, versatile test equipment, adding machines, computers, etc. The bottleneck of obtaining a low-cost readout has been broken.

OLIVER P. FERRELL

DIRECT, unambiguous numerical readout at low cost—the dream of most electronics experimenters, technicians, and engineers—is now made possible by inexpensive integrated circuits and a few seldom-used circuit tricks. For just $12 per decade *total* cost, you can have a complete, resettable decimal counter with a bright staggered-line 0 to 9 incandescent readout, good from one count per day to 10 MHz.

You can cascade as many of these decades together as you need for almost any digital display. Using these decimal counters, POPULAR ELECTRONICS will, in

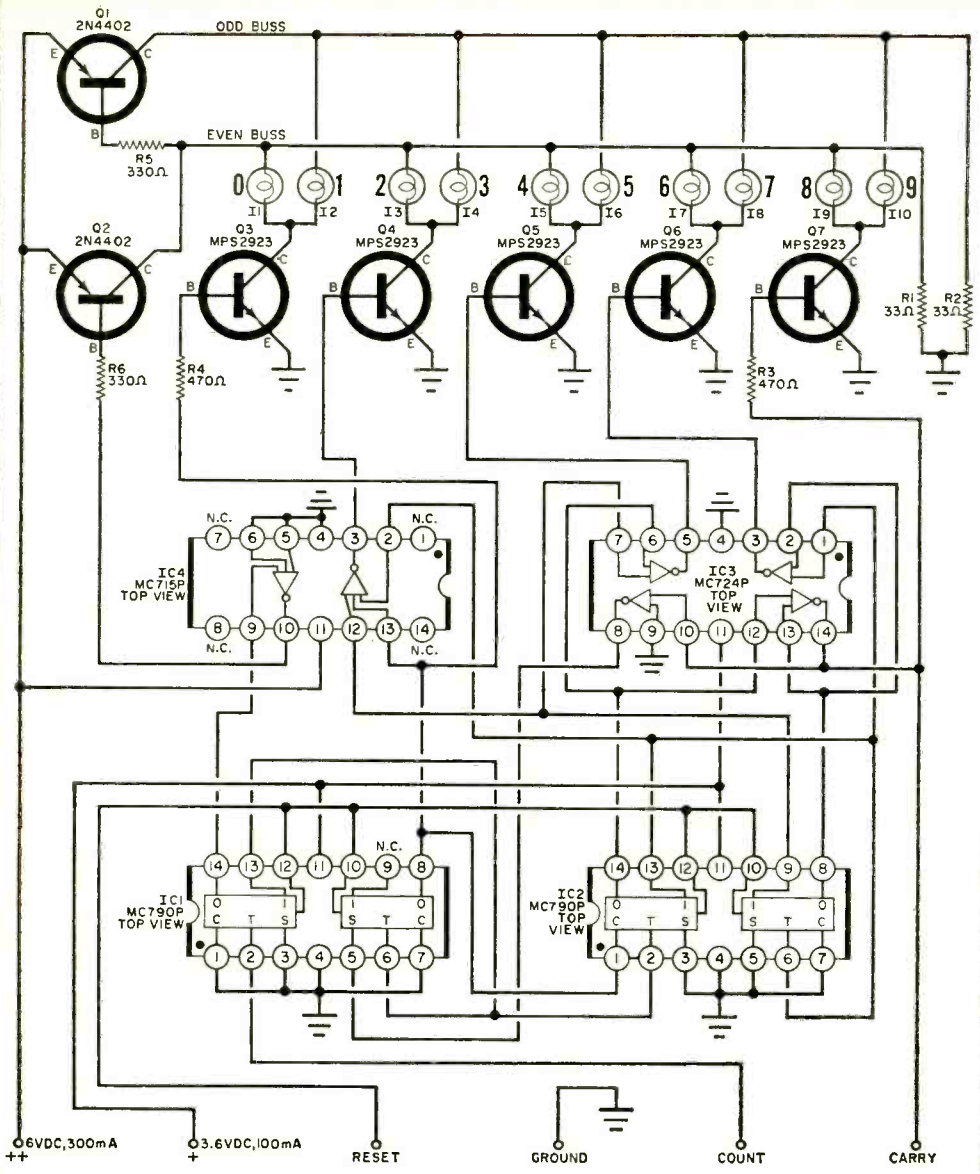


Fig. 1. In IC1 and IC2, the rectangles represent flip-flops while in IC3 and IC4, the triangles with circles represent multiple input gates. Logic symbols replace complicated circuitry.

future issues, show how you can make a digital voltmeter, digital stopwatch, digital multimeter, and a universal frequency counter.

You'll be able to create an adding machine, a ballistic-velocity meter, or an event counter. And the list does not end there. Using this low-cost DCU, you can also make digital thermometers, electronic clocks, engine tachometers, direct-reading CB crystal (or other frequency) crystal checkers, photographic shutter checkers—and even a digital computer.

The basic decimal counter, whose schematic is shown in Fig. 1, uses four IC's, six resistors, seven transistors, and 10 incandescent bulbs. If desired, a complete decade kit is available (see Parts List).

PARTS LIST

*I1-I10—6.3-volt, 50-mA pilot lamp and lens assembly (Southwest Technical Products #0-6.3, or similar)**
*IC1,IC2—MC790P dual JK flip-flop integrated circuit***
*IC3—MC724P quad two-input-gate integrated circuit***
*IC4—MC715P dual three-input-gate integrated circuit***
*Q1,Q2—2N4402 transistor***
*Q3,Q4,Q5,Q6,Q7—MPS2923 transistor***
R1,R2—33-ohm, 1-watt resistor
R3,R4—470-ohm, ¼-watt resistor
R5,R6—330-ohm, ¼-watt resistor
*1—3" x 3¼" PC board**
Misc.—Aluminum bracket—(see Fig. 5); pop rivets (2); #24 wire jumpers (8); PC terminals (6); 3/16"-high instant transfer numerals, black; solder, etc.

**The following parts are available from Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, Texas 78216: etched and drilled PC board #148, $3.00; set of 10 lamps with plastic covers and spare bulb, $2.75; complete kit of all parts, $12.00, postpaid in U.S.A.*

***Available from Allied Electronics, 100 N. Western Ave., Chicago, Ill. 60680. When ordering IC's, specify as follows: 5E26-(IC type number)-MOT. Example: IC1,IC2 should be specified as 5E26-MC790P-MOT. Prices are: MC790P, $2 each; MC724P, $1.08 each; MC715P, $1 each. Transistors 2N4402 and MPS2923 are 82 and 43 cents each, respectively. Data sheets and distributor lists on all of the above are available from the manufacturer, Motorola Semiconductor, Box 955, Phoenix, Arizona 85001.*

Construction. An actual-size printed circuit board appears in Fig. 2, while Fig. 3 shows how the board is drilled, and also indicates the positions for inserting the eight jumpers required. These jumpers are made from #24 solid wire and are added on the component side of the board.

When mounting the components (as shown in Fig. 4), be sure to observe the polarities for all semiconductors—making doubly sure that the IC's are mounted as indicated. Particularly note that the code notch and dot of *IC1* and *IC2* point in the *opposite* direction from those of *IC3* and *IC4*; this orientation is critical. Use a low-wattage soldering iron and fine solder to make all connections.

The readout lamp display bracket is cut and bent out of 1/32" aluminum following the layout in Fig. 5. Two pop rivets secure the lamp bracket to the board. The indicator lamps press-fit into the holes in the bracket, through the front, and are secured by the wedging action of the plastic lens caps. Each pair of bulb leads is soldered to the respective PC board terminals. Bulb marking (0 through 9) is done with 3/16" black instant transfer numerals, which are applied to the plastic lens cap, then coated with a clear acrylic spray.

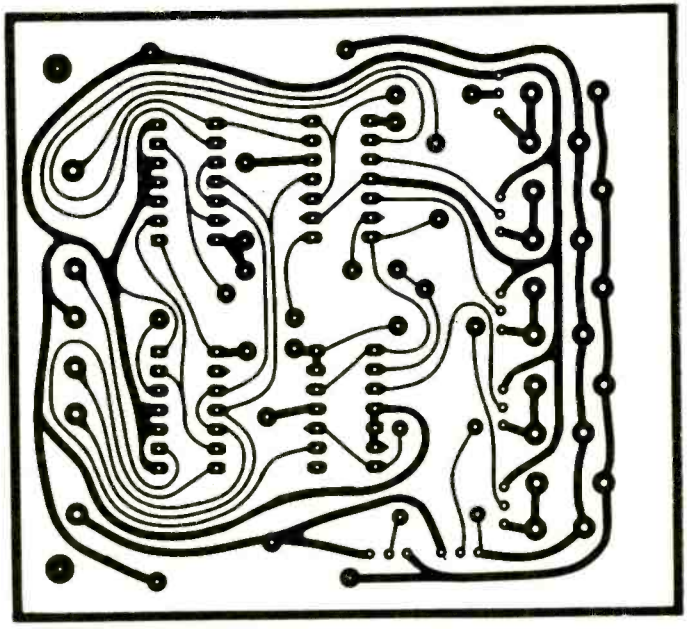


Fig. 2. Because of the complex wiring involved, it is almost mandatory that a printed circuit board, such as the one shown here actual size, be used. An etched and drilled board is available (see the Parts List).

HOW IT WORKS

Where most divide-by-ten circuits use a relatively complex, multi-transistor arrangement of decoder gates and readout drivers, the decimal counter described in this article first divides by *two*, and then by *five* to produce a *biquinary* counter. Such an arrangement is considerably simpler than the conventional decimal counter in that it requires three less transistors and seven less decoding gates to produce the same results.

The input pulse train is fed to a divide-by-two counter (part of *IC1*), a conventional flip-flop which changes state with each pulse input. One state of the input divided-by-two counter will indicate an odd number input while the other state will indicate an even number. The odd-even signal is processed by a section of *IC4* and used to switch transistors *Q1* and *Q2* so that on even numbers the "Even Bus" will be supplied with power, and on the odd numbers the "Odd Bus" is powered. The schematic of the complete decimal counter shows how the indicating bulbs are connected in pairs to the odd and even buses. Each pair of bulbs is connected to ground through a transistor switch (*Q3* through *Q7*) which is open when not energized, and closed when energized.

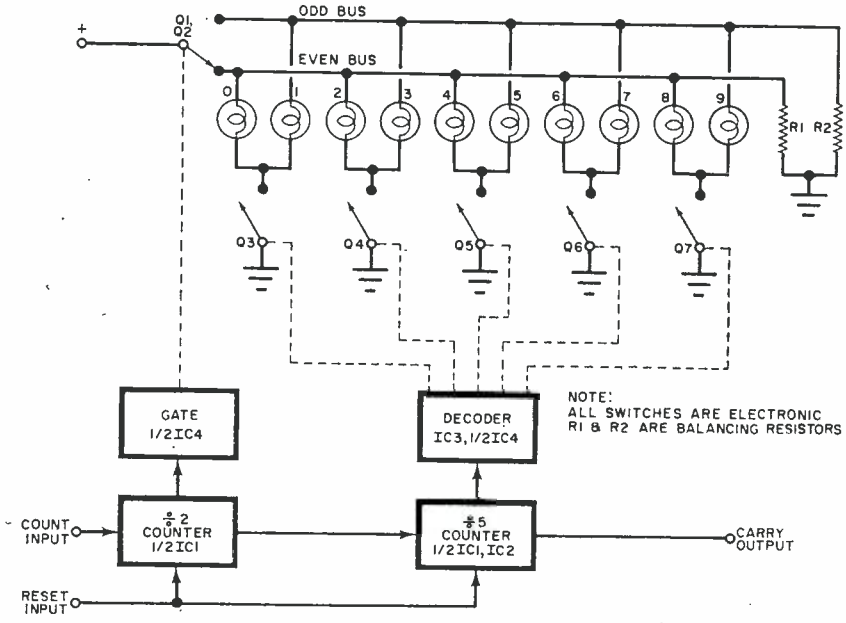
After division by two, the input pulses are fed to the divide-by-five counter, consisting of the remaining part of *IC1* and all of *IC2*. This counter decides whether the input signal is 0 or 1, 2 or 3, 4 or 5, 6 or 7, 8 or 9—and its selected output signals are processed by decoder *IC3* and the remainder of *IC4*. The output signal from the decoder will energize the appropriate transistor switch, effectively closing it and allowing current to flow from the selected odd or even bus, through one bulb and through the transistor switch to ground, illuminating the pertinent bulb.

For example, assume the count has reached the number 7. The divide-by-two counter has determined that it is an odd number and has energized the odd bus. The divide-by-five counter decoder has determined that this pulse is either 6 or 7, and energized transistor *Q6*. Under those conditions, bulb 7 is the *only* bulb illuminated.

In actual practice, all the bulbs will glow very dimly, even when not energized, due to "sneak" paths of series cambinations of "off" bulbs. Balancing resistors *R1* and *R2* are used to average the brilliance of each "off" bulb to produce a uniform, barely visible, background glow.

On each tenth input pulse, the divide-by-ten characteristic of the decimal counter circuit causes it to cycle to 0 indication while simultaneously providing one output pulse which is used to start the count on another counter. Assume that two decimal counters are connected in cascade and the count is 9. The first decimal counter (indicating "one's") displays a 9, while the second decimal counter (indicating "ten's") displays a 0. When the count reaches 10, the "one's" counter cycles to its 0 indication, while the "ten's" counter receives one pulse to display a 1. The overall illuminated readout is then 10. Still another decimal counter can be connected to the "ten's" counter "Carry" output to provide a "hundred's" column, which will start indicating when the total count exceeds 99. And so on.

Although what appear to be six mechanical switches are shown here, actually they represent high-speed transistor switches that are driven by the electronic circuits shown connected to them by the six dashed lines.



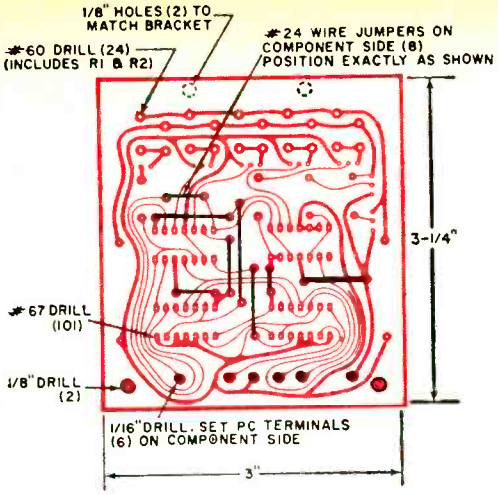
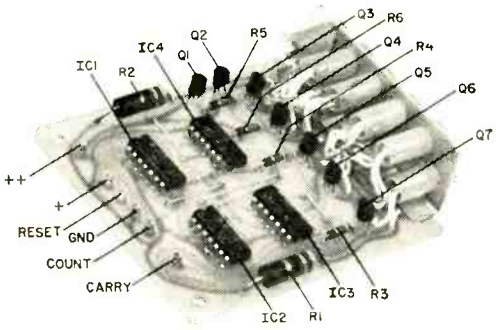


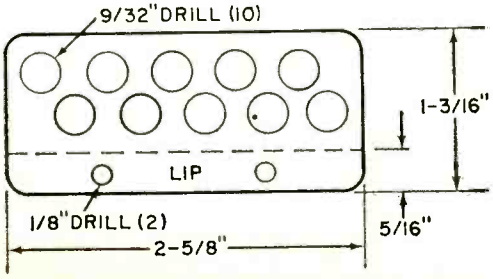
Fig. 3. Drilling details for the board. Don't forget to include the eight insulated wire jumpers.



The PC board with all of the components installed.

Power Supply. There are three power supply connections to be made to the decimal counter: "+ +" requires 5.5 to 7.5 volts at 300 mA; "+" requires 3.6 volts at 100 mA (with less than 0.7-volt peak-to-peak ripple), while "GND" is the common supply return. The power supply shown in Fig. 6 will power up to three decimal counters.

In constructing the power supply, don't skimp on the value of *C2* or the resultant



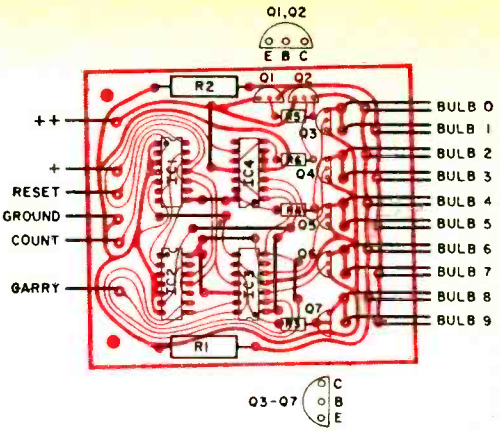


Fig. 4. Placement of the components on the board. Note that all IC's are notch- and dot-identified.

a.c. ripple may be too great. All power supply leads must be of heavy-gauge wire.

Operation. There are three signal connections to be made to the decimal counter—"Count" input, "Reset" input, and "Carry" output. The "Count" input will advance the decade counter one count each time the input signal *abruptly drops* from +3 volts to ground. However, it is *important* that all input signals be properly conditioned to insure that they are noise-free and drop abruptly *once and only once* per count cycle. Failure to do this will result in erratic counting.

There are several ways to make a "bounceless" input signal. If you want to use an s.p.d.t. push button, use the set-reset conditioning flip-flop in Fig. 7(a). If you want to use an s.p.s.t. "make" contact, use the monostable circuit in Fig. 7(b). This conditioning is mandatory for *any* mechanical contact.

Clean sine or square waves from 100 kHz to 10 MHz can be directly applied to

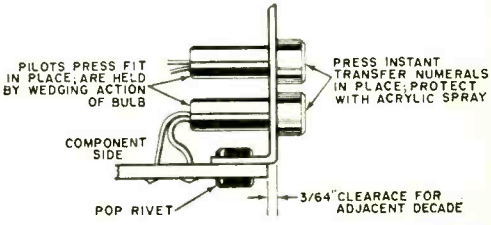


Fig. 5. Drilling details for the lamp bracket are shown at the left. The bracket is secured to the printed board and bulbs inserted as shown above.

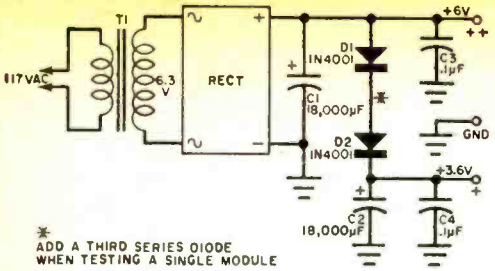


Fig. 6. This recommended power supply will handle up to three decimal counter modules simultaneously.

POWER SUPPLY PARTS LIST

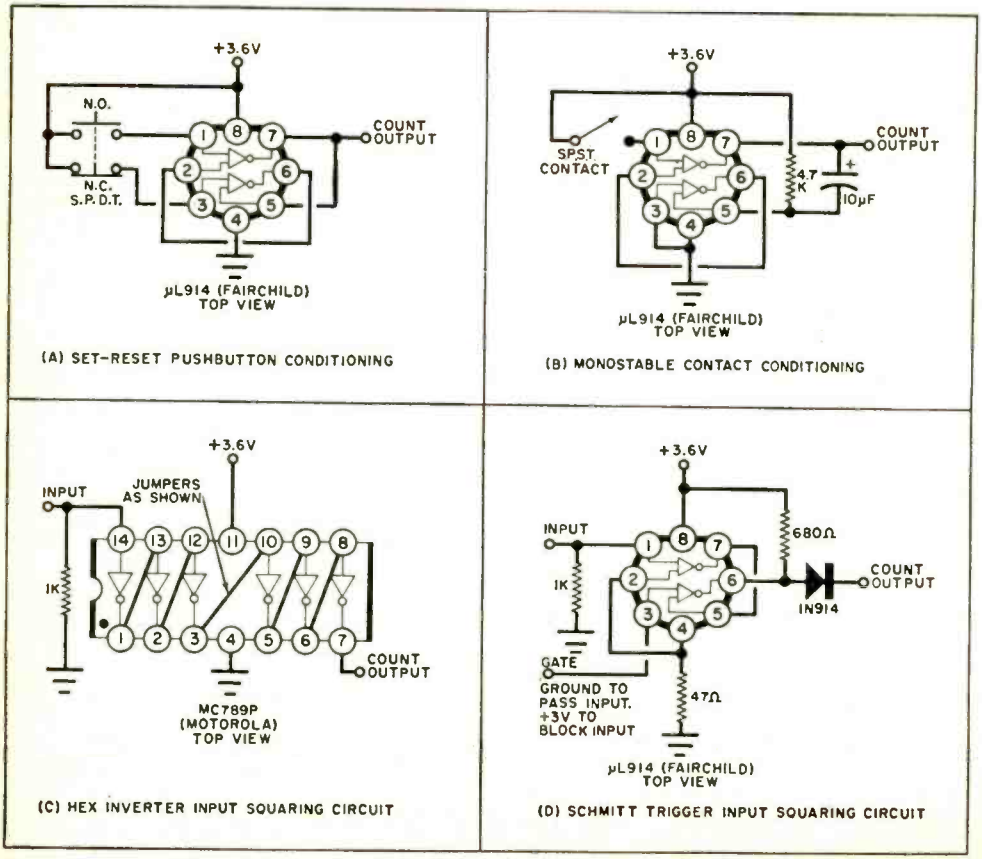
C1,C2—18,000-μF, 10-volt electrolytic capacitor (Sprague 183G010AC or similar)
C3,C4—0.1-μF capacitor
D1,D2—1N4001 diode
RECT—1½-ampere full-wave bridge rectifier assembly (Motorola MDA942-1, or similar)
T1—Filament transformer: primary, 117 volts a.c.; secondary, 6.3 volts a.c.; 1½ amperes (Allied Electronics 54 E 1419, or similar)

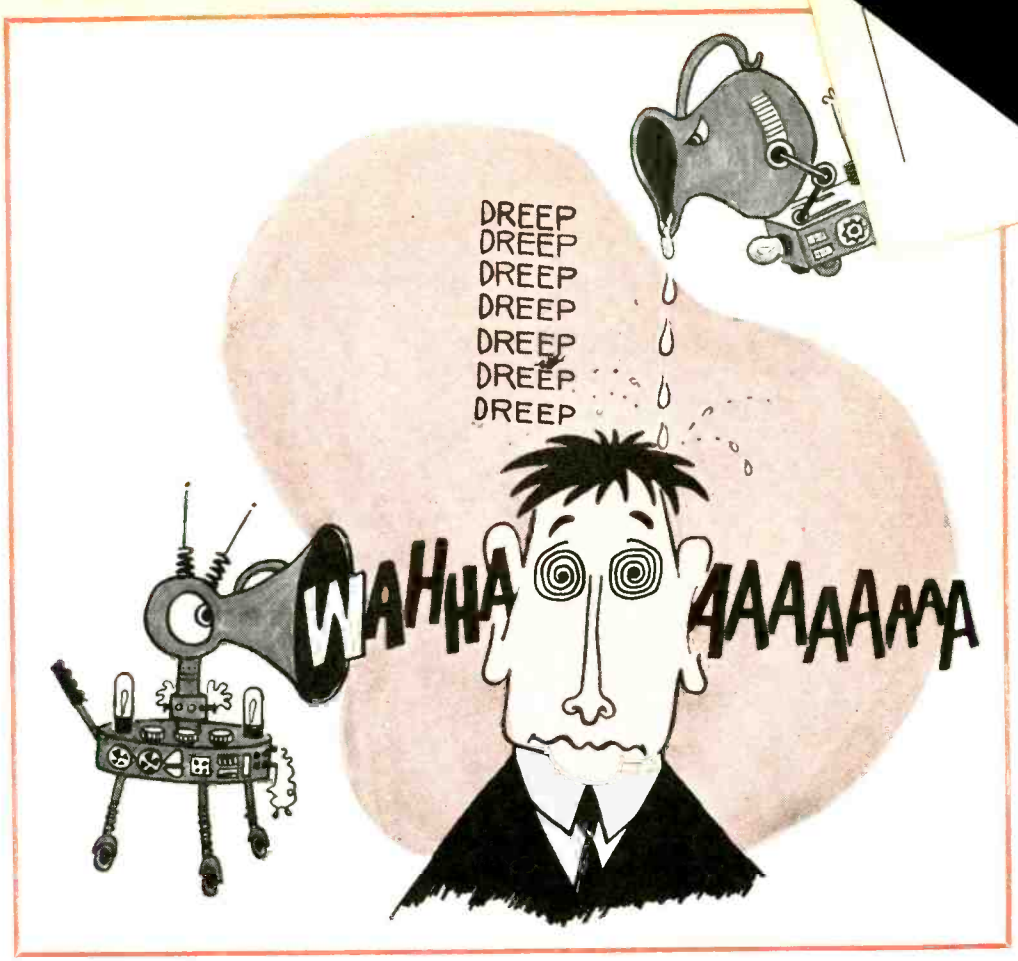
Fig. 7. Pin 8 of the μL914 is identified by a dot. The MC789P is identified by a notch and dot code.

the decimal counter "Count" input without conditioning. Slower signals must be squared up using either the hex inverter squaring circuit in Fig. 7(c), or the Schmitt trigger of Fig. 7(d). Either of the latter two circuits work well with 3 to 5 volts of peak-to-peak input signal. The Schmitt trigger can also be gated by holding its "Gate" input at ground when "Count" signals are to be passed, or at +3 volts or so when "Count" signals are *not* to be passed.

The decimal counter "Reset" input is normally grounded. It will automatically return the counter to its "0" condition any time this input is connected to a +3 volt source. The "Reset" push button need not be made "bounceless."

The "Carry" output is used when two counters are cascaded by directly connecting the "Carry" output of the first unit to the "Count" input of the second. The second counter will register "ten's," a third counter will register "hundred's," and so on. —30—





"The Lease-Breaker" and "The Drip"

BY SAM BRESKEND

A PAIR OF REAL NOISEMAKERS: ONE WILL DRIVE YOU OUT OF THE HOUSE; THE OTHER WILL DRIVE YOU OUT OF YOUR MIND

THERE ARE two types of especially disturbing sounds. One is the loud, raucous wail of the urban ambulance siren with its undulating-tone "whoop-whoop" screaming through the streets. This sound was specially selected to be distinctive and attention-getting.

The second sound is the relatively gentle, low-pitched drip-drip-drip of a water faucet in the middle of the night. Although not acoustically overpowering like the siren, the insistent repetitious pattern can erode your sanity. Heralded in fiction as the "water torture," it will, in its gentle way, rub your nerves raw.

The two circuits described in this article are electronic simulations of both of these phenomena. The first, called "The Lease-Breaker," produces the loud wail of the ambulance siren, while the second, called "The Drip," imitates the "gentle" water torture.

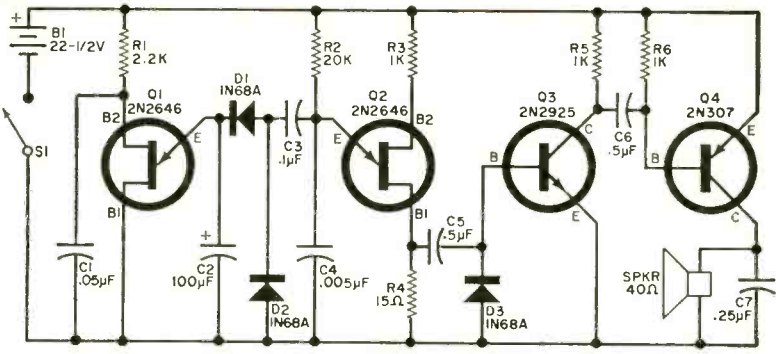


Fig. 1. A pair of unijunction transistor relaxation oscillators originate the wail of the "Lease-Breaker." The two bipolar transistors form the audio amplifier portion of this circuit.

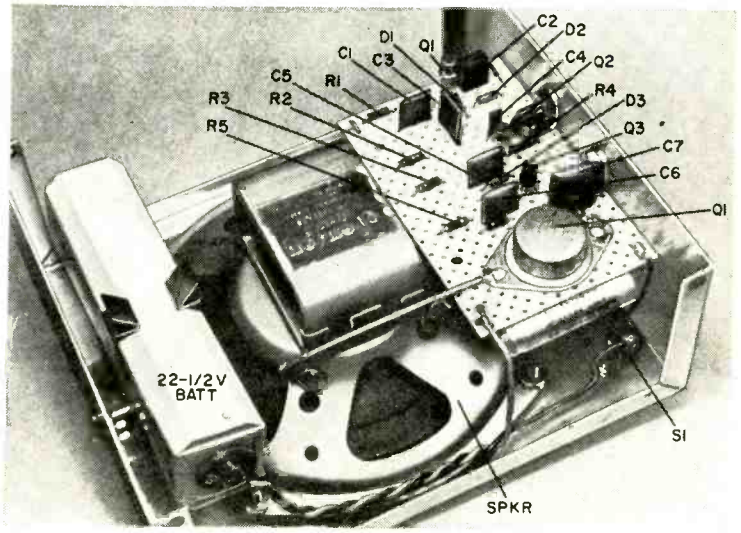
"Lease-Breaker." When turned on, the "Lease-Breaker" starts up with a loud, low-pitched wail that sweeps upscale in frequency to a very high tone, then suddenly drops back to the low tone before starting over again. Audio output from the built-in speaker is enough to disturb a whole apartment house, and when used at night (not recommended), it will arouse neighbors a full city block on each side. When used indiscriminately, it is guaranteed to get your lease, or nose (or both), broken.

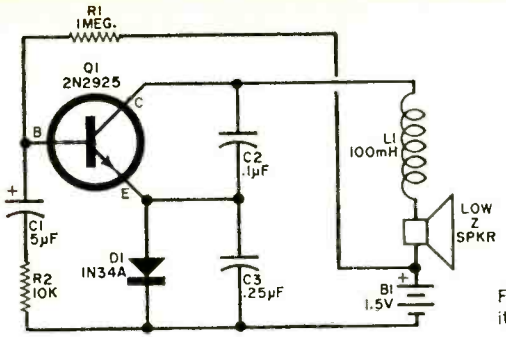
The basic circuit is shown in Fig. 1, while Fig. 2 is the author's prototype. The tone-generating oscillator (*Q2*) is a unijunction transistor (UJT) whose frequency-determining elements (capacitors *C4* and *C3*) are introduced in the circuit in accordance with the operation

"LEASE-BREAKER" PARTS LIST

B1—22½-volt battery
C1—0.05-μF capacitor
C2—100-μF electrolytic capacitor, any low-voltage type
C3—0.1-μF capacitor
C4—0.005-μF capacitor
C5,C6—0.5-μF capacitor
C7—0.25-μF capacitor
D1,D2,D3—1N68A diode
Q1,Q2—2N2646 unijunction transistor
Q3—2N2925 transistor
Q4—2N307 power transistor
R1—2200 ohms
R2—20,000 ohms } *all ½-watt resistors*
R3,R5,R6—1000 ohms } *all ½-watt resistors*
R4—15 ohms
S1—S.p.s.t. switch
SPKR—Any low-impedance type speaker

Fig. 2. Author's "Lease-Breaker" is mounted in a 6" x 5" x 2" metal box with holes cut out for the speaker.





"DRIP" PARTS LIST

B1—1.5-volt dry cell
C1—5-μF electrolytic capacitor, any low-voltage type
C2—0.1-μF capacitor
C3—0.25-μF capacitor
D1—1N34A diode
L1—100-mH miniature inductor
Q1—2N2925 transistor
R1—1-megohm, ½-watt resistor
R2—10,000-ohm, ½-watt resistor
SPKR—Any low-impedance type speaker

Fig. 3. The "Drip" has a low-level audio output, but its insistent chirp will annoy most sensitive people.

of auxiliary UJT oscillator *Q1*. The output signal, a rapidly increasing frequency (until *Q1* fires to return it to a low-frequency tone) is amplified by *Q3* and power transistor *Q4*.

As there is no need to take special wiring precautions, the circuit can be arranged as desired. The author elected to use perforated board construction, but any other method, even point-to-point wiring, will do the job just as well. The entire system, including battery and speaker can be mounted in a small metal enclosure.

"Drip." Diametrically opposed to the loud, raucous "Lease-Breaker," the "Drip" produces a low-level once-per-second chirp that in itself is gentle-sounding. However, when listened to over a short period of time, it is enough to drive even the most patient of people to distraction.

The circuit is shown in Fig 3, and the author's prototype in Fig. 4. This circuit is a Colpitts oscillator designed to "squegg," that is, periodically block itself into and out of oscillation. A low-impedance magnetic earphone is connected in series with the inductor of the frequency-determining circuit (*L1*), and responds to each current pulse that passes through the coil.

Frequency of oscillation is determined by the *Q1* base circuit time constant. Resistor *R2*, which determines the *on* time, can be varied to change the duty cycle. Because current consumption is only about 100 μA, the "Drip" will continue to emit its highly irritating "bleep-bleep" for many months operating on a hearing-aid type battery.

Once again, the construction method is left up to the builder, since there is no critical wiring involved. Although the author used perf-board construction, any other type will suffice. —30—

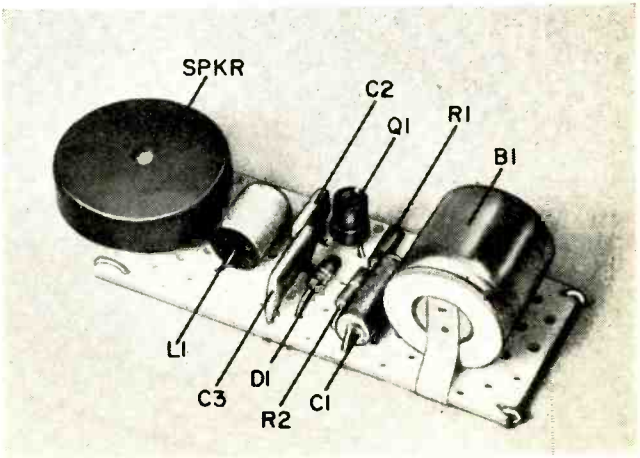


Fig. 4. The author built his "Drip" on a 2¼" x ¾" piece of perforated board. Because the unit requires only 100 μA to operate, a power switch is not used. The size of your "Drip" will depend only on the size of the components you install. The speaker used here is a low-impedance earphone, although any type of miniature speaker will suffice.

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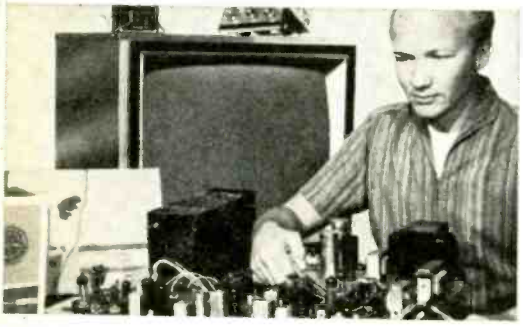

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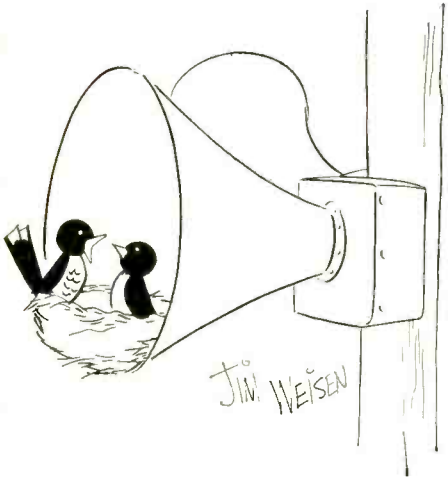
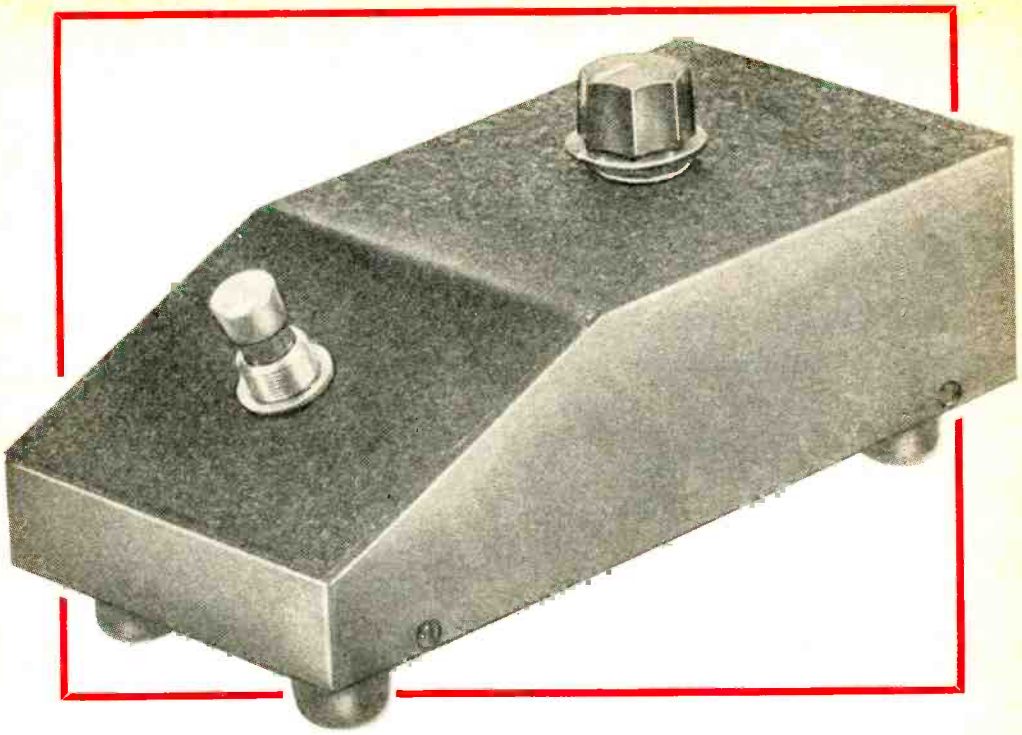


"Is the music too loud for you, dear?"

"I'd like to return this tape . . ."



BY ANTHONY LEO*

Build Fuzz-Box for Electric Guitar

USEFUL ADJUNCT TO ANY ELECTRIC GUITAR IS CONNECTED BETWEEN AMPLIFIER AND GUITAR OUTPUT

PRACTICALLY every electric guitarist—who plays music in the modern-day idiom—has some use for fuzz-tone. There are several methods for obtaining "fuzz," probably the simplest being to place two back-to-back semiconductor diodes across the speaker connection at the guitar amplifier's output transformer. By connecting the diodes in such a fashion, both positive and negative peaks of the signal excursion are clipped.

Such a method does have disadvantages, the principal one being a virtual short circuit across the output transformer when the circuit is conducting at the peaks of the signal excursion. This places a severe stress on the output stage and, simultaneously, the diodes restrict the available power output of the guitar amplifier (there can be no appreciable decrease of volume and power when "fuzz" is applied).

*Edited from the original article published in *ELECTRONICS Australia*, August, 1967; by special arrangement.

PARTS LIST

B1—9-volt battery
C1—0.27-μF capacitor
C2—0.001-μF capacitor
C3—0.47-μF capacitor
J1—Phone jack
Q1,Q2—2N3565, MPS6514, or similar
R1—47,000-ohm, ½-watt resistor
R2—15,000-ohm, ½-watt resistor
R3—470-ohm, ½-watt resistor
R4—680,000-ohm, ½-watt resistor
R5—4.7-megohm, ½-watt resistor
R6—50,000-ohm linear potentiometer
R7—6800-ohm, ½-watt resistor
R8—68,000-ohm, ½-watt resistor
R9—10,000-ohm, ½-watt resistor
S1—S.p.s.t. switch
S2—2-pole, double-throw switch

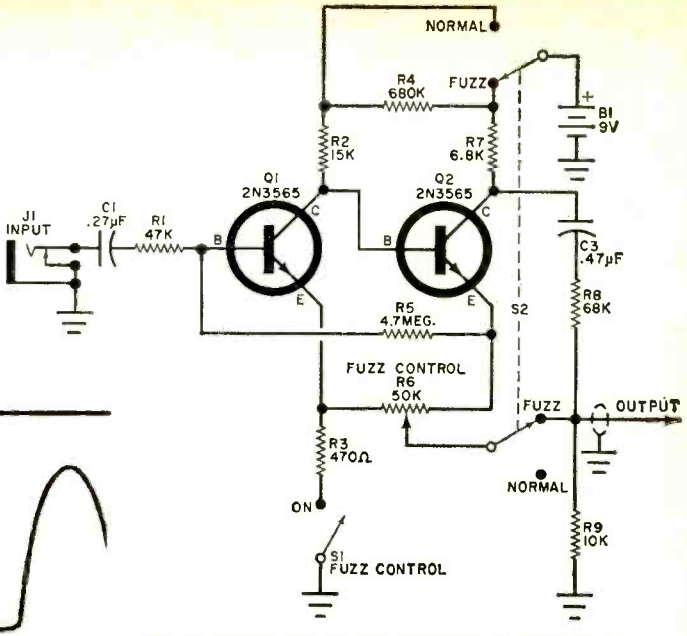
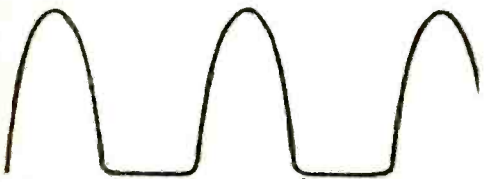
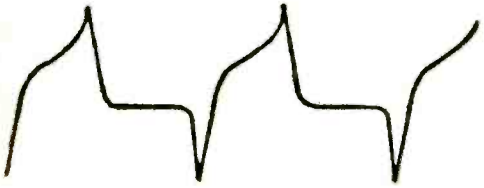


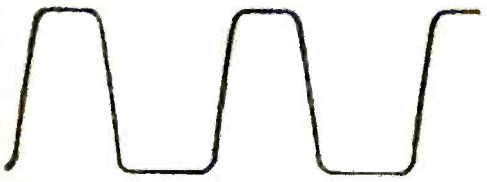
Fig. 1. Switch S1 in the Fuzz-Box is part of potentiometer R6. Turn it off to extend battery life.



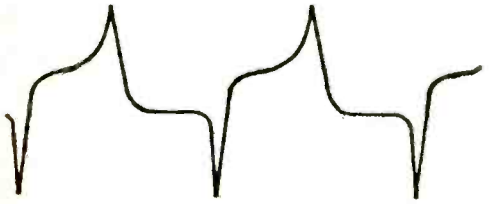
Fuzz "On"—Control R6 at minimum—30-mV input



Fuzz "On"—Control R6 at maximum—30-mV input



Fuzz "On"—Control R6 at minimum—60-mV input



Fuzz "On"—Control R6 at maximum—60-mV input

Fig. 2. The amount of distortion introduced by this circuit is largely independent of guitar output.

A considerably neater method is to pass the guitar signal through a small transistorized amplifier whose operating conditions can be modified to go into the overload mode—using only the direct guitar signal voltage. This method has the additional obvious advantage that the relative loudness of the guitar signal, with and without fuzz, can be made without continuously readjusting the guitar amplifier volume.

As seen in Fig. 1, this "fuzz-box" contains a two-stage direct-coupled transistor amplifier with a means to switch the fuzz-tone in or out, as well as to adjust the basic fuzz-tone waveform. Typical waveforms obtained from the output of the "fuzz-box" are shown in Fig. 2.

Construction. The most important factor to consider in constructing this device is that it must be small and robust. The prototype was housed in a small steel box that contains the entire circuit (including battery) and has the "fuzz-normal" switch on the sloping panel and the "fuzz-control" potentiometer (*R6*) on the top panel. The bottom plate has

(*Continued on page* 100)

BY FRANK H. TOOKER

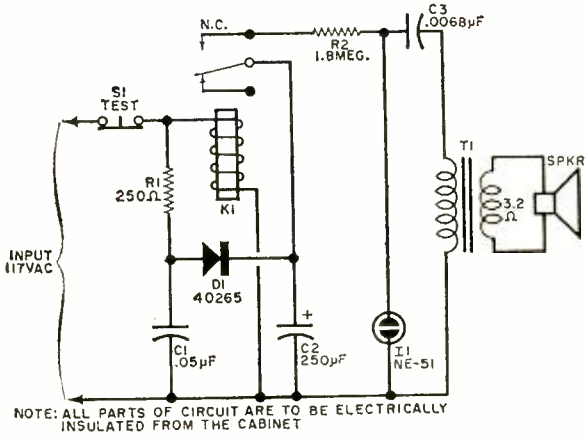
Battery-less Power Failure Alarm

CAPACITOR-POWERED RELAXATION OSCILLATOR SINGS OUT WHEN POWER IS LOST

MOST power failure alarms employ an auxiliary power source, usually a battery, to supply the current needed to operate the alarm device (buzzer, bell, or lamp) that signals when the power line goes off. But over a period of time a battery can deteriorate, become weak, or fail for some other reason, just when the need for it becomes urgent.

The power failure alarm discussed in this article uses a relaxation oscillator transformer-coupled to a speaker and powered by the voltage and current stored in an electrolytic capacitor.

When this unit is plugged into a 117-volt a.c. outlet, the armature of relay *K1* pulls in, opening its normally-closed (N.C.) contact. Simultaneously, capacitor *C2* (a computer-grade component, used as the storage capacitor) charges via resistor *R1* and diode *D1* to the peak value of the line voltage. Resistor *R1* limits the surge current when *C2* starts



PARTS LIST

C1—0.05-μF, 500-volt ceramic disc capacitor
C2—250-μF, 200-WVDC, computer-grade electrolytic capacitor
C3—0.0068-μF, 200-volt Mylar capacitor
D1—40265 rectifier diode
I1—NE-51 neon lamp
K1—Relay, 117-volt a.c. coil, s.p.d.t. contacts
R1—250-ohms, 5-watt wire-wound resistor
R2—1.8-megohm, ½-watt resistor
S1—Normally closed push-button switch
SPKR—5" to 6" speaker, heavy magnet, 3.2-ohm voice coil
T1—Output transformer, 4-watt size (Stancor A-3856 or similar)
Misc.—7¾" x 7" x 4" (approx.) speaker cabinet, power cord and plug, socket for I1, tie-point terminal strip, hardware, wire, solder, etc.

to charge, and also works together with capacitor *C1* to protect *D1* from harm due to line-voltage transients. As long as the power-line voltage remains on, *C2* is kept at full charge.

When a power failure occurs, *D1* becomes reverse-biased, its resistance rises to a very high value, so *C2* cannot readily discharge via this route. The armature of *K1* drops out, closing its N.C. contact, and thereby connecting *C2* across a relaxation oscillation circuit consisting of *R2*, *C3*, *I1*, and the primary of *T1*. When the voltage across *C3* rises to the ignition point of *I1*, the neon lamp fires, discharging *C3* across the primary of *T1*. This cycle repeats itself at an audio rate as long as a sufficient charge remains in *C2*, and the resulting audio-frequency signal (initially 400 to 500 Hz), coupled into the secondary of *T1*, actuates the speaker.

The author's version of this unit continues to sound, with gradually decreasing frequency but without significant decrease in volume, for a period of well over five minutes—an interval quite long enough to attract attention. And the sound level is high enough to be easily heard in an adjoining room when the interconnecting door is open. To obtain a reasonable sound level, it is essential that an efficient speaker of at least five to six inches in diameter, and having a heavy magnet, be used.

Normally-closed push-button switch *S1* is included to permit testing the alarm from time to time, to make certain it is operating properly. When the button is pressed, a power failure condition is simulated, and the alarm should begin sounding immediately. It should cease sounding abruptly when the button is released. —30—

Resistor Standards

WHILE resistors are the least complicated of the active components in electronic circuits, they are often the most misunderstood. A resistor is used either to limit the current or develop a difference of potential (voltage drop) in a circuit, both of which are dependent on the absolute value of the resistor.

The actual value of a given resistor may or may not be the same as the stated nominal value. But it must fall within the tolerances defined by the Electronics Industries Association (EIA) for carbon composition and the Association of Electronics Manufacturers (AEM) for wire-wound resistors. For convenience in mass production, these tolerance notations are 20, 10, and 5 percent of the nominal resistance. However, these notations are not literal.

TOLERANCE NOTATION	COMPUTATION FACTOR	
	CARBON (EIA)	WIRE-WOUND (AEM)
20%	$\sqrt[6]{10} = 1.46$	
10%	$\sqrt[12]{10} = 1.21$	$\sqrt[5]{10} = 1.58$
5%	$\sqrt[21]{10} = 1.10$	$\sqrt[10]{10} = 1.26$

For example, say a unit has a stated nominal value of 3300 ohms and a tolerance of 10%. If it is a carbon-composition unit, its maximum and minimum values must be 3993 and approximately 2727 ohms, respectively. For a similar wire-wound unit, these values would be 5214 and approximately 2090 ohms. If the literal notations were used, these values would have been 3630 and 2970 ohms for both types of resistors.

Tolerance computations are based on a simple mathematical relationship whereby the reference 10 is reduced to the appropriate root. (See table for breakdown.) Wire-wound resistors are not made with a 20% tolerance.

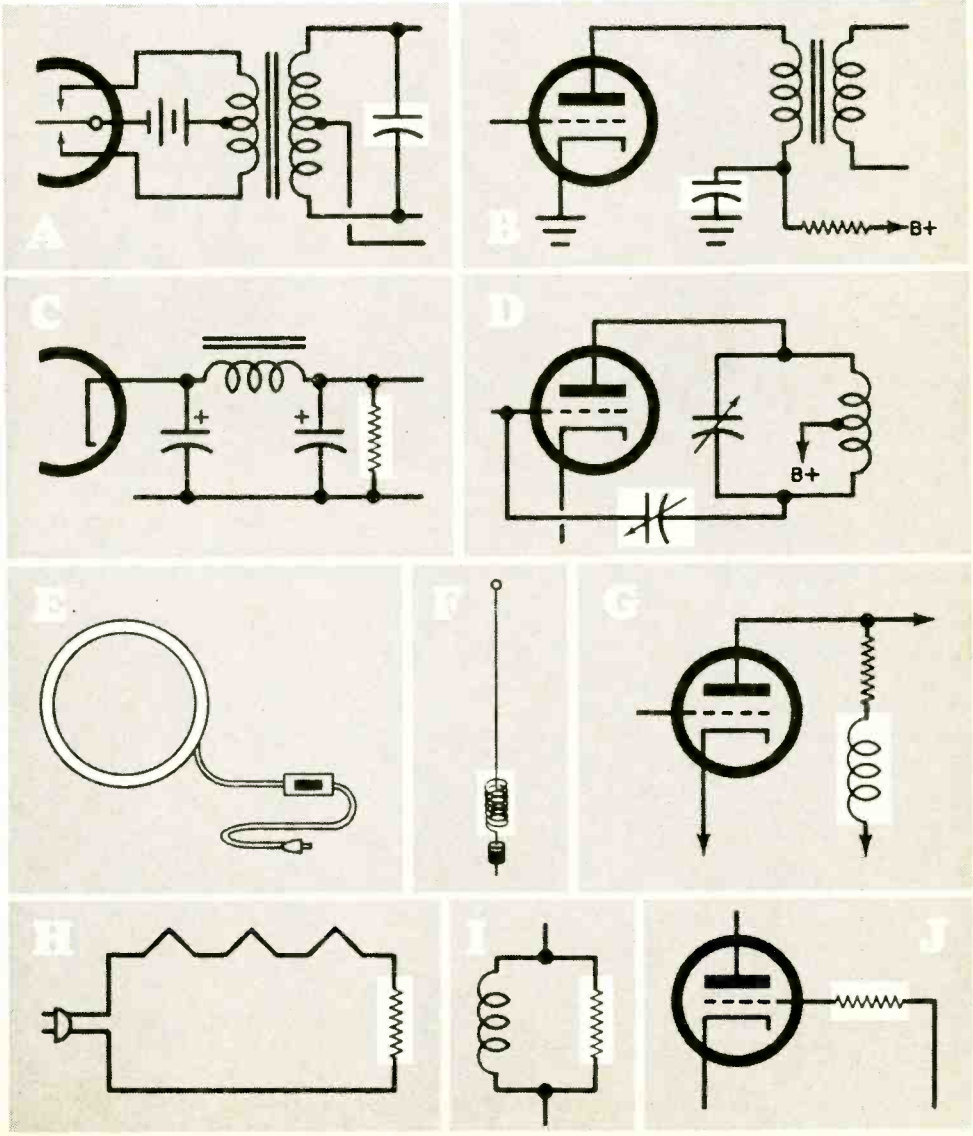
To determine the tolerance limits of any given resistor, using the table, you must know the nominal resistance value, the tolerance, and the type of unit the resistor is. Read down under the proper type heading to the appropriate tolerance line to find the computation factor. Then maximum resistance = nominal value × computation factor; and minimum resistance = nominal value/computation factor. —*Royland Pettersen*

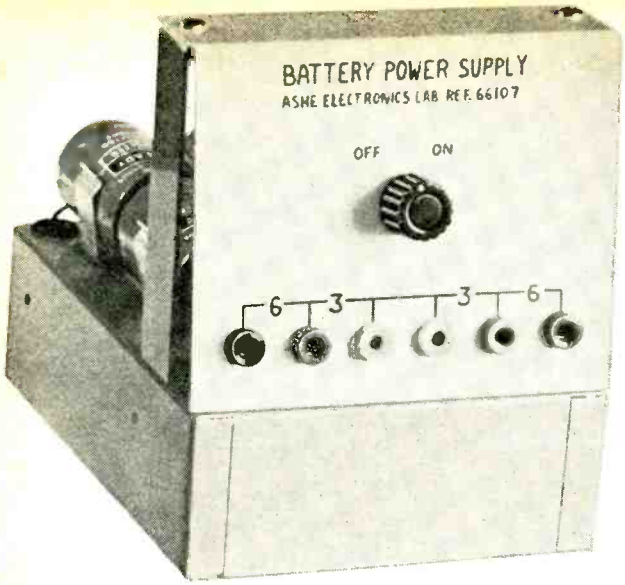
Component Function Quiz

BY ROBERT P. BALIN

Electronic components often acquire special names that describe their particular function in commonly used circuits and devices. To test your knowledge of resistor, capacitor, and coil functions, try to match the technical terms (1-10) to the drawings (A-J) illustrating important functions of each of these three components. (*Answers on page 110*)

1 Ballast _____
2 Bleeder _____
3 Buffer _____
4 Damping _____
5 Decoupling _____
6 Degaussing _____
7 Loading _____
8 Neutralizing _____
9 Parasitic suppressor _____
10 Peaking _____





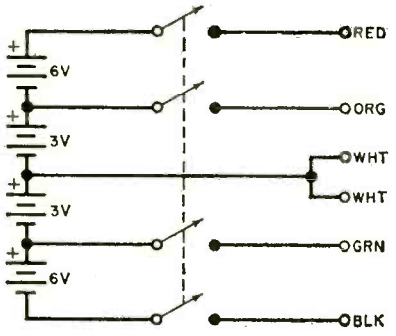
Build a Battery Power Supply

. . . TO OBTAIN PURE D.C. FOR YOUR EXPERIMENTS

BY JAMES ASHE

THE battery power supply described here can be built for about $6 with all new parts. It will let you select 3, 6, 9, 12, 15, and 18 volts—individually or simultaneously—in either positive or negative polarity. You can also select simultaneous opposing voltage polarities for all but the 18-volt range.

First, mount two Keystone No. 201 "D" cell battery holders back-to-back on the top and bottom of a 6″ × 4″ × 2″ aluminum chassis. Bend a 6¾″ × 4″ × 0.05″ piece of aluminum to the shape shown in the photo for the front panel. Then mount the bottom of the panel to the top of the chassis with suitable hardware, and secure the top of the panel with two metal "U" brackets.



The batteries are connected in series to provide up to 18 volts (in 3-volt steps). Several opposing polarity voltages can be selected simultaneously.

Now, mount a four-position, two-pole switch (Mallory No. 3242J, or similar) in the center of the panel and six color-coded (see schematic) pin or banana jacks along the bottom edge of the panel. Be sure that the jacks are well insulated from the chassis and panel.

Finally, wire the battery clips to form a series circuit (use rubber grommets when connecting the bottom Keystone clip to the top of the chassis), and solder suitable hookup wires from the battery taps to the switch and from the switch to the jacks on the front panel. Set 12 "D" cell "transistor" batteries into the two battery holders, taking care to observe the proper polarity.

In use, potential and polarity selection from the battery power supply depends on your choice of connections to the jacks on the front panel. The switch lets you turn the power supply on and off without having to remove and replace two or more wires. —30—

Add "COMPLY" to your Tape Recorder

DISTORTIONLESS SPEECH COMPRESSOR IS INVALUABLE AID

BY CHARLES CARINGELLA, W6NJV

YOU CAN simply forget to look at the recording level indicator on your tape recorder when you build and use *COMPLY*—for Control Of Microphone Peak Loudness Yield. Once *COMPLY* has been set up and adjusted, it will maintain the proper recording level automatically without further attention. It will hold the recording gain constant without introducing noise or distortion, no matter how close or far away you are from the microphone. You just set *COMPLY* once —then forget about it!

Easy to build, the automatic recorder control (*COMPLY*) is inserted directly in the line between the microphone and the tape recorder input, with no need to dig into the recorder circuitry. The 32-dB "compression" range of *COMPLY* also makes it ideal for several other applications. You can use it in the microphone line of a ham or CB transmitter for more modulation "punch." You can also use it ahead of a public address amplifier to maintain a constant output level regardless of variations in input level, and to minimize annoying feedback.

The completed unit can be housed in a modern-looking aluminum enclosure measuring only 3″ deep by 4¼″ wide by 2⅜″ high. An internal 9-volt battery provides the power; however, provision can be made for connection to an external battery or power supply. The wiring diagram is shown in Fig. 1, while the curve in Fig. 2 illustrates the performance of the unit.

As total power consumption is only 2.5 milliamperes at 9 volts d.c., an ordinary transistor radio battery will power

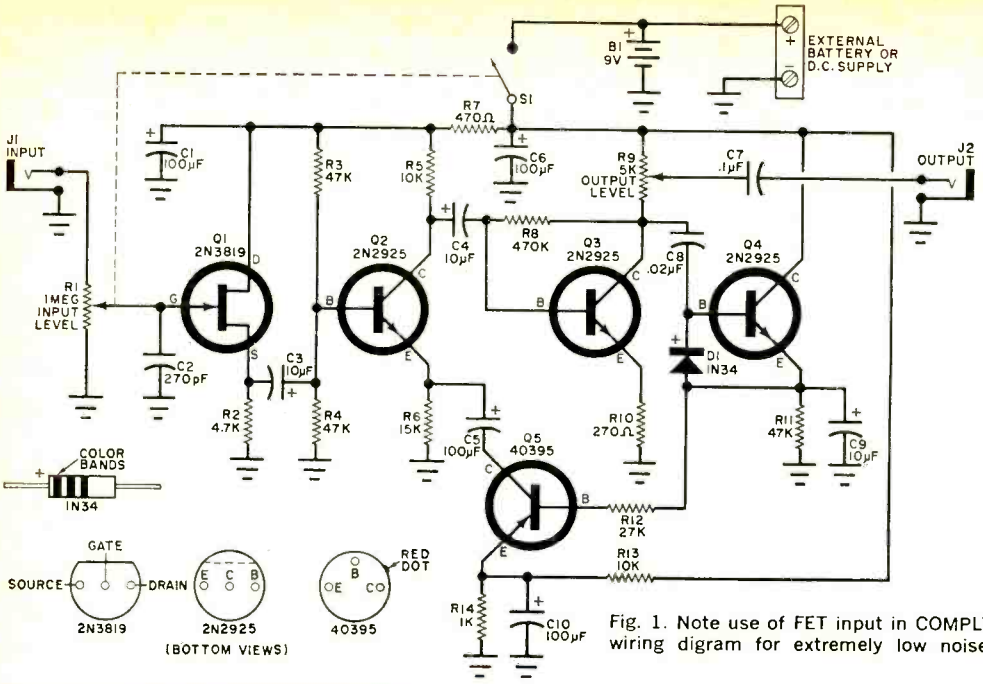


Fig. 1. Note use of FET input in COMPLY wiring digram for extremely low noise.

PARTS LIST

B1—9-volt battery
C1, C5, C6, C10—100-μF, 15-volt electrolytic capacitor
C2—270-pF ceramic capacitor
C3, C4, C9—10-μF, 15-volt electrolytic capacitor
C7—0.1-μF ceramic capacitor
C8—0.02-μF ceramic capacitor
D1—1N34 germanium diode or similar
J1, J2—Standard open-circuit phone jack
Q1—2N3819 n-channel field-effect transistor (Texas Instruments)
Q2, Q3, Q4—2N2925 silicon npn transistor (General Electric)
Q5—40395 germanium pnp transistor (RCA)
R1—1-megohm, linear taper potentiometer with s.p.s.t. switch S1
R2—4700 ohms
R3, R4, R11—47,000 ohms
R5, R13—10,000 ohms
R6—15,000 ohms
All resistors ½ watt carbon
R7—470 ohms
R8—470,000 ohms
R9—5000-ohm linear taper potentiometer (screwdriver adj.)
R10—270 ohms
R12—27,000 ohms
R14—1000 ohms
S1—S.p.s.t. switch (part of R1)
*1—2" x 3" printed circuit board**
1—3" x 4¼" x 2⅜" aluminum cabinet (LMB 342 or similar)
Misc.—Knob, battery holder, ⅛" spacers, terminal strip, battery clip, rubber feet, screws, hookup wire, solder, etc.

*Etched and drilled printed circuit board is available for $2.50 postpaid from Caringella Electronics, Inc., P.O. Box 327, Upland, Calif. 91786: a complete kit of parts (including circuit board, pre-punched cabinet, all components, hardware, wire and solder, but less battery) for $16 postpaid. California residents should add 5% sales tax to all orders.

HOW IT WORKS

Five low-cost transistors are employed in the *COMPLY* circuit. The input stage, *Q1*, is a 2N3819 n-channel silicon FET used as a "source follower," which is analagous to a cathode follower in vacuum-type circuitry. Utilizing the FET in the first stage provides high input impedance—about 1 megohm. Most important is the fact that input noise is practically nonexistent. The input "level" control is potentiometer *R1*.

Transistors *Q2* and *Q3* are *npn* silicon units operated as amplifiers to boost the low-level microphone signals. The output signal is obtained from the collector circuit of *Q3*, where *R9* is the collector load and output "level" control. Part of the output signal is fed to diode *D1* through capacitor *C8*. Diode *D1* rectifies this signal and the resulting d.c. voltage is amplified by *Q4*, another *npn* silicon transistor. The output of the *Q4* stage is used to control *Q5*.

A general-purpose germanium *pnp* transistor, *Q5* is operated at a low level in its linear resistance region and acts as a current-sensitive variable resistor. This "variable resistance" is in series with the emitter bypass capacitor, *C5*, of transistor *Q2*. Thus, the gain of *Q2* changes as the resistance of *Q5* changes. The circuit arrangement can be thought of as a form of negative feedback. As the input signal goes up, the gain of the amplifier goes down.

For input signals between 0.1 and 1.0 millivolt, the circuit operates as a straightforward amplifier with a voltage gain of approximately 200. Compression takes place in the range of 1.0 to 40 millivolts of input signal. Frequency response is "flat" from 10 Hz to well over 20 kHz, both in the linear region of amplification and the region of compression.

COMPLY for many months. If the control is connected to an external a.c.-operated power supply, it must be well filtered to avoid the introduction of hum into the tape recorder.

Construction. Most of the circuit components can be mounted on a 2″ x 3″ printed circuit board. The etched copper-foil side is shown (actual size) in Fig. 3, while Fig. 4 shows the reverse side on which the components are mounted.

Carefully observe the "flat" side of transistors *Q1*, *Q2*, *Q3*, and *Q4* when mounting them in place. Space each transistor about ¼″ away from the circuit board, and make sure each one is oriented properly before soldering it to the board. A heat sink should be used on each transistor lead (as well as on the diode leads) while soldering to prevent heat damage. Mount diode *D1* vertically on the board, and observe the polarity of the diode when it is mounted.

All of the capacitors should be flush-mounted against the circuit board. Observe the polarity of the electrolytic capacitors when installing them. Capacitor *C7* is the only one *not* mounted on the circuit board. All of the resistors are mounted vertically on the board; make sure that one end of each resistor is flush against the board.

A close-up view of the completed circuit board, prior to mounting in the cabinet, is shown in Fig. 5. The connecting leads should be long enough to reach the controls and jacks. Follow the drawing in Fig. 6 to make the holes in the cabinet.

Mount the input and output "level" controls, *R1* and *R9*, in the positions indicated in Fig. 7. Capacitor *C7* is soldered directly between *R9* and *J2*. An inside view of the completed unit is shown in Fig. 8. Mount the circuit board with *4-40* hardware and use ⅛″ spacers between the board and the cabinet. Make sure the resistors on the board near control *R1* do not short out to the control's metal case.

Standard open-circuit phone jacks are used for both the microphone input to *COMPLY* and for the output connection. It will be necessary to fabricate a "patch" cable using shielded wire to connect the output of the control to the input of the tape recorder. There are a variety of prefabricated cables available at most radio supply stores and hi-fi shops.

Many tape recorder microphones are equipped with standard phone plugs on their cables. If your microphone is not equipped with a standard phone plug, it will be necessary to change the existing plug or get a suitable adapter.

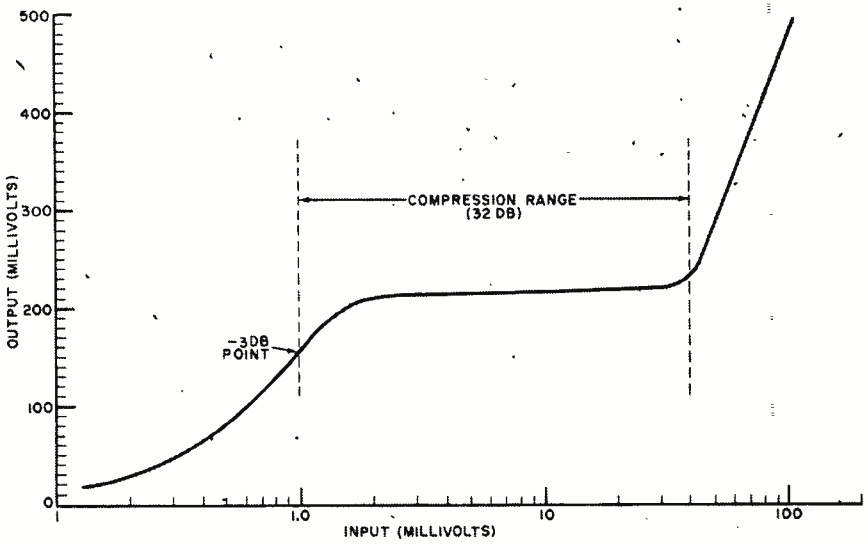


Fig. 2. The output voltage of your COMPLY unit should remain essentially flat for input variations from the microphone of between 1 and 40 millivolts, equal to 32 dB compression.

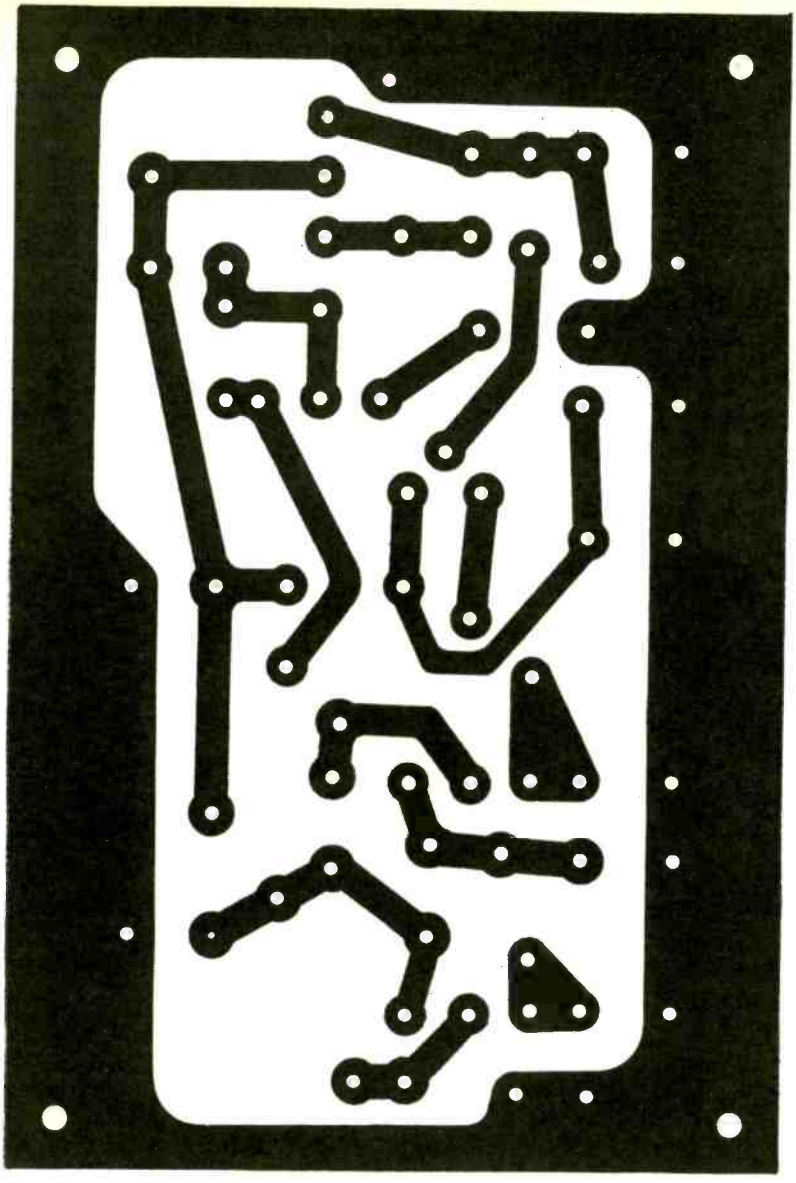


Fig. 3. Construction of COMPLY is greatly simplified through use of a printed circuit board. You can make your own board if you follow this actual-size board pattern. An etched and drilled board is available to readers at a very low cost.

Operation. The *COMPLY* unit is easy to set up and operate. First, connect the microphone directly to the tape recorder. Speak into the microphone at close range and adjust the gain control on the tape recorder for the proper recording level. When this has been done, unplug the microphone from the tape recorder and plug it into your *COMPLY* unit. Connect *COMPLY*'s output to the input of the tape recorder with the "patch" cable.

Set the *COMPLY* input level control up about ¼ of the way from the fully off position. While speaking into the microphone at close range, set the output level control (*R9*) for the recording level on the tape recorder determined above.

Now back away from the microphone and set the input level control (*R1*) on *COMPLY* for the desired microphone sensitivity. If the input level is set for optimum pickup at about 2½-3 feet from the microphone, a speaker cannot "blast" the microphone even if he gets within 6

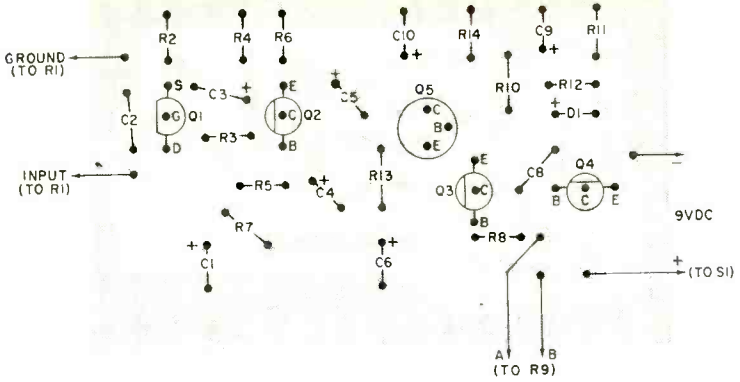


Fig. 4. Flip the printed circuit board over, and mount the necessary resistors, capacitors, and transistors according to placement shown. Be careful to observe polarity.

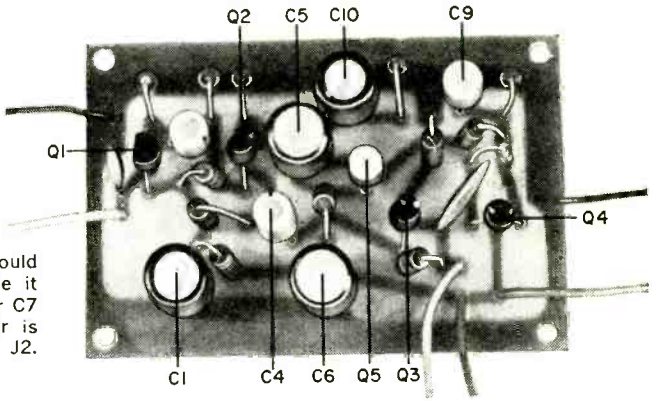
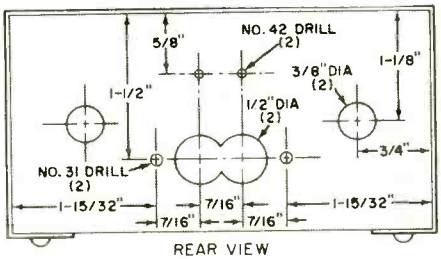
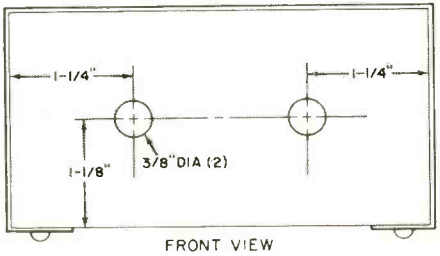


Fig. 5. The printed circuit board should look something like this just before it is mounted in the cabinet. Capacitor C7 is not on the board—this capacitor is connected directly between R9 and J2.





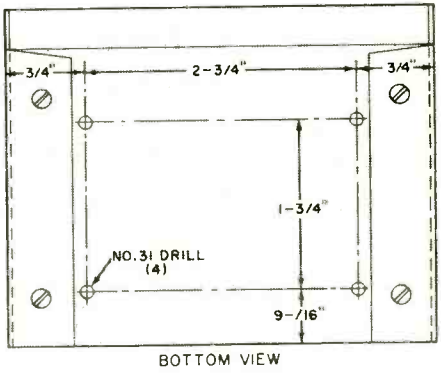


Fig. 6. If you obtain the LMB box used by the author, these rear, front and bottom view drawings will guide you in drilling necessary control holes.

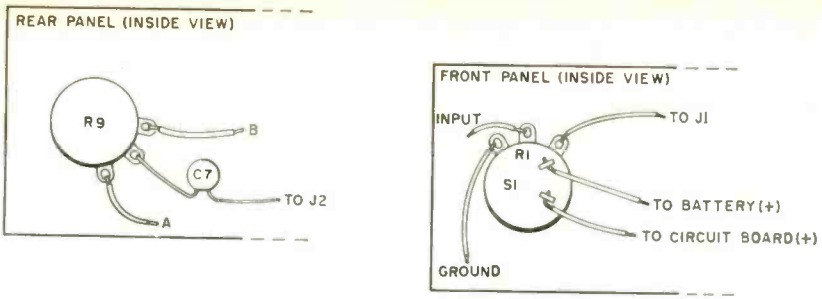


Fig. 7. Before mounting the COMPLY printed circuit board, attach the two controls, R1 and R9, to the front and rear panels, respectively. Capacitor C7 is then soldered in place from R9 to J2.

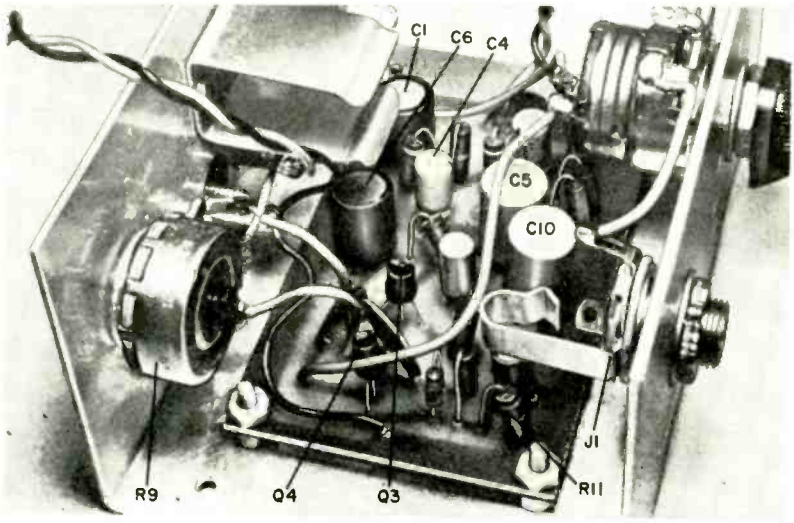
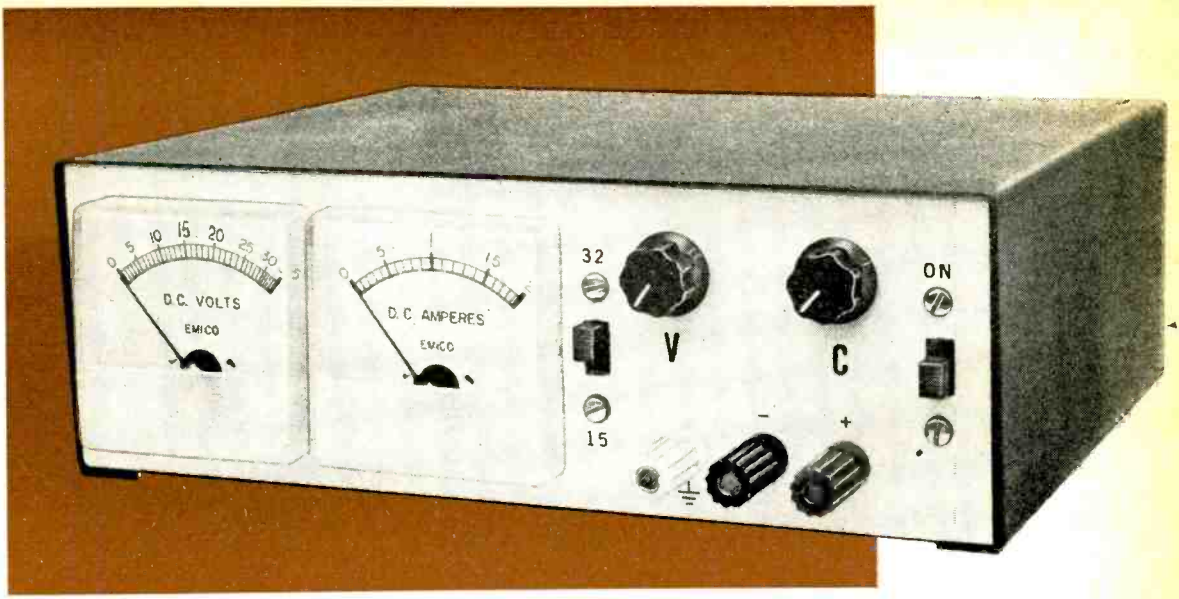


Fig. 8. The PC board is a snug fit in the recommended LMB box. If instructions detailed in text are followed, however, you should not encounter any problems. The battery is mounted in a holder.

Rear view of COMPLY unit shows terminal strip for connection to external 9-volt power source. A screwdriver-adjusted pot is used for level setting.

inches of it. Unlike speech compressors used in some ham or CB rigs, *COMPLY* will not distort the sound by clipping off voice peaks to increase the modulation percentage level.

Your *COMPLY* unit should prove to be of tremendous value in making tape recordings at parties or informal gatherings where there is a mix of voice and music. Recording of press conferences is also greatly facilitated by *COMPLY*. After you have used it a while, you won't want to be without this handy recorder control. -30-



Experimenter's Short-Proof Power Supply

BUILD 2-AMPERE, 0-32 VOLT POWER SOURCE FOR YOUR BENCH

BY JAMES W. CUCCIA

THE biggest problem that can be encountered with a bench power supply occurs if you accidentally short it—poof go the rectifiers, fuse, or assorted components, either singly or in various combinations. Work comes to a grinding halt while you dig away in the power supply and try to fix things up. If this has happened to you, your power supply is not one of the new breed—the automatic current limiter—which is very likely so, since the current-limiting feature has usually been incorporated only in relatively expensive industrial power supplies. Until now.

If you have never worked with a current-limiting power supply, you are in for a pleasant surprise. First, you decide what the maximum safe current would be in the circuit you are testing. Then you short (yes, *short*) the power supply leads together and set the current control until the ammeter indicates this value. Now connect the power supply to the circuit under test, crank up to the desired voltage and go to work. If you should short the power supply leads (either accidentally or because of circuit component failure), instead of a puff of smoke coming from the power supply, the current limiter will not allow the supply to deliver more current to the short than you originally specified for the circuit. You just remove the short, and go back to work.

The complete electrical specifications for this power supply given in the accompanying table compare favorably with those of power supplies costing far more than this project. The schematic for this unit is shown in Fig. 1.

Construction. An actual-size printed circuit board should be made up in ac-

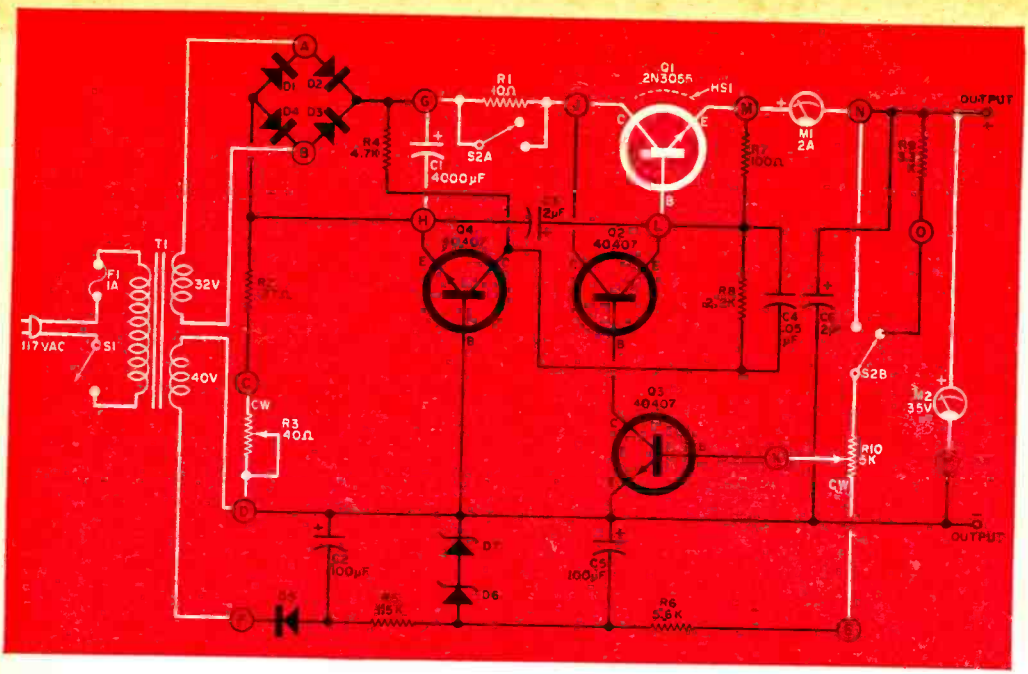


Fig. 1. The components in white are mounted on the chassis. All other parts are mounted on PC board.

PARTS LIST

C1—4000-μF, 50-volt electrolytic capacitor
C2, C5—100-μF, 50-volt electrolytic capacitor
C3, C6—2-μF, 50-volt electrolytic capacitor
C4—0.05-μF, 50-volt disc capacitor
D1, D2, D3, D4, D5—0.75-ampere, 50-volt PIV silicon rectifier
D6, D7—18-volt, 1-watt zener diode (Schauer SZ18 or similar)
F1—1-ampere 3AG fuse, with holder
HS1—Heat sink (Delbert Blinn X-123-d-1)
M1—2-ampere ammeter
M2—35-volt voltmeter
Q1—2N3055 transistor
Q2, Q3, Q4—40407 transistor
R1—10-ohm, 50-watt resistor
R2—0.27-ohm, 5-watt resistor
R3—40-ohm, 3-watt potentiometer
R4—4700 ohms
R5—1500 ohms
R6—5600 ohms
R7—100 ohms
R8—2200 ohms
R9—3300 ohms
} *Resistors R4-R9, ½ watt*
R10—5000-ohm, ½-watt potentiometer
S1—S.p.s.t. slide switch
S2—D.p.s.t. slide switch
T1—Power transformer: primary, 117 volts a.c.; secondary, 32 volts at 2 amperes, and 40 volts at 0.02 ampere (Southwest Technical #P-32-2 or similar)
*1—Etched circuit board**
1—Cabinet/chassis
Misc.—¼" spacers (4), terminal posts (3), capacitor clip, hookup wire, bolts and nuts, line cord

*Printed circuit board for this project is available for $2.75 from Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, Texas 78216; complete kit including punched cabinet and meters for $36.

cordance with Fig. 2 and the parts installed on the board as in Fig. 3. As shown in the schematic (Fig. 1) and in the interior view (Fig. 4), many parts are located off the board.

Except for transistor *Q1* and its associated heat sink, all off-board parts are mounted on the front panel. They can be installed in a cabinet in any desired configuration and wired to the PC board as in Fig. 1. Use mounting brackets to secure resistor *R1* and capacitor *C1* to the chassis. The power transformer is mounted on its own lugs. When these parts have been mounted, install the PC

SPECIFICATIONS

Voltage Range	0-32 volts, 10 mA to 2 amperes, continuously adjustable
Regulation	1% or 0.1 volt, whichever is greater, for 0-100% load
Stability	Less than 20-mV drift (constant ambient temperature with fixed load) over a 6-hour period
Input	105-125 volts a.c.
Ripple	0.003%, or 10 mV r.m.s. maximum

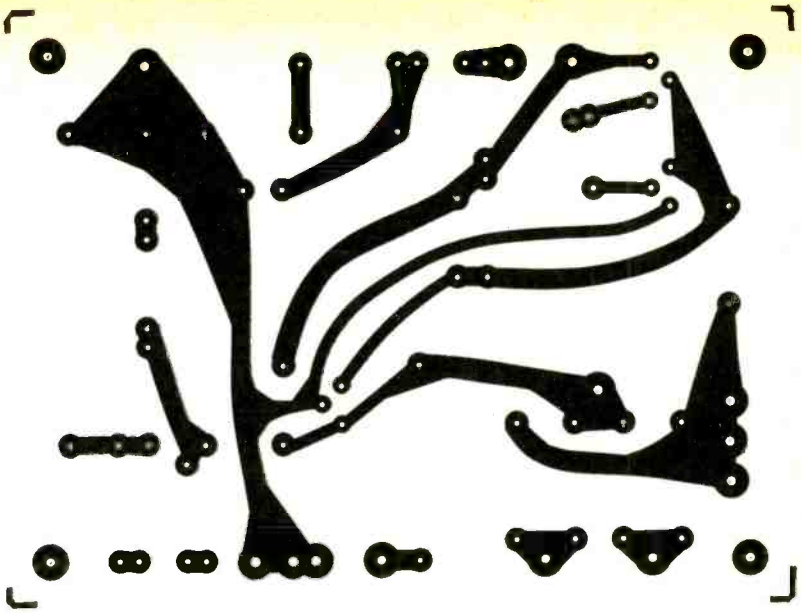


Fig. 2. This actual-size printed board can be copied to remove the possibility of wiring errors. The four corner holes are used in mounting the board.

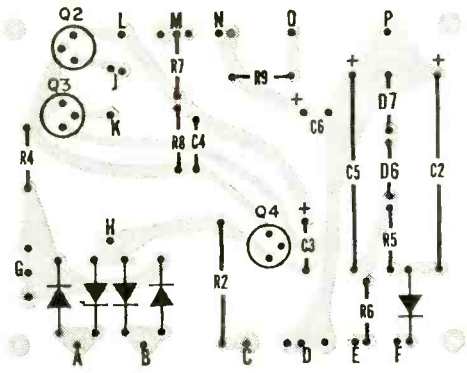


Fig. 3. Flip the board over so that the foil side is down, and install the components as shown here. Observe polarities of semiconductors and capacitors.

HOW IT WORKS

The power supply circuit is basically a series-type regulator in which power transistor *Q1* is made to act as a voltage-variable power resistor controlled by a voltage error amplifier *(Q2* and *Q3)*. Power transformer *T1* supplies both the main power and bias for the unit, diodes *D1* through *D4* form a full-wave bridge rectifier, and *C1* is the main filter capacitor.

Because the voltage difference applied between the base and emitter of *Q3* is reflected in a change in resistance of series transistor *Q1* (and thus a change in voltage output), the base of *Q3* is connected to voltage control potentiometer *R10* which, in turn, is connected between the positive output and a negative voltage developed by bias rectifier *D5*. This voltage is filtered by *C2, R5, C5, R6,* and level-controlled by zener diodes *D6* and *D7*. The level of output voltage is indicated on voltmeter *M2*.

When power resistor *R1* is not in the circuit, the power supply can deliver up to 32 volts output; with *R1* in the circuit, the output level can only reach 15 volts. When *R1* is switched in or out of the circuit, a simultaneous switching action introduces a series resistor *(R9)* into the voltage control potentiometer *(R10)* circuit.

If the load tends to lower the output voltage, the voltage at the rotor of *R10* will be lowered. Transistors *Q3* and *Q2* then react to lower the series resistance of *Q1*, thus raising the voltage. When the output voltage tends to increase, the reverse action occurs. Obviously, any ripple on the output lead is reflected back as voltage variations, the three transistors make high-speed compensation, and ripple is reduced to a very low level (see Specifications Table). Capacitors *C3* and *C4* are bypass units which reduce the high-frequency gain and suppress parasitics.

Current limiter *Q4* senses the voltage drop across *R2* and *R3* (the latter is the current control potentiometer). The voltage drop increases as more current is drawn by the load until it reaches the value required to turn *Q4* on. When this happens, *Q4* reduces the base voltage of *Q2* and *Q1* which, in turn, lowers the output voltage until only the current set by *R3* flows in the load. The current-limiting circuit is arranged so that *R3* can be preset from 12 mA to 2 amperes of maximum load current. Load current is indicated on ammeter *M1*.

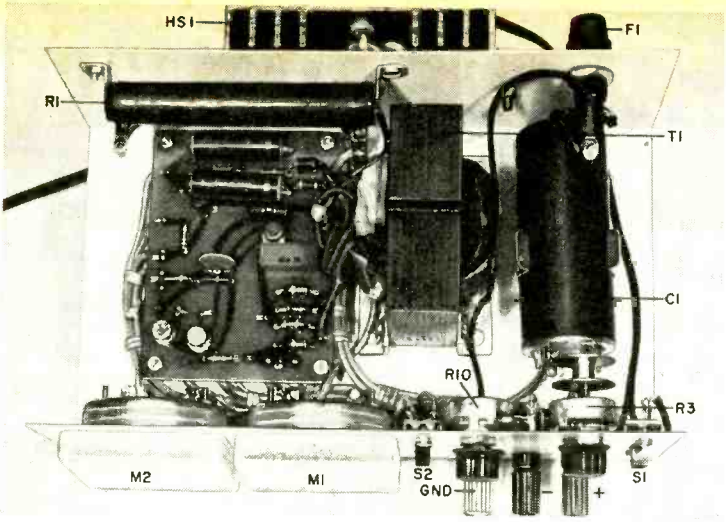


Fig. 4. Interior view of author's prototype. Capacitor C1, power resistor R1 and the printed board are supported by standoffs. All other components are mounted directly to the chassis as shown here.

board using small spacers to stand it off the chassis.

Mount *Q1* on its heat sink using insulated washers for the mounting screws, and a mica washer between the transistor and the heat sink. Be sure to apply silicon grease to both sides of the transistor mica washer before mounting *Q1*. Failure to use the grease may result in *Q1*'s overheating and possibly burning out. Place a soldering lug on one transistor case mounting lug to provide the collector connection to the transistor.

Remember that the case of transistor *Q1* is also the collector connection and is "hot" to ground, and since the heat sink is ground, take care when mounting the transistor on the heat sink, and when placing the power supply on the bench so that a short circuit cannot occur. Figure 5 shows the rear of the author's proto-type and how the transistor and heat sink are mounted to the cabinet.

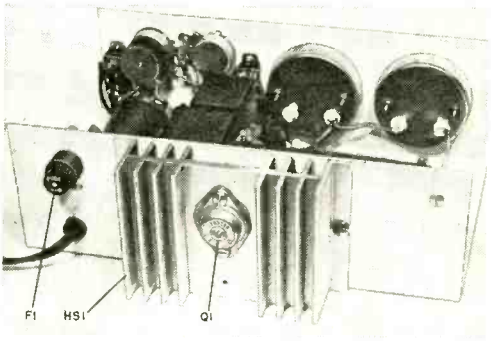
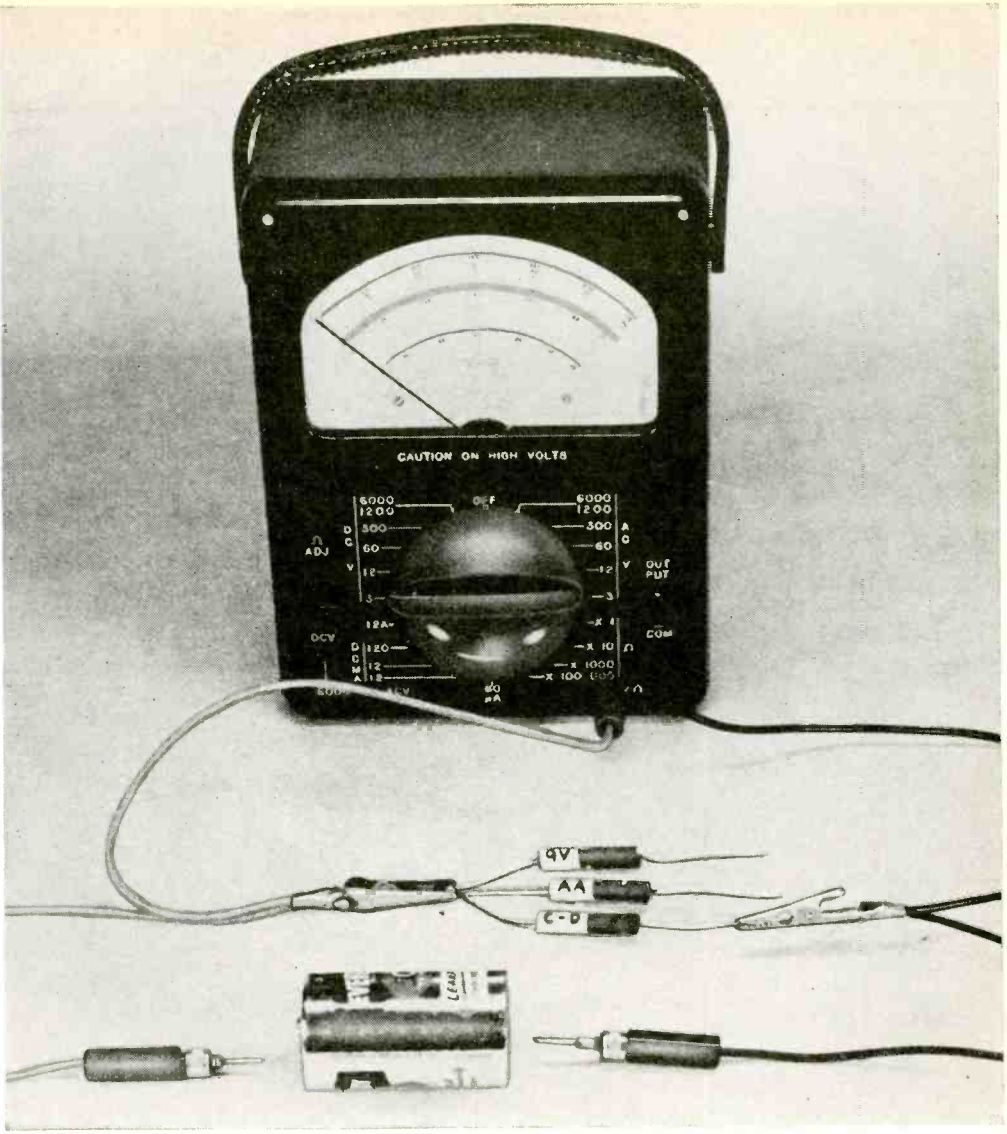


Fig. 5. Rear view of power supply chassis. Transistor Q1 is thermally (not electrically) connected to heat sink HS1. The heat sink is mounted to the rear apron of the chassis, as is the line fuse.

Operation. The power supply is simple to use. Plug it in and turn on *S1* (the primary power on/off switch). For voltage output from 0 to 15 volts, place *S2* ("15/32" volt selector switch) in the "15" position; for voltages above 15 volts, place *S2* in the "32" position. Adjust voltage control *R10* ("V") for the desired output voltage.

Rotate current control *R3* ("C") to maximum counterclockwise position. Place a short circuit across the power supply output terminals and adjust *R3* until the ammeter indicates the desired maximum current. When making this current calibration, the voltmeter indication will obviously drop to zero. Remove the short and connect the power supply to the circuit being tested.

Note that the chassis of this power supply is floating so that you need not be concerned about the chassis shorting to any external ground. —30—



Dry Cell Tester

HERE IS THE CORRECT WAY TO TEST DRY CELLS OR BATTERIES

BY LEWIS A. HARLOW

TESTING dry cells and batteries is a primitive operation that usually delivers mysterious and unprecise results. If you use a VOM, all you find out is how much *voltage* the battery can deliver at that moment. However, most electronic devices require the battery to deliver *power*.

The only way to definitely find out if the battery is good or not is to test it under load. If the VOM indicates the ap-

proximate voltage of the battery, it is a good battery. If, on the other hand, the VOM indicates about 85% of the battery voltage, it is borderline and will require replacement; or if it is a rechargeable type, recharging is in order at that point.

By using your VOM, a few resistors, four lengths of wire, and some assorted hardware, you can make up an excellent battery/dry cell tester that will instantly spot good, bad, or indifferent units from the simple 1.5-volt cell to the large 90-volt battery.

The Harness. A complete harness for the battery/cell tester is shown in the photo. Start with four 12-inch flexible test leads, two red and two black. To one red end and one black end, attach the type of tip that your VOM will accept. To one end of the *other* red and black leads, attach any type of test prod. These prods will be used to make contact with the battery under test.

Remove about one-half inch or so of insulation from the loose ends of the four test leads, then connect the two red ends together and solder them to an alligator clip. Do the same with the two black leads.

BATTERY TEST TABLE

BATTERY RATING (volts)	VALUE OF SHUNT REQUIRED (ohms)	DISCARD POINT (volts)
1.5*	13	1.27
1.5**	130	1.27
3.0	300	2.55
4.5	430	3.70
6.0***	620	5.10
7.5	820	6.40
9.0	1000	7.70
10.5	1100	8.90
12.0***	1200	10.20
15.0	1600	12.70
22.5	2200	18.70
30.0	2700	25.50
45.0	3900	38.10
67.5	5600	57.50
75.0	6200	64.00
90.0	7500	76.50

**For "C," "D," or larger cells*
***For "AA" and smaller cells*
****Results inconclusive on automobile and other heavy-duty storage batteries*

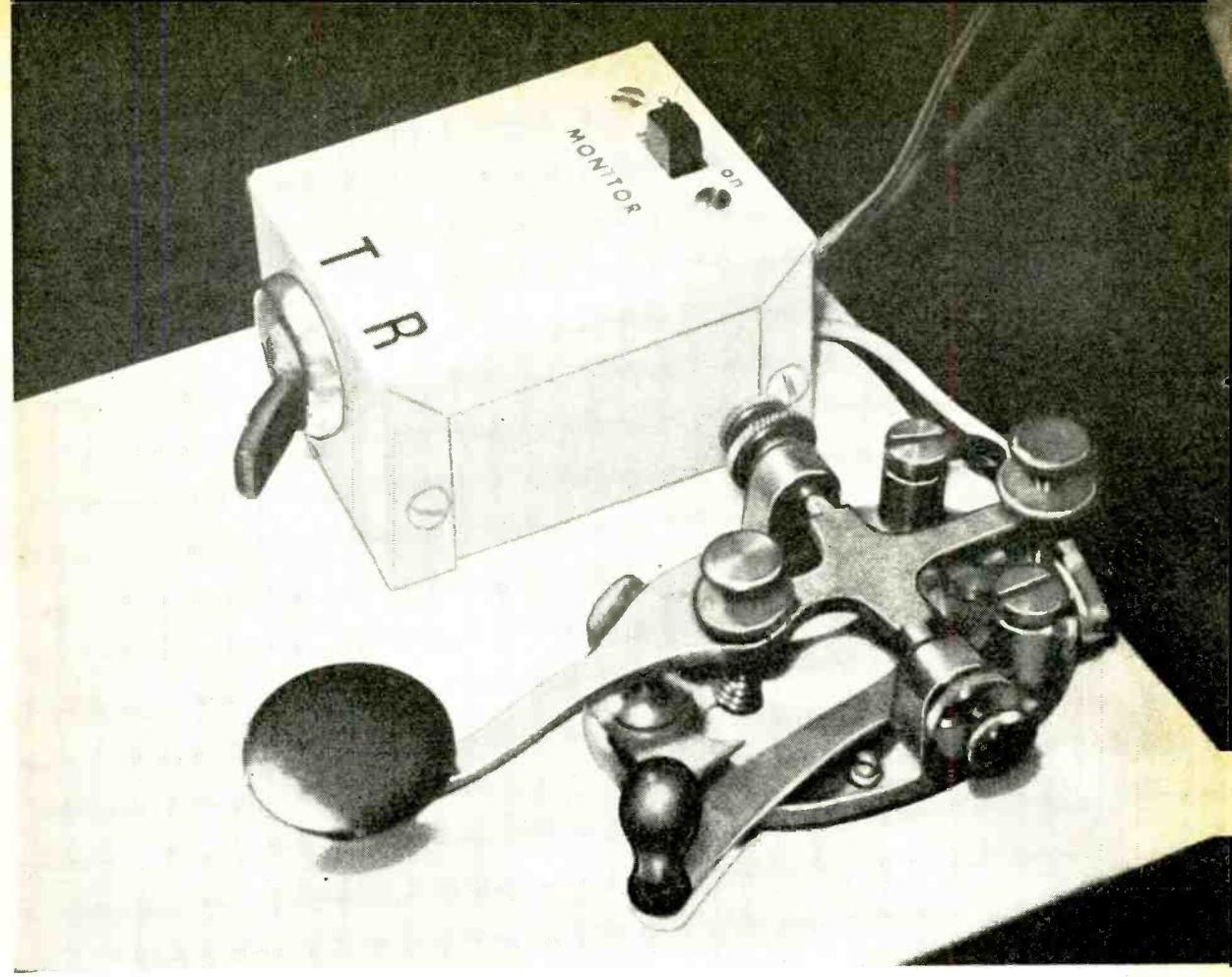
Shunts. Because the voltage is to be measured across a specific load, some type of resistor is required to serve as a shunt. The accompanying table indicates the resistance value required to properly test all types of dry cells and batteries commonly encountered. These resistors are conventional 1-watt, 5% types (the closest commercial equivalent to the calculated theoretical value).

To speed up testing, select the shunt resistor values required for the most common cells or batteries you will encounter. Identify each, not as to resistance value, but as to the type of cell or battery it is to be used with. For example; assume that you want to test "AA" cells, "C" and "D" cells, and ordinary 9-volt transistor radio batteries. The table shows that you will need a 130-ohm, 13-ohm, and 1000-ohm resistor respectively.

Wrap a piece of white tape around each resistor (or paint it white) and mark it with the battery type (see the shunts in the photograph). Solder one end of the three resistors together, and leave the other ends free and isolated from each other.

Operation. To use the battery tester, connect the red and black leads to the VOM d.c. input terminals (red to positive, and black to negative input, respectively). Set the VOM range switch to the appropriate voltage position. Secure the soldered ends of the three resistors in one of the harness alligator clamps, and connect the other alligator clamp to the selected resistor loose end.

Then touch the test prods to the battery under test (red to positive, black to negative). The VOM should indicate almost the full battery voltage. If the voltage drops to the value shown in the "Discard Point" column of the table, the battery should be discarded (or recharged). —30—



Build A Compact, Inexpensive KEYING MONITOR

TAKE ADVANTAGE OF THOSE CHEAP MODULES

BY BERNARD MICHAELS, WB2WYO

ONE ITEM that is apparently lacking in many ham stations—as evidenced by the strange conglomeration of sounds some hams fob off as code—is a keying monitor. A few seconds of listening to a tape recording of my own fist convinced me that I needed such a device. So I decided to design an inexpensive and simple keying monitor.

The prototype I built works great on the seven-watt rig I use on camping trips. And the results are equally good when I use it with my Collins 32V3 home station.

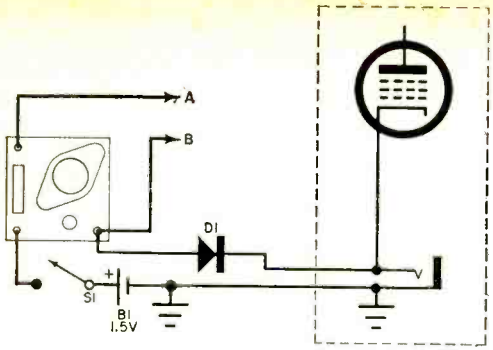


Fig. 1. This drawing demonstrates the correct method of connecting the keying module to the "key" jack in transmitters that use cathode keying. Points A and B connect to the speaker's voice coil in the receiver.

The monitor consists of a pre-assembled code practice oscillator module, a "D" cell battery, a 200-PIV, 70-mA silicon diode, and two cables. However, if you use the monitor with a cathode-keyed transmitter, a s.p.s.t. switch should be included as shown in Fig. 1.

Although the entire keying monitor is small enough to fit inside most transmitters, you might want to build it in a metal utility box as shown in the photo on page 59. The switch located at the front end of the box is not part of the monitor; it is a transmit/receive (*T* and *R*) mode selector, installed for operating convenience.

Depending on whether your rig utilizes cathode or grid block keying, the components that make up the monitor will be wired together as shown in Figs. 1 or 2, respectively. The points marked "*A*" and "*B*" go to the speaker circuit in your receiver (see Fig. 3).

The diode, *D1*, used in both monitor circuits serves a dual purpose—it isolates the monitor from the transmitter circuits, and it allows the key to complete the ground circuit for the monitor. This simple arrangement eliminates the need for keying relays and accessory switches.

Depending on the forward resistance of the diode, it may be necessary to increase battery voltage to 3 or even 4½ volts. The module requires a 1½-volt d.c. power source to generate a pleasant 1000-Hz tone. With a 1½-volt supply, the audio output is more than adequate, but if you want to increase the supplied voltage, you will have to install a resistor of a value between 10 and 50 ohms in series with the battery to obtain an acceptable balance between pitch and loudness.

The keying monitor described above has a bonus feature. You can use it to practice code without turning on either your transmitter or your receiver. Just key away. —30—

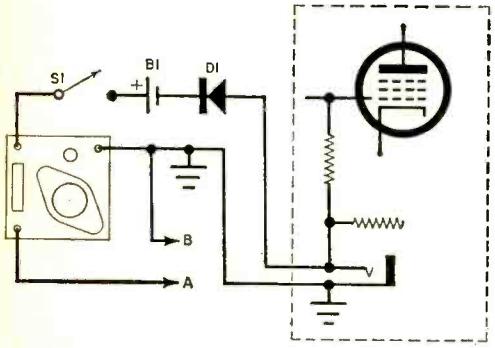


Fig. 2. Basic difference in hookups between cathode and blocked-grid keying is location of "key" jack.

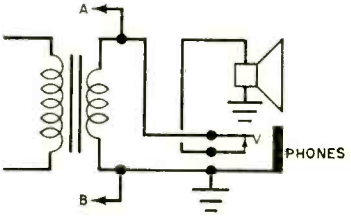
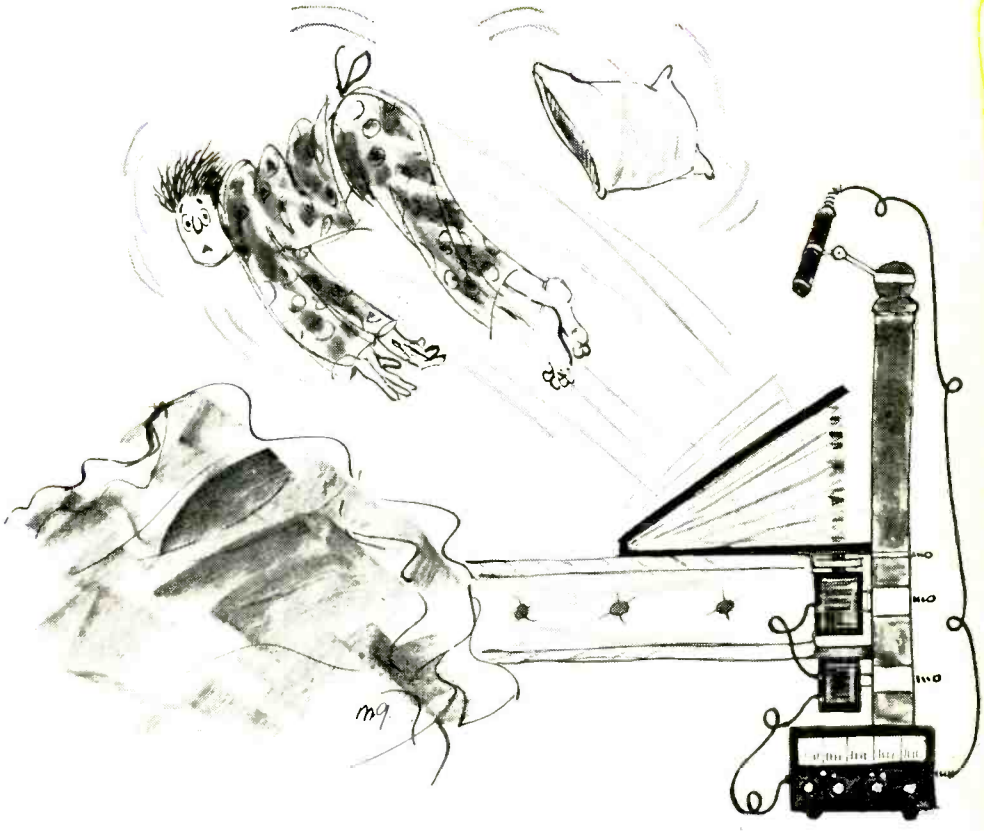


Fig. 3. For keying monitor, connect module's output to A and B on speaker voice coil in receiver.

UNIQUE PATENTS



SNORE ALARM

Invented by George J. Wilson Patented May 7, 1963—No. 3,089,130

Here's an invention that should be welcomed by wives with husbands who sleep like a log, but whose slumber sounds like a buzz saw. This antisnore alarm system employs a simple microphone pickup to drive a voltage amplifier that triggers a solenoid plunger under the sleeper's pillow. Any sound louder than a preset ambient level sets the plunger into operation, gently (?) shaking or elevating the sleeper's head. Presumably the sleeper would awaken, turn off the circuit to retract the solenoid plunger, then return to sleep—to dream—to snore.

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☐ Space Electronics ☐ Nuclear Engineering Technology
☐ Industrial Electronics for Automation
☐ Computer Systems Technology

APPROVED FOR TRAINING UNDER NEW G.I. BILL

Extending Battery Life

BY IRVING M. GOTTLIEB

ARE YOU CONSTANTLY REPLACING BATTERIES IN YOUR TRANSISTOR RADIO? ADD ONE COMPONENT, AND YOU'LL GO 30% LONGER BETWEEN CHANGES

PORTABLE transistor radio receivers squeeze considerably more performance from a given weight of batteries than did their vacuum-tube predecessors. Therefore, it is ironic that these batteries must often be replaced long before their useful life is over.

By the addition of one low-cost electronic component, batteries in many cheap transistor radios can be made to yield a 30% longer play time.

Batteries are not usually discarded because of reduced volume capability of the receiver, but because of increasing audio distortion, "motor-boating," or poor local oscillator operation. It all has to do with the fact that, in most transistor radios, the battery itself is a common circuit element; and, for proper operation, the battery must have a very low internal impedance throughout its active life.

However, a battery's internal impedance increases with use and thus represents an unseen—but very real—impedance in series with the voltage source. This common impedance couples the r.f., i.f., and audio stages together, generally in such a manner as to produce the "motorboating" and poor local oscillator operation.

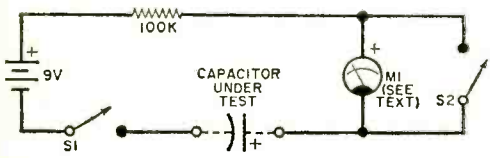
There is another problem associated with this increasing impedance. Inasmuch as the average d.c. current required by the audio stages alternates with the input signal, the inability of the power source to respond to the demands causes a flattening of wave peaks, thus "clipping" the waveform and introducing audio distortion.

Note that the actions described are a function of the battery *internal impedance*, not its capability of producing power. If the impedance of the power source is kept low, the battery can keep on powering the set until its power capability is actually reduced to a non-working value.

Probably the easiest way to reduce power source impedance is to connect a large-valued capacitor across the battery. Fortunately, large-value, low-leakage, physically-small electrolytic capacitors are available at any electronics parts distributor. The larger the capacitance value, the better. Make sure that the capacitor is voltage-rated higher than the battery voltage of the set, and that it has low leakage (less than one microampere).

The circuit on this page illustrates one method of evaluating capacitors. Meter *M1* should be capable of indicating from 50 μA, full scale, to 10 μA (or less), full scale. You first open *S1*, close *S2*, and connect the capacitor to be tested into the circuit. Set the meter to its highest current range (in μA). Close *S1* and wait for at least three minutes for the capacitor to charge and polarize. Then open *S2*, and switch the meter down-range to get a usable indication. The meter should read less than 1 μA for a good capacitor. (You may want to try several capacitors to find the one with the lowest leakage.)

Once a capacitor has been selected, observe its polarity, then solder it into the receiver circuit across the battery. Reception should improve either with fresh or used batteries. —30—



Test several capacitors and use the one with the lowest leakage. Make sure that S2 is closed before operating S1 or the sudden current surge produced by the capacitor charging can easily damage the meter.

Build a Bathroom Sterilizer

STOP THE SPREAD OF INFECTION BEFORE IT STARTS

BY BYRON G. WELS

HAVE YOU EVER NOTICED how quickly a communicable infection like the common cold can spread through an entire family? At times, it can be like an epidemic, striking one person, then another, until everyone in the family is coughing and sniffling.

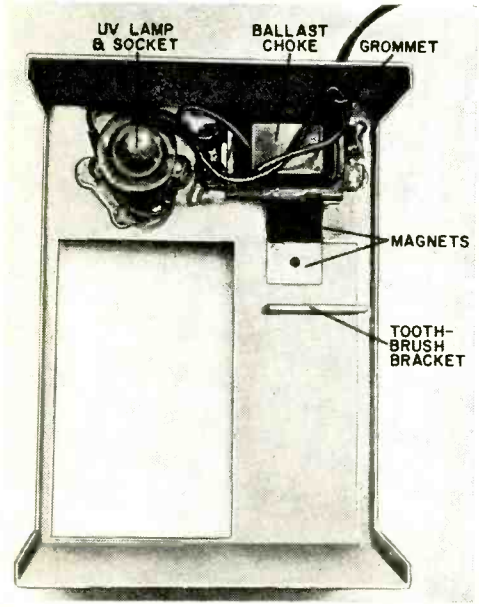
Much infection spreading can be traced to the family bathroom, and two obvious culprits stand out—the water tumbler and the family toothpaste tube. The first member of the family to come down with the infection brushes his teeth, touching the infected toothbrush bristles to the toothpaste tube. When he is finished, he rinses his mouth with water from the

tumbler. Finally, he rinses the tumbler and his toothbrush and sets both back in their usual places. Enter the next member of the family to repeat the cycle.

Rinsing the water tumbler and the toothbrushes does not kill or get rid of germs. However, a germicidal ultraviolet lamp will sterilize both the glass and toothbrushes quietly and unobtrusively. It is an ultraviolet lamp around which the "Bathroom Sterilizer" is built.

Construction. The ultraviolet lamp (GE #GHS11, or similar) is the type used in many electric clothes driers. (If your electrical supply store doesn't carry it, try a clothes drier sales center.) The direct radiation of the lamp is harmful, so the lamp must be housed in a suitable box. The box used in the prototype is a 3" x 6" x 8" aluminum utility box available from most electronics parts suppliers. (A wood box could be used instead.) Size is not critical.

Take the box apart, and drill two holes in the rear section to facilitate mounting the box on your bathroom wall. Then cut holes for two compartments in the front section of the box as shown in the photo on page 67. Mount the lamp socket and ballast choke approximately as shown, using Dow Corning's "Silastic 732 RTV" silicone rubber adhesive. Although conventional machine screw hardware could be used for mounting these parts, the adhesive holds almost as well, eliminates the need for drilling holes, and insulates the parts from the metal box.



Sizes of the toothbrush and tumbler compartment cutouts are not critical. They should, however, be located approximately as shown for maximum benefit. All parts should be well insulated from chassis.

Fashion a toothbrush bracket from a ¼"-thick piece of plexiglass, drilling enough ½" holes to accommodate all of the family toothbrushes. Then cut another piece of plexiglass to a size slightly larger than the dimensions of the toothbrush compartment cutout, and use epoxy cement to mount the bracket on one side and a door pull on the other side.

Apply a fairly thick bead of "Silastic" adhesive along the bottom edge of the toothbrush compartment cutout, and press the plexiglass assembly in place. Allow the cement and adhesive to set overnight. When the adhesive does set, you'll find it almost as flexible as a mechanical hinge—and it will last almost as long.

Finally, drill a hole in the top of the box, near the ballast choke, line it with a rubber grommet, and pass a power cord through. Connect the lamp socket and ballast choke in series across the power line, and glue two small, flat magnets in place as shown to hold the compartment door closed. Then paint the box.

Using the Sterilizer. Screw the ultraviolet lamp into the lamp socket, mount the unit on your bathroom wall, and plug the power cord into a convenient a.c. outlet. Set your water tumbler in the open compartment and your toothbrushes in the other compartment. The direct radiation from the lamp will play on the tumbler and toothbrushes. In a relatively short time, most types of infectious bacteria will be killed off by irradiation.

You get an additional benefit when you use the "Bathroom Sterilizer." The ultraviolet radiation produces ozone—a powerful deodorant. Bathroom odors, like the spread of infection, will also become less of a source of anxiety.

A word of caution: when you build and mount the unit, be sure there is no possibility of anyone looking directly at the lighted ultraviolet lamp. —30—

INFORMATION CENTRAL

By CHARLES J. SCHAUERS, W6QLV

YOUR *Information Central* column has been in operation for one year. During this time, you readers have really tested us with some penetrating queries. Yet, so many readers ask questions that have already been answered in print that we sometimes feel that no one reads this column unless he or she has submitted a question and is looking for the answer to that question only. Before you take pen in hand—or preferably typewriter—please check back issues of this magazine to see if a question similar to yours has already been asked—and answered.

When you do submit a question, please type or write it clearly, on a postcard if possible—one question at a time—and send the card to the attention of *Information Central*. Because quite a number of questions are received each month, and space does not permit answering them all, we try to select those questions that will interest a broad range of readers.

Sticking Decoder Reeds. *I have a very early C-3101 Hallicrafters tone unit (CA-2 "Command Call") for CB use and it is troubled by intermittent and sticking decoder reeds. What can I do about them?*

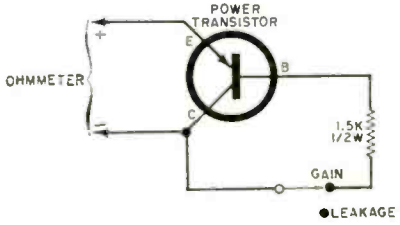
Install a 1.5-ohm, ½-watt resistor between the decoder relay contacts and integrating capacitor *C15*.

Turntable Operation on 60 Hz. *While in Germany, I bought a Model 1009 Dual turntable that operates on 50 Hz. Now that I am back in the U.S., how do I convert it to 60-Hz operation?*

You will need a 31NU28 motor pulley ($3.70) available from United Audio Products, 535 Madison Ave., New York, N.Y. 10022. Make sure that you also convert the unit to 117-volt a.c. operation by making the necessary internal power line changes.

Power Transistor Checker. *I have a large number of power transistors and would like to set up a simple checker to test for leakage and gain. Can you help me?*

See diagram above, right. The ohmmeter is used on low scale (R X 1). Do not use an ohmmeter that contains a battery of more than 3 volts. With a transistor in the circuit, the lower the ohmmeter indication, the higher the leakage. If a zero indication is obtained, the transistor is shorted. By switching the resistor into the base circuit, the relative gain of the transistor can be checked. Indications of over 60 ohms indicate that the transistor has low gain; high-gain transistors will cause the meter to indicate between 6 and 12 ohms; and moderate gain units will read between 25 and 40 ohms.

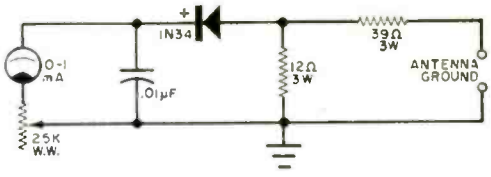


Antenna Gain. *How can I increase the gain of my 2-meter dipole antenna?*

Try placing the antenna in front of a screen reflector. You will gain about 6 dB—and this is worth the effort! Raising the antenna will *not* increase its gain.

CB Dummy Load. *I need a combined dummy load and r.f. indicator for my CB rig. Can you help me?*

See the diagram below. This circuit will work with nearly any CB transmitter. It is best to mount the entire unit in a metal enclosure to prevent radiation.



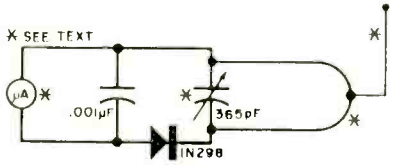
T-60 Overheating. *I have a Knight-Kit T-60 transmitter which works very well, but when it is connected to a light bulb used as a dummy load, the tubes heat up—especially the 6HF8 oscillator-multiplier tube. The bulb continues to glow after the heat-up. I only hold the key down for a couple of minutes or so. What can I do to prevent overheating the tubes?*

Don't hold the key down any longer than it takes you to make the light bulb glow. This set was made for intermittent operation

—not key-down operation. Over-dissipation of the tubes results when the key is held down too long.

VHF FS Meter. *I need a VHF relative field-strength meter that will cover both the 6- and 2-meter ham bands. Can you provide a circuit for such a meter?*

We have used the FSM diagrammed below with much success. The tank consists of a 1⅜"-long piece of #16 copper wire bent so



that its terminals meet those of the Allied Radio No. 43 B 7091 miniature single-section 10-365 pF tuning capacitor. The meter can be either a 50- or 100-microampere unit. The pickup antenna connected to the center of the tank is a stiff 12-inch piece of #8 copper wire—its length can be adjusted (by clipping) for best sensitivity. This unit will cover a frequency range of about 45 to 250 MHz.

FM Wireless Mike Reception. *We have two FM wireless mikes and want to simultaneously feed our public address system with them from two different locations. As a receiver feeding the p.a. system, we use an AJ-14 Heath FM stereo tuner. Getting both mikes on frequency (the exact frequency) is a problem, for the tuner a.f.c. seems to favor one of the units. Do you know of any solution?*

Crystal control of the mikes is the logical solution, but don't forget that when the mikes are located at different locations a signal strength problem also exists. This can be solved by running a very thin antenna wire (#36 or so) around the area to pick up the signal for the tuner.

Mercury Relays. *Why are mercury-wetted contacts used in relays?*

Because the mercury film provides a continuously renewed contact area which breaks quickly to minimize contact arcing. Also, with no electrical erosion and mechanical wear, contact resistance is kept low. Mercury-wetted contact relays are used in computer type devices where billions of operations are not uncommon.

NCX-3 DX Chirp. *I bought a second-hand NCX-3 transceiver and my DX contacts report that the set chirps. What can I do about such a condition?*

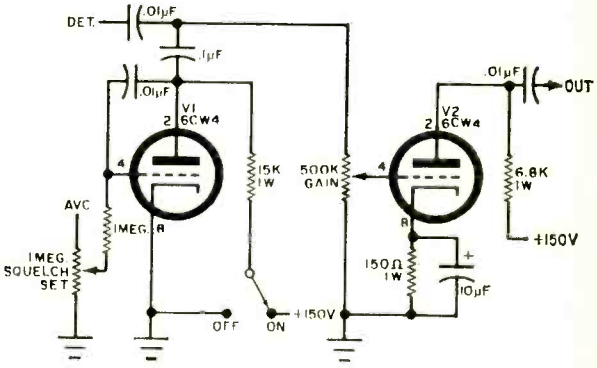
This condition is easy to cure. Remove the red wire from pin 1 of tube *V18* and reconnect it to pin 6. Then add a 2.5-millihenry r.f. choke (50 mA) between pins 1 and 6, and add a 0.01-μF ceramic capacitor from pin 6 to ground. Your chirp will disappear.

Construction Help. *I am not the only one who would like to be able to buy some of the construction projects described in* POPULAR ELECTRONICS *in finished form. Do you know of anyone who builds and sells* POPULAR ELECTRONICS *projects?*

No, but we try to make it as easy as possible for you to build them. In all cases, parts for projects are available from mail order houses (Allied, Lafayette, etc.), parts distributors, and the like. In many cases, printed boards—and even all components—are available from a particular supplier. Check the Parts Lists for projects you are interested in.

Universal Squelch. *I need a squelch circuit for my tube-type CB receiver. Can you help me?*

The squelch circuit shown below is very effective, easy to install and operate. Only two tubes (nuvistors) are needed plus a



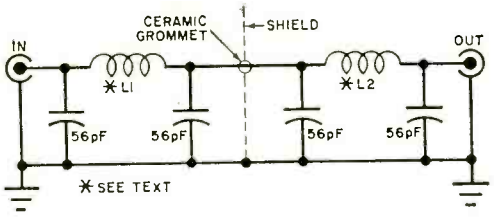
few low-cost parts. If your set already has a triode first audio stage, nuvistor *V2* can be dispensed with. If your set uses a pentode first audio stage, this can be replaced with the nuvistor (*V2*) stage shown.

Old UHF Tuner. *I have an old GE Model UHF-70 TV tuner that has "outlived" five TV sets and is still working. However, to make it work, I have to push in hard on the tuning knob and rock the band selector. During a single program I sometimes have to do this four or five times. Can you tell me what's wrong with the tuner?*

You do have an "oldie," all right. Well, I would say your tuner needs a complete overhaul. You may be able to cure the intermittent by cleaning all bandswitch contacts with a contact spray cleaner.

6-Meter Low-Pass Filter. *Can you please suggest a low-pass filter for 6 meters that is easy to make, requires no special tuning, and which will help me to get rid of TVI?*

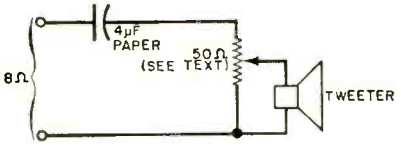
The filter shown below has been successfully used on 50 MHz and works very well.



Make sure the components are installed in a metal cabinet as shielding is important. Use good coaxial-type connectors for input and output connections. Coils *L1* and *L2* consist of 2¾ turns of #19 wire, ½" diameter, ⅜" long, ⅛" between turns. This filter will handle 10 watts.

Tweeter Volume Control. *A friend gave me a University Model 4401 tweeter for use with my hi-fi and I would like to add a volume control to it to control the output of the highs. How can I do this?*

See the schematic below. A wire-wound control with a rating of 3 to 5 watts should be used and it should have a logarithmic



taper, but because it is difficult to obtain other than a linear taper for the resistance specified, the attenuation will occur in the final third of resistance.

Dipole Differences. *I have been told that a ½-wave folded dipole antenna fed with 300-ohm line is better than a single ½-wave dipole fed with 72-ohm coaxial cable. Is this true?*

No, it is not true. The folded dipole does have a wider bandwidth but it is no better than the single ½-wave dipole so far as gain or directivity is concerned—for a given frequency.

6LQ6 and Higher Power. *Have any new tubes been developed for color television which can be used in some ham rigs to give more power?*

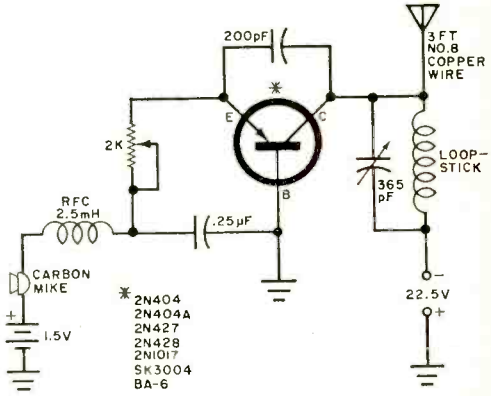
Yes, the 6LQ6 can replace the 6JE6A, or B, and has 200 watts plate dissipation. It is made by RCA and you'll be hearing more about it as time goes on.

Hallicrafters S40-A Improvement. *I am an SWL and have an S40-A receiver which I understand can be improved by switching the 6SG7 tube with a 6AC7 and the 6SA7 with a 6SB7Y. If this is so, what modifications would be necessary?*

You can change the 6SA7 without modification but the socket will have to be rewired for the 6AC7. Some improvement may be noted.

Wireless AM Mike. *I need an AM wireless mike to help park school buses. My radius of operation is about 50 feet and as each bus has an AM radio, special receiving equipment would not be required. Any ideas?*

The unit shown below will work fine and will not exceed the FCC radiation require-



ments for such a device. You can probably build the whole thing for less than $5.00. Good luck, and good parking!

Tube Problem. *Recently, the two final tubes in my "Galaxy V" failed. Because I could not obtain the GE 6HF5's recommended by the manufacturer, I used another brand. However, I could not neutralize the final with the other brand. Eventually, I located the GE tubes, and now the set works fine. Why should there be a difference in tubes of the same type number?*

There are differences in internal capacitance, construction, etc., in various brands. The type you tried would no doubt work in a TV set, but for r.f. power work it is another story.

CB Transceiver to 10 Meters. *How easy is it to convert a CB rig to 10 meters for ham operation? What has to be done?*

Converting any 11-meter CB transceiver for 10-meter ham-band operation requires some technical skill. Generally, crystals must be changed, coils trimmed a bit in the r.f. circuits, and some receiver mixer circuits modified. POPULAR ELECTRONICS pub-

(*Continued on page 99*)

the product gallery

REVIEWS AND COMMENTARY ON ELECTRONIC GEAR AND COMPONENTS

KNIGHT-KIT LINEAR AMPLIFIER (Model T-175)

If you want to give your low-powered AM, CW, or SSB 6- or 10-meter signal a 10-dB power boost, the Knight-Kit Model T-175 linear amplifier (from Allied Radio, 100 N. Western Ave., Chicago, Ill.) will do the trick. Designed for operation on either the 6- or 10-meter ham bands, it can deliver an output up to 40 watts on AM phone, over 75 watts on CW, and 150 watts PEP on SSB.

The average ham constructor should be able to assemble the Model T-175 kit in 8-10 hours of working time. The instruction book is crystal-clear, and the only difficulty that your reviewer encountered was a minor one—in soldering the clips for the 6JE6 plate caps. This problem was finally solved by first "etching" in some plating with acid-core solder, rinsing thoroughly, and completing the operation with rosin-core solder.

The Model T-175 is housed in a green metal cabinet with a green and silver panel —to match the Knight-Kit TR-106 6-meter transceiver. The linear amplifier has two panel meters—one a combination grid current and r.f. output meter, and the other a plate milliammeter to simplify tuning.

Putting the Model T-175 into operation is very simple. The principal requirement is to hold the maximum amplifier grid current down to something below 12 mA on AM phone. For CW operation, the grid drive is increased to 20 mA and the output goes up to about 75 watts or more.

At first glance, the shielding of the Model T-175 appears to be less than adequate to eliminate possible harmonic radiation—especially on 6 meters in a TV Channel 2 viewing area. In on-the-air tests, however, the amplifier created no interference to two different name-brand TV receivers located within 15 feet of your reviewer's 6-meter rig. In fact, excellent reception was obtained from TV transmitters some 30 miles away on Channels 5, 7, 9, 11, 26, and 32. If Channel 2 interference were to be encountered, a low-pass filter would no doubt conquer this problem.

The Knight-Kit Model T-175 linear amplifier is a nice addition to Allied Radio's popular kit line. Although it was tested primarily on 6 meters, the linear amp also performs equally well on 10 meters and might be an excellent investment for the ex-CB operator who has converted his old 11-meter transmitter to the 10-meter ham band.

Circle No. 86 on Reader Service Page 15 or 115

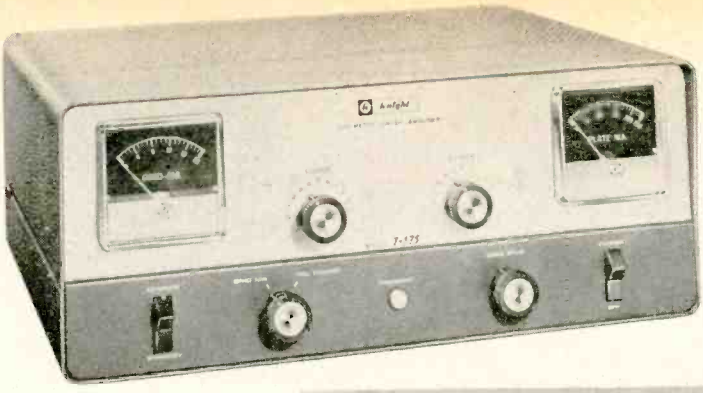
ERI AM/VHF-FM POCKET RADIO (Multivox 140)

If you are a newspaper reporter, volunteer fireman, or just plain SWL, you've probably been eyeing the new crop of transistor pocket radio receivers that tune 150 MHz, and up. Most of these receivers have two bands—one covering the usual AM broadcast frequencies, the second tuning 150-175 MHz. The latter band is popularly referred to as the VHF hi-band and 70% of all police and fire stations operate on these frequencies. The hi-band is also loaded with thousands of stations operating in a variety of fixed-to-mobile (or vice-versa) radio services—including taxis, buses, appliance service vehicles, mobile radiotelephones, etc.

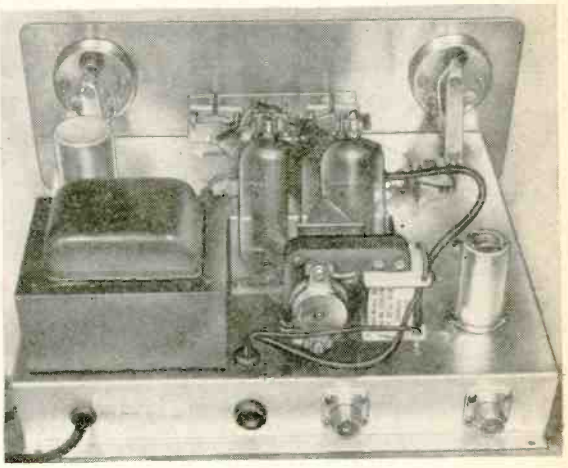
Any 2-band receiver that tunes regular AM broadcasts and the VHF band is a compromise product. All sorts of trick circuits have been developed to alleviate the problems of tuning range, AM vs. FM detection, etc., and the potential buyer must be careful. At the worst, these receivers have absolutely no image rejection or are readily overloaded and swamped by nearby powerful TV or FM broadcasting stations. At best, reception is clear, selectivity is adequate, and overloading non-existent.

Your reviewer was pleasantly surprised by the Multivox 140 (distributed by ERI, Box 5877, Washington, D.C. 20014). During a desk-top test in mid-Manhattan—surrounded by *volts of r.f. energy*—the Multivox 140 was quiet, oblivious to interference, reasonably sensitive, and seemingly immune to body capacitance effects. The weather broadcaster (KW035) on 162.55 MHz could be received with the telescoping antenna fully collapsed.

When the Multivox 140 was taken 30 miles from New York City, reception of police and fire signals within a radius of 10-15 miles demonstrated the good sensitivity of the unit in a typical suburban dwelling. Weather broadcasts continued to be received with ex-



This efficient linear amplifier can be driven by any transmitter on 6 or 10 meters which has a 4-watt output. The T-175 will deliver up to 40 watts on AM phone, 75 watts on CW, or 150 watts PEP on SSB. Kit can be assembled in a minimum amount of time; your reviewer encountered one minor difficulty. Timing clock motor visible on rear of chassis protects linear amplifier power output tubes by delaying turn-on time of plate voltage.



ERI AM/VHF POCKET RADIO

Two-band, 12-transistor radio receiver is a recent import from Taiwan. Switch on back of unit changes wave bands and detection circuitry. In tests made at POPULAR ELECTRONICS, this receiver demonstrated good sensitivity and outstanding immunity to strong TV signals in immediate vicinity. Dial accuracy was good and selectivity adequate for suburban reception.

tpg

CONTINUED

cellent clarity. The only problem encountered was from aircraft (jets) flying overhead breaking through on an image frequency.

Having tested many pocket-type VHF receivers, your reviewer feels that the Multivox 140—selling at $19.95—is a rather remarkable import.

Circle No. 87 on Reader Service Page 15 or 115

ATLAS SOUND MOBILE SPEAKER (Model MO-1)

If you have a CB transceiver mounted in your car or truck, are you missing a chance to double its usefulness? According to a survey of CB equipment made by POPULAR ELECTRONICS, four out of every five CB transceivers have a panel-mounted switch that converts the CB modulator stages to a public address amplifier. All you need to do is connect the appropriate speaker to the designated transceiver output terminals and you have a powerful 3-4 watt p.a. system.

Mobile loudspeakers suitable for CB/p.a. use are manufactured by Atlas Sound (10 Pomeroy Rd., Parsippany, N.J. 07054). Your reviewer scrutinized a recent Atlas Sound catalog and selected the weatherproof Model MO-1 for testing in conjunction with a Regency CB "Ranger." Possibly a Model MO-2 speaker would have performed as well; the principal difference between the two is that the Model MO-1 was designed for outdoor mounting, and the Model MO-2 for mounting in a concealed, limited space under the hood between the radiator and grill work. The measured output of the Regency "Ranger" is 3.3 watts of audio at 1000 Hz.

The Model MO-1 was "road-tested" atop the cab of a gas station pickup truck for several months. The mounting was rigid and the weather frequently foul, but the MO-1 came through with flying colors. In the words of the gas station owner, "We don't know how we ever got along without this p.a. system to call instructions out to cars stalled on the roadway—and you can be sure we won't be without it again."

Both the MO-1 and the MO-2 sell for $26.70 each and an economy model which has a plastic bell (the others have metal bells) goes for only $14.85. The latter, the model EC-10, is suitable for either outdoor (roof or cowl) as well as protected under-the-hood mounting.

While CB business use of the p.a. system has been stressed here, some thought should also be given to the facility in many CB transceivers of piping the received *CB output* to an external speaker. Some transceivers have a switch on the front panel for this purpose—on others you can do it by interchanging phone jacks.

Circle No. 88 on Reader Service Page 15 or 115

KNIGHT-KIT REGULATED SUPPLY (Model KG-663)

The electronics experimenter who does any work with solid-state components must—sooner or later—buy or build a low voltage power supply. The ideal supply will put out pure d.c. with a ripple well below 1 millivolt, continuously variable voltage up to at least 30 (or more) volts, have current regulation up to at least one ampere—and be short-circuit-proof. Only a few power supplies can fulfill this bill of particulars. One of them, the Knight-Kit KG-663, exceeds all of the above requirements with room to spare.

Now being offered by Allied Radio Corp., the KG-663 ($94.50) is occupying a select space on the POPULAR ELECTRONICS laboratory workbench. This is a deluxe low-voltage supply with a continuously variable range up to 40 volts and 1.5 amperes. The output voltage can be accurately set with the concentric (coarse and fine) front panel controls. The current limiter control permits the experimenter to preselect the desired maximum current that can be delivered to an experimental circuit. Any excess current demand by the test circuit is automatically shorted out. This feature alone will repay the initial investment in the KG-663 if you perform delicate transistor experiments.

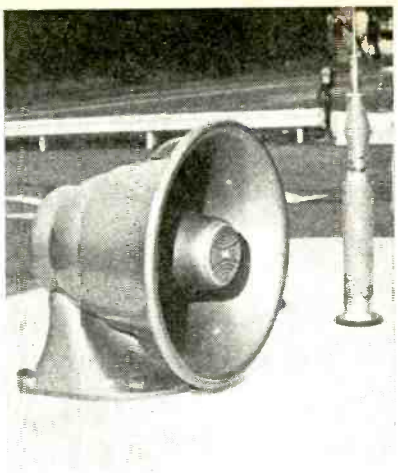
There are several understated features in the Model 663. One is the provision for remote error sensing or programming (control). This feature allows precise voltage or current control when the experiment is at a distance from the power supply. Another feature is the "Operate/Standby" switch that allows the experimenter to interrupt a test without continuously resetting the voltage and current limiting controls.

The construction of the KG-663 is up to the usual high Knight-Kit standards. Wiring time should average a little over four hours. Your reviewer had no problems in assembling this kit. And, we still appreciate the Knight-Kit pre-cut and pre-trimmed color-coded hookup wires. Even with an average kit (in terms of construction difficulty), such as the KG-663, this little "extra" saved about 20-25 minutes.

Circle No. 89 on Reader Service Page 15 or 115

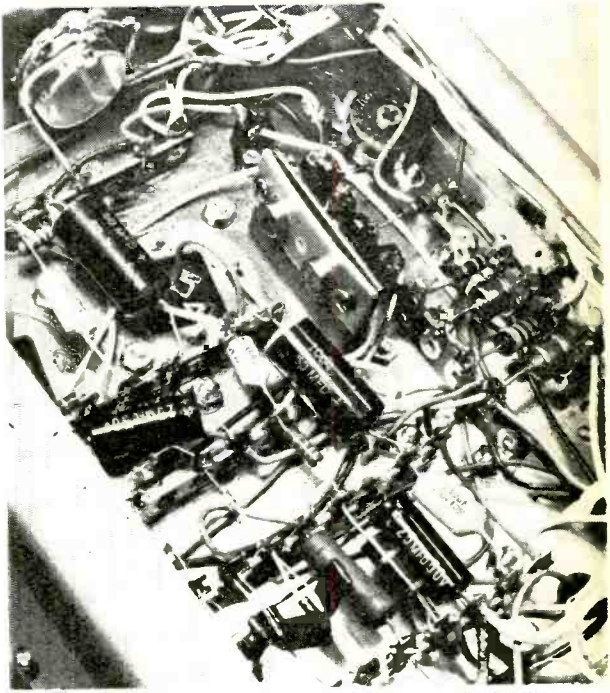
ATLAS COMMUNICATIONS SPEAKER

Take advantage of the public address output connections of your CB transceiver. In the mobile installation at right, an Atlas Sound outdoor communications speaker has been mounted atop the cab of a gasoline station pickup truck. The CB transceiver inside the cab can be switched to p.a. whenever the driver wants to talk to cars being pushed.

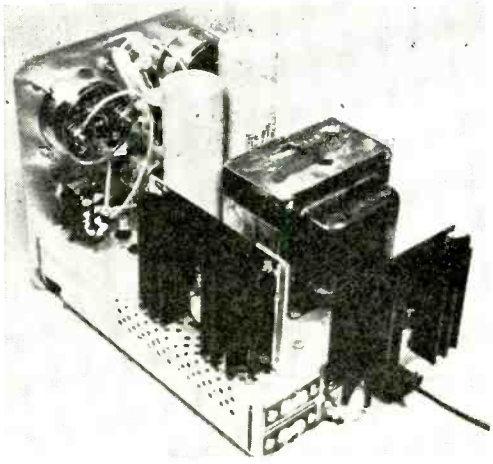


KNIGHT-KIT LOW VOLTAGE SUPPLY

The Knight-Kit KG-663 is a new member of the Allied Radio test equipment line-up. External cabinet dimensions complement other items in this line.



The point-to-point wiring of the KG-663 kit takes about 4½ hours. Chassis is heavy-gauge metal and the whole unit has a feel of solid construction.



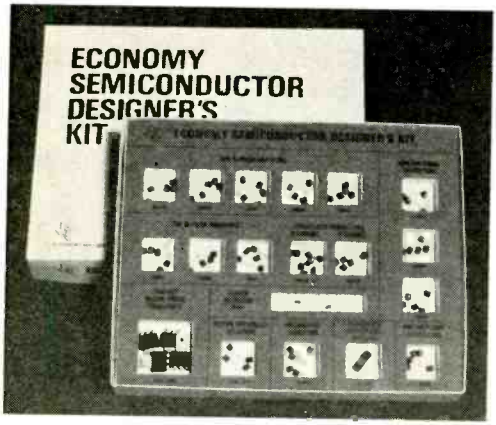
Heat sinks, large transformer, and filter capacitors are shown at left. Terminals strips in lower left corner of chassis are for remote sensing connections.

SOLID STATE

By LOU GARNER, Semiconductor Editor

MOST electronics enthusiasts have a great interest in experimenting with various types of semiconductors, and appetites have been further whetted by the availability of an ever-widening range of devices. However, there is one common problem that almost all hobbyists encounter—the cost of a good sampling of new semiconductors makes a dent in a sometimes meager budget. To help solve this problem, several manufacturers have come up with semiconductor "kits" which can put many of the latest devices into the hands of the serious experimenter at a reasonable cost.

For example, Texas Instruments' "Economy Semiconductor Designer's Kit" sells for only $24.50 and includes 25 *npn* and 15 *pnp* bipolar amplifier transistors, 5 *pnp* and 15 *npn* bipolar switching transistors, 10 *n*-channel FET's, 5 *p*-channel FET's, 5 UJT's, 4 SCR's, 5 silicon rectifiers, 4 silicon power transistors, and one IC operational amplifier—a grand total of 94 semiconductors at about 26 cents each. The kit is available from any TI franchised distributor.



Texas Instruments' "Economy Semiconductor Designer's Kit" offers a large selection of semiconductors at a modest price. Other "kits" are available.

Radio Corporation of America's "PHP Max Value Sampler," stocked by many RCA semiconductor distributors, sells for only $3.95, yet contains 22 high-quality transistors, two each of 11 different types (about 18 cents per device). All are silicon planar types in hermetically sealed packages and include low-noise UHF and VHF amplifiers, high-gain r.f. types, high-voltage units, and medium power types. Ask for the QK2100 Sampler.

Siliconix's "VCR FET Designer's Kit" (DK-6) at $19.50 consists of an assortment of six voltage-controlled resistor (VCR) type FET's worth $30 if purchased individually. For further information on this new type of device, contact your local Siliconix distributor, or write to Siliconix, Inc., 1140 W. Evelyn Avenue, Sunnyvale, California 94086.

Incidentally, if you like to work with semiconductor circuits, you might want to get a copy of the latest RCA "Silicon Power Circuits Manual SP-50" (available for $2 at your local parts distributor). This 400-page manual contains a wealth of design and application information covering all types of power circuits using silicon semiconductor devices, including transistors, rectifiers, SCR's and triacs.

Reader's Circuit. Submitted by Professor Raoul J. Fajardo of the Electronics Department of Pasadena City College (1570 East Colorado Blvd., Pasadena, Calif. 91106), the half-watt audio amplifier circuit in Fig. 1 is suitable for a variety of portable (battery-operated) applications, and can be used in receivers, field intercoms, and record players. According to Professor Fajardo, the circuit furnishes 67 dB gain, has an extremely linear frequency response from 16 Hz to over 60 kHz, and is so efficient that up to 100 hours of operation can be obtained from a fresh set of "D" cells.

An earlier contribution by the Professor—a 5-watt amplifier circuit which was featured in our March, 1965 column—proved so popular that he received letters from readers in the Philippines and South America as well as from many in the 50 United States.

This time Professor Fajardo has developed a unique complementary design which features direct coupling to the speaker as well as between stages. In operation, *C1* serves as the input coupling capacitor

to predriver stage *Q1*. Temperature-compensated base bias is established by a voltage divider made up of *R1*, balancing potentiometer *R2*, and *R3* in conjunction with emitter resistors *R6* and *R7*, the latter bypassed by *C3*. Resistor *R4* serves as *Q1*'s collector load while *R5*, bypassed by *C2*, acts to establish *Q3*'s base bias level for push-pull operation. The amplified output signal from *Q1* is applied to driver transistors *Q2* and *Q3* with these, in turn, direct-coupled to the class B complementary symmetry power amplifier stage, *Q4* and *Q5*. The dual power supply, *B1* and *B2*, is controlled by a d.p.s.t. switch, *S1*.

Standard components are used. Transistor *Q1* is a 2N404, while *Q2* and *Q5* are Motorola *pnp* HEP 51's and *Q3* and *Q4* are *npn* HEP 53's. All resistors are half-watt types, and *R2* is a linear potentiometer. Electrolytic capacitors *C1*, *C2*, and *C3*, can be 6- to 12-volt types. Batteries *B1* and *B2* each consist of two series-connected "D" cells (four in all), with *S1* a toggle, slide, or rotary switch. Finally, an 8-ohm PM speaker is used.

Neither layout nor lead dress should be overly critical, but, of course, good wiring practice should be followed in duplicating the circuit. Signal leads should be kept short and direct, and all d.c. polarities observed. With relatively few parts, the design is ideal for etched circuit or perforated board construction.

Once the wiring is completed and checked for possible errors, *R2* must be adjusted for balanced operation. The preferred technique requires an oscilloscope and audio signal generator. With the scope connected across the speaker terminals, apply a 1-kHz signal to the amplifier's input terminals, adjusting the input level until clipping is observed. Next, adjust *R2* until both peaks (positive and negative) of the amplified signal begin to clip at the same level.

If suitable test equipment is not available, a reasonably good adjustment can be made by using an audio signal obtained from a tuner or small receiver and adjusting *R2* for maximum *undistorted* output volume.

Manufacturer's Circuit. Requiring a minimum of components, the a.c. power line control circuit in Fig. 2 was abstracted from Technical Specification Data Bulletin, File No. 257, issued by RCA's Electronic Components and Devices Division in Harrison, N.J. Featuring a relatively new semiconductor device with a built-in trigger diode element, the circuit can be used as a light dimmer, heater element control, or speed control for universal motors, and is capable of handling loads of up to 720 watts.

The circuit's basic operation is similar to that of a phase-controlled SCR circuit, except that the triac is a bi-directional silicon switch which allows full-wave operation and hence is not only more efficient than the unidirectional SCR, but permits a wider range of control action. The triac is a Type 40431 (available from any RCA-franchised

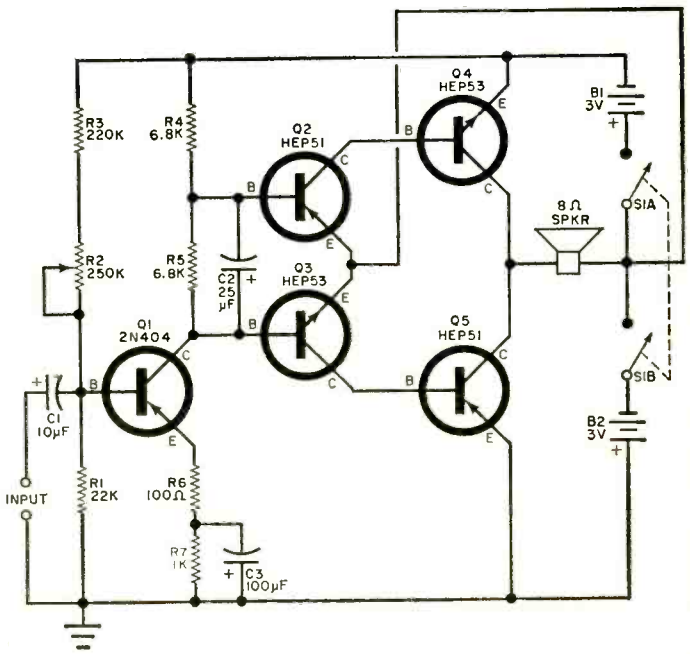


Fig. 1. Professor Fajardo's half-watt amplifier has 67 dB gain, and a frequency response from 16 Hz to over 60 kHz. Four "D" cells power it for 100 hours.

semiconductor distributor), while *R1* is a conventional potentiometer and *R2* a 1-watt fixed resistor. Capacitors *C1* and *C2* are 200-volt ceramic, plastic film, or paper types. If desired, a s.p.s.t. switch may be connected in series with the load as a basic on-off control.

In common with most power control circuits, layout and wiring are not overly critical. However, the triac must be heat-sinked if used near its maximum rating. Since the triac has a bi-directional conduction characteristic, its electrodes cannot be properly identified as anode, cathode, and gate as in an SCR. Rather, the gate designation is retained only for the control electrode, while the other two electrodes are identified simply as "main terminals" (*MT1* and *MT2* in Fig. 2). The 40431 is assembled in a modified TO-5 package, with the outer metal case serving as *MT2*'s terminal and conventional wire leads provided for the gate and *MT1* connections. Its case is tin-plated to facilitate soldering directly to a heat sink.

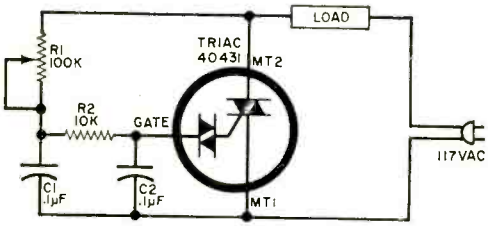


Fig. 2. RCA power controller uses a single triac.

Overseas News. A solid-state instrument which may help correct color blindness has been designed by a Japanese scientist, Dr. Susumu Imamura, of Kansai University. Dubbed a "Sunvister," the instrument is essentially a low-frequency current generator. In practice, it is used by the patient for 20 minutes a day over a three- to six-month period. Initial results have been quite promising.

Using a mesa-collector, planar-emitter structure developed by a Dutch firm, Philips' Gloeilampenfabrieken, semiconductor manufacturers in both Japan and the United States are now producing power transistors with collector-base ratings of 1500 volts. Designed for use in TV sets as horizontal output amplifiers, the new transistors are being offered by the Matsushita Electronics Corp. in Japan and the Amperex Electronic Corp. in the United States.

The new Model 1600 VW's produced in West Germany feature fully electronic fuel-injection control systems. About the size of a cigar-box, each control unit employs 25 transistors, 35 diodes, 140 resistors, and 20 capacitors. In operation, sensors develop information on intake-manifold pressure, cylinder temperature, crankcase temperature, throttle position, and engine speed which is fed to the control unit. The electronic device, in turn, develops control signals for the fuel-injection valves to insure maximum efficiency and minimum exhaust pollution.

Transitips. Reader John H. Cone (1496 North Lake, Pasadena, Calif.), a West Coast real-estate executive, suggests a simple technique for determining whether a given semiconductor device is germanium or silicon. His technique is based on the differences in the voltage drops across forward-biased diode junctions.

The basic circuit used is given in Fig. 3. Although a *pnp* transistor is featured in the example, a *npn* type can be checked just as easily by reversing all d.c. polarities. In addition, the same basic technique can be applied to diodes or, for that matter, to *any* semiconductor device having a *pn* diode junction.

In the diagram, *I* is a milliammeter, *V* a sensitive voltmeter, and *R* a current-limiting resistor. The latter's value is not critical—from 100 to 1000 ohms is satisfactory for most tests. A variable d.c. power source is needed (a potentiometer connected across a 12-volt battery can be used in a pinch), and the test is made simply by adjusting

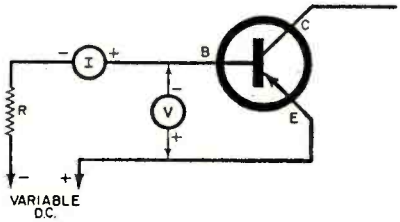


Fig. 3. John Cone's simple transistor identifier.

the power source for a base-emitter current of 10 mA as indicated on *I*, and checking the base-emitter voltage on *V*.

According to reader Cone, commercial germanium devices have a *pn* junction voltage drop between 0.3 and 0.5 volt, with an average near 0.4 volt, while silicon devices, on the other hand, have drops of between 0.55 and 0.8 volt, averaging about 0.7 volt. If the *pn* diode junction voltage is above 0.6 volt, then you are almost certainly dealing with a silicon device—and with germanium if the voltage is below that figure.

That does it for February, fellows. Until next month . . .

—Lou

AMATEUR RADIO

By HERB S. BRIER, W9EGQ
Amateur Radio Editor

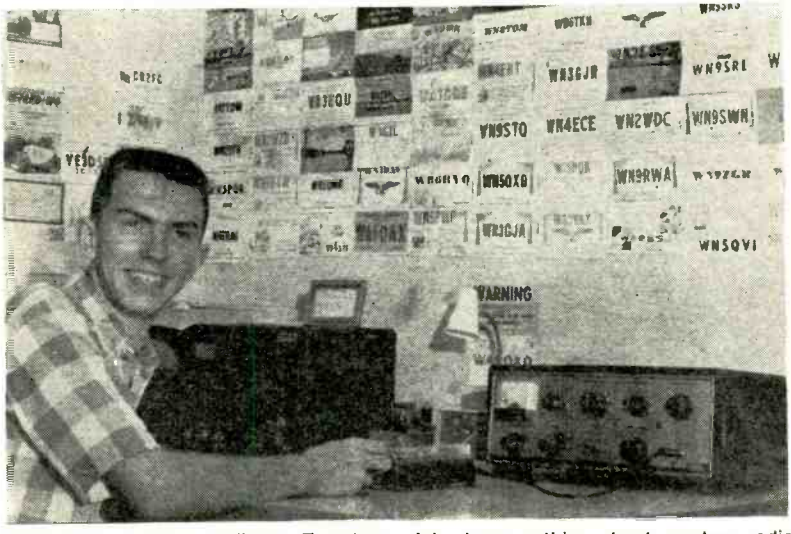
AMATEUR TELEVISION AROUND THE WORLD

SINCE the world's first amateur 2-way TV contact in May, 1952, between G3BLV/T and G5ZV/T, English amateurs have been active TV'ers. Across the English Channel, most European governments—except Finland—were reluctant to issue ATV licenses prior to 1965; hence, most early European ATV work was of the closed-circuit type. Nevertheless, there have been active ATV groups in countries like Belgium, Finland, France, Germany, Holland, and Switzerland for years. Three amateur TV licenses have been issued in India, and ATV stations exist in the Falkland Islands, Japan, New Zealand, and the Phillippines.

Australia has a particularly resourceful group of ATV'ers. Recently, they set up an amateur TV receiver at an exhibition to receive sound and pictures from a TV transmitter installed on a hill half a mile away. At the last moment, however, the Australian "FCC" vetoed transmitting picture and sound signals simultaneously on different frequencies. Undaunted, the boys set up a 250-watt electric light at the transmitting site and beamed it towards the exhibition hall with a reflector and modulated the light beam with an audio signal. At the exhibition hall, they aimed a photoelectric cell at the light on the hill and fed the cell's output into the audio system of the TV receiver. The demonstration was a complete success.

In the United States, there are about

AMATEUR STATION OF THE MONTH



Richard A. Hopkins, WA5QQF, Texarkana, Ark., knew nothing about amateur radio until he visited the shack of Jim Culver, W5WGD. Dick started learning the code the next day. After he received his Novice license, he worked 40 states and five countries with an EICO 720 transmitter and an old, old Hallicrafters S-40B receiver. A Swan-350 transceiver is on the way now. Also, Dick's dad is studying "like mad" for HIS ham ticket. WA5QQF will receive a one-year subscription for submitting the winner for February in our Amateur Station of the Month photo contest. To enter the contest, send a clear picture of your station with you at the controls and some details on the equipment you use and your ham career to Amateur Radio Photo Contest, c/o Herb S. Brier, W9EGQ, P. O. Box 678, Gary, Ind. 46401.

5000 amateurs with aspirations to transmit TV pictures; at any one time, approximately 1000 of them are capable of doing so. In addition to transmitting conventional TV pictures, U.S. amateurs have been pioneering 120-line, "slow-scan" TV.

Compared to the 4- to 10-MHz bandwidth and 30- to 200-mile range of conventional TV signals, slow-scan TV signals occupy no more bandwidth than a conventional AM or SSB phone signal and can be transmitted worldwide. Furthermore, they can be transmitted and received on conventional amateur phone receivers and transmitters with the addition of relatively inexpensive accessory equipment. Although slow-scan TV can be used only to televise still objects, and its detail is less than the conventional 525-line TV, the results are surprisingly good for amateur purposes.

In 1959, WA2BCW successfully transmitted slow-scan TV pictures to G3AST on 29 MHz. In recent tests authorized by the FCC, several amateurs were able to send good slow-scanned TV pictures to Antarctica and other DX countries regularly on 14 and 21 MHz. As a result of these tests, the FCC will probably soon permanently authorize General and Extra Class licensees to use slow-scan TV in portions of various amateur phone bands.

For much of the above information, your Amateur Radio Editor is indebted to *SIRAN* (South India Radio Amateur Newsreel), the club paper of the Bangalore, India, Amateur Radio Club.

"Mr. 160 Meters" himself, Stew Perry, W1BB, Winthrop, Mass., operates from his special 160-meter portable station located on a cliff overlooking the Atlantic Ocean. Running 100 watts input to a Johnson "Valiant" transmitter feeding an inverted-V antenna, Stew has worked VS1LP, Singapore—probably the longest distance ever covered on 160 meters—and all other continents from this station.

Leon DeVries, WA7DTH, is trustee for WA7GPD, Cyprus Pirate Amateur Radio Club station, Cyprus High School, Magna, Utah. The station, equipped with a Collins 32-S3 transmitter, 75-S3C receiver, and 30-L1 amplifier, plus a Hy-Gain tri-band beam 80 feet high, would be the envy of most hams.

ARRL Novice Roundup. February and March offer both Novices and old-timers operating events tailored specifically for them. For Novices, there is the annual ARRL Novice Roundup. Operating a maximum of 40 hours between 6 p.m., local time, February 3, and 6 p.m., local time, February 18, Novices will work all classes of amateurs, and the latter will work Novices. Each contestant will earn a point every time he sends a contest number (starting with number one) and the name of his ARRL section, and receives the same type of information from the other station.

To obtain your score, you add the highest code speed shown on your ARRL Code Proficiency Certificate—if you have one—to your QSO points, and multiply the total by the number of different ARRL sections worked. Mail your score to: Communications Department, American Radio Relay League, Inc., 225 Main St., Newington, Conn. 06111. The ARRL will award certificates to the highest scoring Novices in each section. You can write to the ARRL ahead of time if you wish, and request log sheets and a free map of the ARRL sections.

Novices must, of course, operate inside the Novice bands, but other classes of amateurs may participate in the Roundup from frequencies just outside the Novice bands; so Novices who neglect to listen outside their bands will probably miss many contacts. Good luck, and may you add many states to your WAS (Worked All States) total.

International DX Competition. The 1968 International DX Competition is divided

(*Continued on page* 102)

ON THE CITIZENS BAND

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

DURING 1968 your CB Editor plans to visit various parts of the country to meet with CB'ers and discuss their problems, their present activities and plans for the future, and to monitor their operation. The purpose of such monitoring will be to get an "on location" representative view of how CB radio is being used in various parts of the United States. The first monitoring session was conducted in Denver, Colorado.

Veteran TV personality (and old friend) Ron Voigt, anchorman newscaster with KWGN-TV, Denver, Colorado, welcomed us to the mile-high city, and pointed out spots where CB monitoring would be most effective. The end of the line proved best,

DEADLINE DENVER

approximately three-quarters of the way up the side of Lookout Mountain, which overlooks Golden, Colorado, and sports a crown of transmitter towers for radio and TV stations. Monitoring at this level appeared to be nearly as effective as flying over the area at a few thousand feet.

During a four-day period of intermittent monitoring, it was interesting to note that the claims regarding the flagrant misuse of the CB channels do not apply to Denver, Colorado. The CB'ers here apparently take pride in keeping channel 9 for use exclusively as the area calling channel. Nearly 400 calls were monitored, and only once did an infraction of the rules occur—when the "Roadrunner" placed a call to "The Eagle." The "bird" did not answer—he was apparently out of his "nest."

On the great majority of Denver calls monitored, both stations agreed upon an alternate channel and cleared "9" immediately after contact was made. In fact, in order to monitor actual conversations, it was necessary to tune the band. "Nine" was consistently silent, as it should be. The CB activity in the Denver area was generally orderly, proper, and there was a lot less chit-chat than you might expect.

By contrast, at about the same time, our voluntary western correspondent Ken Winslow reported that in California the FCC was busy fencing in 18 violators in the Hayward, San Leandro, and Fremont area.

Newscaster Ron Voigt simulates a CB transmission for your CB Editor on the news set at KWGN-TV, Denver, Colorado. (Channel 2 photo by Dave Porta)

Among them were "Granny Goose," "Tarantula," and "Drunken Alcoholic," to name a few. The FCC agents monitored the happenings for two weeks, homed in on the operators' signals, then closed down. The violators could get $100 fines for their frivolity.

Also, by contrast, your CB Editor had a chance to do some monitoring around Chicago, Ill., where CB activity was heavy, with shenanigans and legal transmissions

(*Continued on page* 105)

A Johnson "Messenger III" portable was used for monitoring purposes near the top of Lookout Mountain by your CB Editor. (Photo by Harry Gladwin)

FOREIGN-LANGUAGE BROADCASTS TO NORTH AMERICA

Prepared by ROGER LEGGE

LANGUAGE	STATION	TIME—EST	TIME—GMT	FREQUENCIES (MHz)
ALBANIAN	Tirana, Albania	9-9:30 p.m.	0200-0230	6.187, 9.715
ARMENIAN	Yerevan, U.S.S.R.	10-10:30 p.m.	0300-0330	15.18, 17.775, 17.88
ARABIC	Beirut, Lebanon	9-9:30 p.m.	0200-0230	11.925
	Cairo, U.A.R.	7-8 p.m.	0000-0100	9.475
BULGARIAN	Sofia, Bulgaria	8-8:30 p.m.	0100-0130	9.70
CHINESE	Peking, China	8-10 p.m.	0100-0300	15.10, 15.20, 17.715
		10-12 p.m.	0300-0500	15.35, 17.735
CZECH/SLOVAK	Prague, Czechoslovakia	8:30-9 a.m. (Sun.)	1330-1400	15.448, 17.705, 21.45
		10-10:30	0300-0330	6.355, 7.345, 9.55
DANISH	Copenhagen, Denmark	7-7:45 a.m.	1200-1245	15.165
		8-8:45 p.m.	0100-0145	9.52
DUTCH	Brussels, Belgium	6:15-8 p.m.	2315-0100	9.615
	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	9.615
	Paris, France	7-7:30 p.m.	0000-0030	9.755, 11.845, 17.73
	Rome, Italy	8:20-8:35 p.m.	0120-0135	9.575, 11.81
	Vatican City	8:10-8:25 p.m.	0110-0125	7.25, 9.69, 11.76
GERMAN	Berlin, Germany	8:30-9:30 p.m.	0130-0230	9.50, 9.60
	Cologne, Germany	7-10 p.m.	0000-0300	6.10, 9.545, 11.795
		10 p.m.-1 a.m.	0300-0600	6.10, 9.735, 11.795
	Vienna, Austria	7-11 p.m.	0000-0400	9.77
HUNGARIAN	Budapest, Hungary	7-7:30 p.m.	0000-0030	6.235, 9.833, 11.91
		9-10 p.m.	0200-0300	6.235, 9.833
ITALIAN	Rome, Italy	5:30-8 p.m.	2230-0100	9.575, 11.81
JAPANESE	Tokyo, Japan	7:15-7:30 a.m.	1215-1230	9.505
		8:30-9 p.m.	0130-0200	15.135, 15.235, 17.825
LITHUANIAN	Vilnius, U.S.S.R.	5:30-6:30 p.m.	2230-2330	9.745, 11.96, 11.975
NORWEGIAN	Oslo, Norway	6-7:30 p.m.	2300-0030	9.55, 11.735, 11.85
		10-11:30 p.m.	0300-0430	9.55, 11.735, 11.85
PORTUGUESE	Lisbon, Portugal	7-9 p.m.	0000-0200	6.025, 9.68, 11.935
		9:45-11 p.m.	0245-0400	6.025, 9.68, 11.935
RUMANIAN	Bucharest, Rumania	6:15-7 p.m.	2315-0000	6.15, 9.51, 11.94
		10:30-11 p.m.	0330-0400	6.15, 9.57, 11.94
RUSSIAN	Moscow, U.S.S.R.	7 a.m.-1 p.m.	1200-1800	15.15, 17.78, 21.575
		6:30-7 p.m.	2330-0000	9.63, 12.03
		9-9:30 p.m.	0200-0230	9.61, 9.63
SPANISH	Havana, Cuba	6 a.m.-4 p.m.	1100-2100	6.135, 11.76, 15.27
		5-11 p.m.	2200-0400	6.135, 9.55
	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	8-8:30 p.m.	0100-0130	5.99
		11-11:30 p.m.	0400-0430	11.705
UKRAINIAN	Kiev, U.S.S.R.	6:30-7 p.m.	2330-0000	9.61, 9.665, 9.685
		10:30-11 p.m.	0330-0400	9.61, 9.685, 12.03

SHORT-WAVE LISTENING

By HANK BENNETT, W2PNA/WPE2FT
Short-Wave Editor

SHORT-WAVE BROADCASTING FROM VL-LAND

FOR THE PAST several months there has been an increasing interest in several short-wave broadcast stations operated in the Far Southwest Pacific by the Australian Trust Administration of Papua and New Guinea. These stations transmit in the two-to-four megahertz band and *CAN* be heard if you are fortunate enough to tune during good receiving conditions. Trying to tune in a low-powered 90-meter band station at a distance of several thousand miles can be a formidable challenge. But for those who have asked for a list of these stations, here is a complete run-down on them, including frequency, power, and operating times.

VL9BR, *R. Rabaul*, New Britain, New Guinea, 3385 kHz, 10 kW, operates at 2000-2200 and 0600-1300 in Tolai, pidgin, and English, broadcasting to the Tolai people of the Gazelle Peninsula, New Britain (population, 53,000).

VL9CD, *R. Wewak*, Wewak, New Guinea, 3335 kHz, 10 kW, operates at 2000-2200 and 0615-1230 in pidgin English. This station serves the people of the Sepik District (population 200,000).

VL8BK, *R. Kerema*, Gulf District, Papua, 3245 kHz, 250 watts, operates at 0700-1200 in Toaripi, Orokolo, Eng., and Police Motu (the *lingua franca* of the Islands). The area served is the Gulf District of Papua (population, 55,000).

VL8BD, *R. Daru*, Western District, Papua, 3305 kHz, 10 kW, operates at 0645-1200 in Police Motu and English, broadcasting to the Western District of Papua (population, 60,500).

VL9CG, *R. Goroka*, Eastern Highlands, New Guinea, 2410 kHz, 250 watts, operates at 0700-1130 in Gahuku, Kafe, Kuman (language of the Chimbu people) and pidgin. The Eastern Highlands is the area served (population, 286,000).

VL9CH, *R. Mount Hagen*, Western Highlands, New Guinea, 2450 kHz, 250 watts, operates at 0730-1130 in pidgin English, Enga, Medlpa, and Mid Wahgi. This station serves the Western Highlands (population, 304,000).

Programming on these six stations is designed exclusively for the people covered by the stations and all the announcing and presentation is done by natives of Papua and New Guinea. Musical programs range from traditional music to pop, and there are numerous newscasts. Features include health, agriculture, and children's programs, hit parade programs in pidgin English and Police Motu, broadcasts of local government council meetings and interviews. All technical services, transmitters, studio equipment, etc., are supplied and serviced by the Department of Posts and Telegraphs,

(Continued on page 112)

One of New England's veteran DX'ers, Fred Barrett, WPE1FD, Stamford, Conn., has been an SWL enthusiast since 1928. His receiving equipment includes a Hallicrafters SX-71 (center), a BC-453 on top of a BC-454 (at right), and a power booster topped by a 6-antenna switch box (at left). Incidentally, Fred is the owner of an old Radio Museum that may be visited by appointment only.

ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

FOR THE MONTH OF FEBRUARY

Prepared by ROGER LEGGE

TO EASTERN NORTH AMERICA

TIME—EST	TIME—GMT	STATION AND LOCATION	FREQUENCIES (MHz)
7 a.m.	1200	Melbourne, Australia	9.58, 11.71
7:15 a.m.	1215	Montreal, Canada	9.625, 11.72
7:45 a.m.	1245	Copenhagen, Denmark	15.165
9 a.m.	1400	Stockholm, Sweden	21.585
6 p.m.	2300	London, England	6.11, 9.58, 11.78
		Moscow, U.S.S.R.	7.15, 9.665, 9.685
7 p.m.	0000	Sofia, Bulgaria	9.70
7:30 p.m.	0030	Budapest, Hungary	6.235, 9.833, 11.91
		Johannesburg, S. Africa	11.875, 15.22
		Kiev, U.S.S.R. (Mon., Thurs., Fri.)	9.61, 9.665, 9.685
		Stockholm, Sweden	5.99
7:50 p.m.	0050	Vatican City	7.25, 9.69, 11.76
8 p.m.	0100	Berlin, Germany	9.50, 9.60
		Havana, Cuba	9.525
		Madrid, Spain	6.13, 9.76
		Peking, China	15.06, 17.68, 17.795
		Prague, Czechoslovakia	6.355, 7.345, 9.55
		Rome, Italy	9.575, 11.81
8:30 p.m.	0130	Berne, Switzerland	6.12, 9.535, 11.715
		Cologne, Germany	9.64, 11.945
		Hilversum, Holland	9.59 (Bonaire relay)
		Tirana, Albania	6.187, 7.30
9 p.m.	0200	Cairo, Egypt	9.475
		Lisbon, Portugal	6.025, 9.68, 11.935
		London, England	6.11, 7.13, 9.58
		Moscow, U.S.S.R.	7.15, 9.655, 9.685

TO WESTERN NORTH AMERICA

TIME—PST	TIME—GMT	STATION AND LOCATION	FREQUENCIES (MHz)
8 a.m.	1600	Tokyo, Japan	9.505
6 p.m.	0200	Melbourne, Australia	15.32, 17.84
		Taipei, China	15.125, 15.235, 17.825
		Tokyo, Japan	15.135, 15.235, 17.825
6:30 p.m.	0230	Johannesburg, S. Africa	9.705, 11.875
7 p.m.	0300	Madrid, Spain	6.13, 9.76
		Seoul, Korea	15.43
7:20 p.m.	0320	Yerevan, U.S.S.R. (Tues., Wed., Fri., Sat.)	15.18, 17.775, 17.88
7:30 p.m.	0330	Prague, Czechoslovakia	5.93, 7.345, 9.55
		Stockholm, Sweden	11.705
8 p.m.	0400	Lisbon, Portugal	6.025, 9.68, 11.935
		Moscow, U.S.S.R. (via Khabarovsk)	9.54, 11.85, 15.18
		Peking, China	11.82, 15.095, 17.68
8:30 p.m.	0430	Bucharest, Rumania	6.15, 9.51, 11.94
		Budapest, Hungary	6.235, 9.833
		Kiev, U.S.S.R. (Mon., Thurs., Sat.)	9.61, 9.685
8:45 p.m.	0445	Cologne, Germany	9.545, 11.945
9:15 p.m.	0515	Berne, Switzerland	6.12, 9.695
10:30 p.m.	0630	Havana, Cuba	9.655

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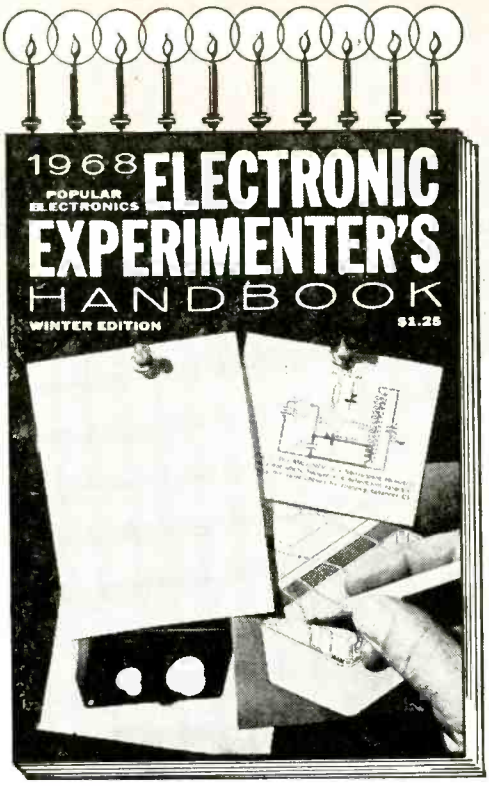

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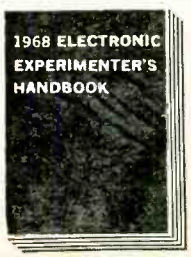

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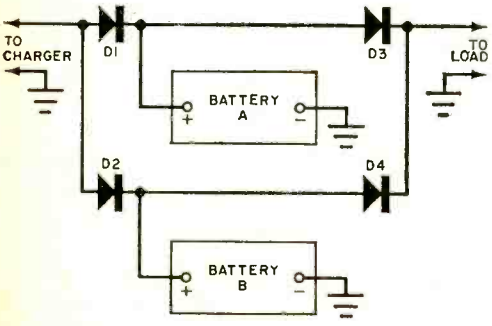
You CAN Parallel Storage Batteries

BY EDWIN T. JAYNES

UNTIL high-amperage solid-state rectifiers became commonly available, it was not practical to parallel wet cell storage batteries. The slightest difference in the open-circuit voltages of parallel-connected batteries will set up a circulating current whereby the battery with the greater voltage will tend to charge the one with the lesser voltage. This circulating current is capable of damaging both batteries.

When the solid-state rectifier came along, it became practical to parallel storage batteries for increased ampere-hour capacity without setting up a circulating current loop. If, for example, diodes *D1*, *D2*, *D3*, and *D4* are connected in a parallel circuit containing two batteries as shown in the schematic diagram, potential differences between the batteries cannot cause an appreciably large current to circulate. The little current that does circulate with the reverse-biasing of *D1* through *D4* is generally on the order of a few milliamperes.



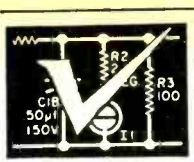
Diodes D1, D2, D3, and D4 prevent circulating current loops from being set up between batteries A and B when the batteries are connected in parallel.

The diodes form a bridge circuit, allowing a battery charger to charge both batteries through *D1* and *D2*. Batteries *A* and *B* deliver current through *D3* and *D4*, respectively, to the load. And, because *D1-D2* and *D3-D4* are connected back-to-back, the possibility of a circulating current loop being set up is overcome. Both batteries, however, will still supply current to the load.

If more than two batteries are to be connected in parallel, another pair of diodes (connected as shown for *D2* and *D4*) must be used with each additional battery. Be sure that the PIV and current ratings of the diodes are sufficient for the potentials and currents that must be handled. For example, if you want to charge a 12-volt battery at 10 amperes and have a 10-ampere drain by the load, the diodes you use would have minimum 25-volt PIV and 10-ampere ratings. (Radio Shack's Stock No. 276-1060 stud-mounted diodes, with 50-PIV and 12-ampere ratings, will suffice for most applications. These diodes sell for 59 cents each.)

When two or more batteries are to be used independently (as for mobile CB or ham radio) but charged from a single generator or battery charger, diodes *D3* and *D4* should be eliminated and the connections from *D1* and *D2* should be used as the "hot" lines for two separate circuits.

The interesting feature of the arrangement shown is that during recharging the weaker battery will receive the lion's share of the charge current. Conversely, the battery with the greater charge will deliver the greater amount of current to the load without interactions. It isn't often that nature cooperates so nicely to bring about the most desirable conditions. -30-



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.*

Webster-Chicago Model 106-27 "Diskchanger." Plug-in head for pickup arm needed. (Don F. Lehman, 378 Fairway Dr., Columbus, Ohio 43214)

Approved Electronics Instrument Model A-460 field strength meter. Schematic and instruction manual needed. (Steve Topley, 145 Quarry St., Mt. Pleasant, Pa. 15666)

Hallicrafters Model SX-24 "Skyrider Defiant" receiver. Schematic and alignment instructions needed. (Dave Strieter, 6440 S. Artesian, Chicago, Ill. 60629)

Abbott Instruments Model TR-4B 2-meter transceiver. Schematic and operating manual needed. (Lawrence Garfield, 48 Hemlock St., Ft. Walton Beach, Fla. 32548)

Genometer Model TV-50A. Operating manual and schematic needed. (Elwood W. Goss, 432½ Manor St., Lancaster, Pa. 17603)

TS-34/AP scope unit, marked "U.S. Navy"; contains 11 octal and miniature tubes. Schematic needed. (D.J. Munro, 4 Harrow Terrace, Wick, Caithness, Scotland)

National UM-50 50-pF, 600-volt variable capacitor. **National** UM-100 100-pF, 600-volt variable capacitor. Two of each needed. (Arnold E. Smith, Gwendolyn Dr., Route 1, Powell, Ohio 43065)

Paco Model ST-55 MX/ST-55 FM stereo tuner. Assembly manual and schematic needed. (William Adasiewicz, 360 Alta Vista Dr., South San Francisco, Calif. 94080)

Columbia Model C-615 "Triumph III" receiver (West German); tunes BC, 1.5 to 3.5 MHz. 88 to 108 MHz. Schematic and parts source needed. (William J. Dietz, 1180 Long Pond Rd., Rochester, N.Y. 14626)

Hallicrafters Model S-119 "Sky Buddy II" receiver; tunes AM and SW bands from 2.0 to 16.5 MHz. Schematic needed. (John Andreucci, 149 Heywood St., Fitchburg, Mass. 01420)

Philips Model GM53A6 receiver, circa 1946; tunes broadcast and 4 SW bands; has 5 tubes. Dial face needed. (M. Deschenes, 553-C-Cuvillier, Montreal 4, Quebec, Canada)

McMurdo Silver Model 904 capacitance resistance bridge. Schematic and operating manual needed. (Clarence A. Webster, 3569 Oak St., Jacksonville, Fla. 32205)

Philco Model 42-350 radio receiver; has 7 tubes; tunes SW, FM, and AM. Circuit diagram, alignment and tube replacement information needed. (James D. McDaniel, 3319 Los Angeles Blvd., Dallas, Texas 75233)

(*Continued on page* 92)

How to get into

One of the hottest money-making fields in electronics today– servicing two-way radios!

HE'S FLYING HIGH. Before he got his CIE training and FCC License, Ed Dulaney's only professional skill was as a commercial pilot engaged in crop dusting. Today he has his own two-way radio company, with seven full-time employees. "I am much better off financially, and really enjoy my work," he says. Read here how you can break into this profitable field.

More than 5 million two-way transmitters have skyrocketed the demand for service men and field, system, and R&D engineers. Topnotch licensed experts can earn $12,000 a year or more. You can be your own boss, build your own company. And you don't need a college education to break in.

HOW WOULD YOU LIKE to start collecting your share of the big money being made in electronics today? To start earning $5 to $7 an hour... $200 to $300 a week... $10,000 to $15,000 a year?

Your best bet today, especially if you don't have a college education, is probably in the field of two-way radio.

Two-way radio is booming. Today there are more than *five million* two-way transmitters for police cars, fire department vehicles, taxis, trucks, boats, planes, etc. and Citizen's Band uses—and the number is still growing at the rate of 80,000 new transmitters per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Many of them are earning $5,000 to $10,000 a year *more* than the average radio-TV repair man.

Why You'll Earn Top Pay

One reason is that the United States Government doesn't permit anyone to service two-way radio systems unless he is *licensed* by the Federal Communications Commission. And there simply aren't enough licensed electronics experts to go around.

Another reason two-way radio men earn so much more than radio-TV service men is that they are needed more often and more desperately. A home radio or television set may need repair only once every year or two, and there's no real emergency when it does. But a two-way radio user must keep those transmitters operating at all times, and *must* have their frequency modulation and plate power input checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the available licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least $5.00 per hour, $7.50 on evenings and Sundays, plus travel expenses. A more common arrangement is to be paid a monthly retainer fee by each customer. Although rates vary widely, this fixed charge might be $20 a month for the base station and $7.50 for each mobile station. A survey showed that one man can easily maintain at least 100 stations, averaging 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

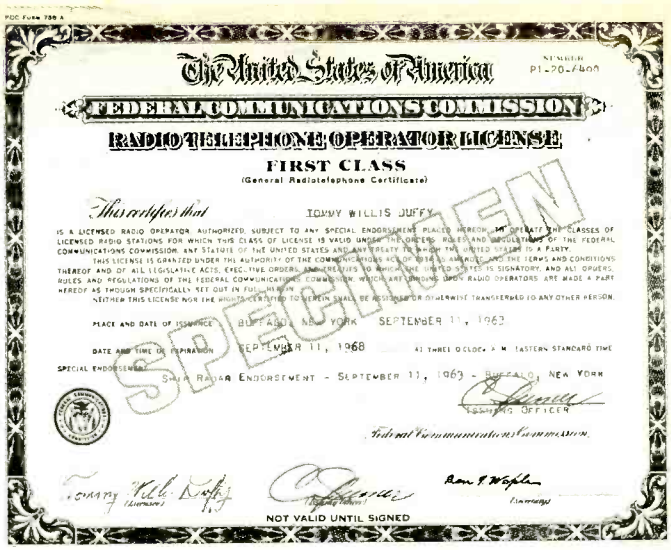
Be Your Own Boss

There are other advantages too. You can become your own boss—work entirely by yourself or gradually build your own fully staffed service company. Instead of being chained to a workbench, machine, or desk all day, you'll move around, see lots of action, rub shoulders with important police and fire officials and business executives who depend on two-way radio for their daily operations. You may even be tapped for a big job working for one of the two-way radio manufacturers in field service, factory quality control, or laboratory research and development.

How To Get Started

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC Exam and get your Commercial FCC License.
2. Then get a job in a two-way radio service shop and "learn the ropes" of the business.
3. As soon as you've earned a reputation as an expert, there are several ways you can go. You can move *out* and start signing up and servicing your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net you $5,000. Or you may even be invited to move *up* into a high-prestige salaried job with one of the major manufacturers either in the plant or out in the field.



THIS COULD BE YOUR "TICKET" TO A GOOD LIVING. You must have a Commercial FCC License to service two-way radios. Two out of three men who take the FCC exam flunk it ... but nine out of ten CIE graduates pass it the first time they try!

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Ed Dulaney is an outstanding example of the success possible through CIE training. Before he studied with CIE, Dulaney was a crop duster. Today he owns the Dulaney Communications Service, with seven people working for him repairing and manufacturing two-way equipment. Says Dulaney: "I found the CIE training thorough and the lessons easy to understand. No question about it—the CIE course was the best investment I ever made."

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CIRCLE NO. 12 ON READER SERVICE PAGE

ASSIST (Continued from page 87)

Zenith "Long Distance" receiver, circa 1940; AM-SW. Schematic, operating manual, and source for parts needed. (R. Gormley, 5 Cantitoe Rd., Yonkers, N.Y. 10710)

Stromberg-Carlson superhet receiver, chassis 30870; has 6 tubes; tunes 5.0 to 18 MHz and 550 to 1600 KHz. Schematic and technical data needed. (Ken Harbit, 329 Poplar Lane, New Lenox, Ill. 60451)

Zenith Model ZE-70 power supply. Schematic and operating manual needed. **Bell Sound Systems** "Record-o-Phone." Operating manual and technical data needed. (Steve King, Sandia Park, New Mexico 87047)

GE LWM-3 transceiver. GE "Ham News," Jan.-Feb. 1962, needed for tune-up of transceiver. (Earl Bradley, Apt. 142, 1040 Peach, Arlington, Texas 76010)

Hickok Model 156 "Indicating Traceameter" signal tracer; has 5 meters. Instruction manual needed. (Kevin Hartley, 19256 Coventry, Riverview, Mich. 48192)

Type 4AP10 cathode-ray tube. Diagram, operating voltages, and any other available information needed. (Randall Kirschman, 1725 Franck Ave., Santa Clara, Calif. 95051)

Weston Model 981 tube tester, type 3. Instruction manual and schematic needed. (W.G. Emory, Box 55, Union, S.C. 29379)

Paco Model C-25 in-circuit capacitor checker. Operating manual and schematic needed. (David Osier, Box 5, Clearlake, Wash. 98235)

American Gramaphone "Autophone" automatic phonograph, 1912; has 12 cylinders. Literature and source for parts needed. (John Boyd, 7434 15 Ave., New Westminster, B.C., Canada)

Fada Model 175-A S/N 41445 neutrodyne receiver. Operating manual, schematic, and/or information on "C" voltage for Cunningham CX-301-A tubes needed. (Thomas E. Storm, Sr., 1301 N3, Atchison, Kan. 66002)

Atomic Instrument Model TR-144A transceiver; tunes 144 to 148.5 MHz. Schematic and/or instruction manual needed. (Charles McCullough, 1775 Proffit Rd., Vienna, Va. 22180)

Triumph Model OBL-3 oscillograph. Schematic needed. (David Dailey, RD1, Box 823A, New Kensington, Pa. 15068)

Harvey Wells Model TBS-50A transmitter; tunes 2 through 80 meters; has 8 tubes. Schematic, operating manual, and information on power supply needed. (David A. Miller, 23681 Ravensbury Ave., Los Altos Hills, Calif. 94022)

Stromberg-Carlson Model 27633 short-wave receiver, circa 1940; has 12 tubes and electrodynamic speaker; tunes 0.53-66 MHz in 15 bands. Schematic and parts list needed. (Kenneth Belferman, 3810 Greystone Ave., Bronx, N.Y. 10463)

Precise Model 300B oscilloscope, circa 1955; has 10 tubes and 7JP1 cathode-ray tube. Schematic and operating manual needed. (Steve Maziarz, 7542 E. Fillmore, Scottsdale, Ariz. 85257)

RCA Model A.V.R. 20-A aircraft receiver; tunes 2250 to 3600 kHz; has T.R.F. stage. Receiver schematic and power supply schematic needed. (Joseph Rotello, Jr., 1341 S. Edlin Ave., Tucson, Ariz. 85711)

Weston Model 983 5" oscilloscope. Schematic needed. (D. E. Cummins, Route #1, Box 37-D, Tallahassee, Fla. 32301)

National Model NC-120 receiver, circa 1943; tunes 54 kHz to 30 MHz; has 11 tubes. Schematic and operating manual needed. (David L. Parta, 23819 Heartwood, RR #1, Northville, Mich. 48167)

Gonset Model G-77 transmitter; covers 80-10 meters. Schematic and power cable from power supply to transmitter needed. (Ken Wilhelmi, Rt. 4, Box 807, Eugene, Ore. 97401)

Galvin Model SCR-H and SCR-J Forest Service Region Six Radio Component, circa early 1950's; ser. 19519; has 2 channels. Schematic needed. (Joel Miller, 6870 S.W. Baylor St., Tigard, Ore. 97223)

Radio Mfg. Engineering Model 43 receiver. Type RT-10/APS-3 radar head; 3 cm. Type PP-5041/APG-501 radar receiver; ARM 101-10; 46 CGE. Circuit diagram, voltages, and operating instructions needed. (R.K. Lloyd, Box 1164, Lusaka, Zambia, Central Africa)

Philco Model 642 receiver; tunes AM and SW. Schematic and parts list needed. (Gerald D. Crotinger, Rt. 2, McCracken, Kan. 67556)

CIRCLE NO. 14 ON READER SERVICE PAGE→

Sparton Model 931 receiver, circa 1930; has 9 tubes; tunes broadcast band. Power transformer needed. (Albert Malone, 3 Circle Ave., Mill Valley, Calif. 94941)

AN/PRC-1184 (XE-1) 20-channel transceiver; tunes X-band. Schematic, operating manual, and source of parts needed. (Pete Ritter, 1025 Cedar Dr., Oxford, Ohio)

Bell Model BT205 stereophonic tape recorder. Schematic needed. (Lee Lanterman, 201 S. Lafayette, Frederick, Okla. 73542)

Superior Instruments Model 1210 tube tester. Schematic and tube chart needed. (A. Benbenk, 1 Church St., E. Hampton, L.I., N.Y. 11937)

Westinghouse Model SW-64SW receiver; has 6 tubes. Schematic needed. (Leonard Soicher, 445 Greenwood Dr., Beaconsfield, Quebec, Canada)

McMurdo Silver Model 904 capacitance-resistance bridge; 1945 series. Schematic and/or operating instructions needed. (C.R. Rhein, Rt. 1, Carillon Dr., Pfafftown, N.C. 27040)

Philco Model CT-2 automoble radio, circa 1933; code 125. Schematic needed. (Hal Denman, 855 Dobbs Ferry Rd., White Plains, N.Y. 10607)

RCA Model WV 97A Volt Ohmyst. Source for a.c.-d.c. voltage head needed. **Western Auto** "Truetone Imperial" 23-tube TV set. Information on tubes, and 12 DQ 6 tube needed. **NCR Accounting** Model 300 adding machine. Source for parts needed. **Dennie Egan** Model 60 amplifier. 5016, 12SQ7, and 12DQ7 tubes needed. (Jeffrey Strieble, 1745 Empire Rd., Wickliffe, Ohio 44092)

VM "Tape-O-Matic" tape recorder; 5 tubes. **VM** "Tape-O-Matic" tape recorder with extra 6V6 tube. Schematics and parts lists with complete description of transformers, coils, and tape heads needed. (Glenn Walker, 7 Cavendish Ct., Highland West, Wilmington, Del. 19808)

Kolster Model 43 receiver, made by Brandes Corp. Schematic and servicing data needed. (V. Meznora, 115 E. Hathaway La., Havertown, Pa. 19083)

Radio City Products Model 664 VTVM. Schematic needed. (Donald Rockford, 3650 Olinville Ave., Bronx, N.Y. 10467). Schematic, calibration instructions, and information on d.c. probe resistance needed. (James A. Morgan, 5012 Perrine Dr., Jacksonville, Fla. 32210)

Philco Model 42-560 receiver; has 8 tubes; covers BC, SW, and police bands. Schematic, parts list, and source for tubes needed. (C.T. Cinek, 1101 N. Reagan St., West, Texas 76691)

Coastwise Electronics Model 730 VTVM and signal tracer combination. Schematic needed. (William K. White, 185 Carol Dr., Toms River, N.J.)

Superior Instruments Model 1280 tube tester. Instruction manual needed. (Richard A. Spritz, 7928 Montgomery Ave., Elkins Pk., Pa. 19117)

Hazeltine Model 718 FM receiver; has 13 tubes; tunes 4 bands. Schematic needed. (Michael Gross, 5066 Veloz Ave., Tarzana, Calif. 91356)

Capehart Type M audio power amplifier. **Mantola** Model 572-21-149B; circa 1942. Schematics needed. **Heathkit** GW-10D CB transceiver; circa 1961. Assembly manual needed. (David Hamilton, 3421 Fayette Ave., Louisville, Ky. 40213)

Nutronics "Duafone" RX-108 intercom, circa 1952; has 4 tubes. Schematic needed. (William Schlegelmilch, 3220 43 St., Highland, Ind. 46322)

RCA CRV-46151 WWII aircraft radio receiver. Schematic needed. (Donald L. Kidd, 1740 Williams Rd., Williamsport, Pa. 17701)

Sparton "Equasonne" Model 930 receiver, ser. 57391. Dynamic speaker B-2278 needed. (Arivers Lee, 939 Mt. Vernon, Detroit, Mich. 48211)

Superior Instruments Model 1230 signal generator. Schematic and instruction manual needed. (William W. Schirf, Box 9064, North Station, Newark, N.J. 07104)

Zenith Model 26-311 receiver; covers 3 bands; has 12 tubes. Schematic, and list of tubes needed. (Randy Martin, 222 Arrowhead Rd., Fawn Lake Village, R.D. 2, Vincentown, N.J. 08088)

Webster-Chicago Model 80-1 "Electric Memory" wire recorder, circa 1945. Wire and tape head needed. (David O. Taber, 2212 Lake St., San Francisco, Calif. 94121)

National Model NC156-1 receiver (Navy type CNA-46188 or CNA-46188-A), circa WWII. Parts list, operating manual, and alignment data needed. (Joseph C. Gibson, 247 S. 92 St., Milwaukee, Wis. 53214)

ASSIST

(*Continued from page 93*)

Hallicrafters Model SX-28 receiver, circa 1946; tunes 550 kHz to 42 MHz. Schematic and/or operating manual needed; also information on updating, product detector, etc. (Walter H. Persans, 339 Vanderbilt Ave., Staten Island, N.Y. 10304)

RCA Model 46X12 AM-SW superheterodyne receiver; 550 to 1600 kHz and 2300 to 6300 kHz; has 6 tubes. Schematic or tube complement and their locations needed. (Science Club, Lejeune High School, Camp Lejeune, N.C. 28542)

R-122/ARN-12 surplus receiver; tunes 75 MHz; circa 1951-4. Schematic for power supply needed. (P. Kazmierski, 9146 Forrer, Detroit, Mich. 48228)

Pierce Model 560 magnetic belt dictating machine, ser. 1142. Schematic showing input transformer and service data needed. (H. Velme, 1236 Garfield, Denver, Colo. 80206)

SAC "Automatic" radio and Geiger counter. Geiger tube 18503, parts source, and schematic needed. (Bruce Rahn, 1511 E. Main St., Little Chute, Wis. 34140)

Zenith Models 12L57 and 12L58 receivers, 1935; tune 4 bands; have 12 tubes. Oscillator coil or wiring data on coil needed. (N.C. Richardson, 304-B Wilson Apts., Columbus, Ga. 31904)

E.H. Scott Model SLRM receiver, 1942; tunes 4 bands (500 kHz-18 MHz); has 12 tubes. **General Motors** Model 110-MA receiver, 1930; tunes BC only; has 6 tubes. Schematics needed. **Stromberg-Carlson,** circa 1938; tunes 145 kHz-18 MHz in 4 bands; has 10 tubes. Schematic and alignment instructions needed. (Michael Bishop, 208 Water St., Chardon, Ohio 44024)

Emerson Model CY269 2-band radio receiver; ser. 2871765. Schematic needed. (L.L. Lungren, P.O. Box 361, Poulsko, Wash.)

RCA Victor Type AR6 R.C.A.F. radio receiver; 1942; 10D/1428; covers 0.14 to 21 MHz. Schematic and instruction manual needed. (William C. Valentine, II, 139 E. Grove Ave., Mesa. Ariz. 85201)

Bendix Model 04BT Ford Pickup receiver. Audio output transformer N2090849-2 needed. (Gus A. Green, 12692 Green St., Boron, Calif. 93516)

Wickes Model DK-1 color-TV receiver. Schematic or operating manual needed. (Darcy Brownrigg, Chelsea, Quebec, Canada)

RCA Type 195A VoltOhmyst. Schematic and/or information on replacement of power transformer needed. (Dale Jones, 327 S. Haines, Alliance, Ohio 44601)

Crosley Model 52 regenerative receiver, ser. 82923-0; patent date on some parts Oct. 14, 1914; has 3-01A tubes. Operating manual, date of manufacture, or any available information wanted. (Tom Smith, 201½ E. Filmore Ave., Fairfield, Iowa 52556)

Philco Model 37-620 receiver, code 121, circa 1937; tunes BC and 2 SW bands; has 6 tubes. Schematic, parts list, and operating manual needed. (Dale Wimmer, Rt. 3, Box 350-28, Springfield, Mo. 65804)

GE Model 6278 receiver, ser. 1485R-3; has 5 tubes; chassis 959; tunes 55-160 kHz. **Zenith** Model 6G501M receiver, ser. T414011; chassis 628; has 6 tubes; tunes 55-150 kHz. **Crosley** Model 62TOWC receiver, ser. 145511; chassis 37; has 6 tubes, tunes to 150 kHz. Schematics needed. (Leo Cravines, 1660 Lantana Way, Turlock, Calif. 95380)

RCA Model "Radiola II" receiver, 279391, circa 1922. Schematic and power requirements needed. (Mike Skomba, 66 Fayette St., Perth Amboy, N.J.)

Stromberg-Carlson Model AWP-8 "International" radio receiver, circa 1955. Original list price wanted. (R.A. Aman, 2618 Harris blvd., Austin, Texas 78703)

Triumph Model 841 oscillograph. Schematic and operating manual needed. (H.L. Matthews, 1130 W. 48 St., Hialeah, Fla. 33012)

Philips Lamps Ltd. PCR 3 TPL ZA 30607 receiver, circa 1940-45, ser. 4599. Schematic needed. (Hans Lunkka, Naldammsvagen 8 II A 2, Helsingfors 92, Finland)

Regency T3 transistorized all-band converter. Alignment procedure needed. (Bob Langdon, 6 Sussex Pl., Deer Pk., N.Y. 11729)

Hallicrafters S-20-R "Sky Champion." Parts list, schematic and operating instructions needed. (Fred G. Svendsen, 120 Winder Rd., Garfield Park, New Castle, Del. 19720)

—30—

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

ALL radio listeners interested in furthering the hobby of SWL'ing—regardless of whether you DX on the BCB, VHF, TV, SW, or FM bands—are eligible to apply for a POPULAR ELECTRONICS "Certificate of Registration." You must have verified (have QSL cards from) a minimum of five radio stations, of which one was outside the borders of the United States. There is no age limit, or special equipment qualification; the only requirement is that the applicant have a sincere interest in radio communications.

All certificates are filled in and lettered before mailing; they are mailed flat and unfolded. If you want to register and receive your WPE identification sign, fill in the application blank below. Mail with 50 cents in coin (or stamps) to: MONITOR, P.O. Box 333, Cherry Hill, N.J. 08034. (Personal checks will not be acceptable.) Canadians should use their own currency, and other applicants not in the U.S.A. should use 10 International Postal Reply Coupons. Allow 4-6 weeks for processing.

(Please Print) (Do not fill out)

Name . . . . . .

Street, City and Zone . . . . . .

State and Zip . . . . . .

Receivers in use Make . . . . . Model . . . . . .

Make . . . . . Model . . . . . .

Age Occupation . . . . . .

Ham/CB call-letter assignment(s) . . . . . .

I listen mostly to SW Broadcast Hams CB BCB VHF VLF . . . . . .

I use the following antennas . . . . . .

I have QSL cards and countries verified. Check if subscriber to P.E. . . . . .

Signature . . . . . Date . . . . . .

PARTS/METHODS/IDEAS/GADGETS/DEVICES

tips & techniques

FUSE BOTH SIDES OF THE A.C. POWER LINE

Even if the manufacturer of an electronic device that employs a transformerless power supply does not specify it, there should be a fuse in both sides of the incoming a.c. line. A careful check of a one-fuse circuit will show that if the power line is plugged into an a.c. outlet so that the fuse is in the ground side of the line, a short circuit between the "hot" side and ground will simply bypass the fuse. This can result in extensive damage to the electronic device. The only way to effectively avoid such a situation is to put a fuse in both sides of the line.—*B.W. Blachford*

MAKE YOUR OWN DYNAMIC MICROPHONE

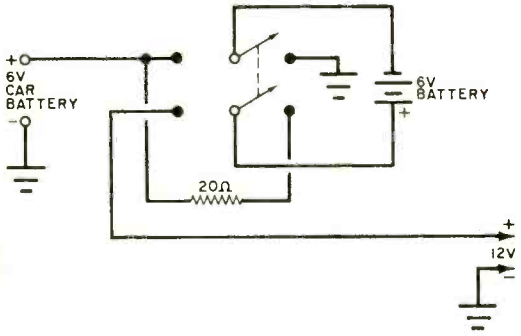
You can make a microphone that can be used with any p.a. system or tape recorder for as little as $1.59 plus an Ersin "Multicore" solder dispenser. The diameter of the blunt end of the solder dispenser provides a perfect fit for Lafayette Radio's 99 H 4527 dynamic microphone cartridge. Remove the blunt end of the dispenser, and spray the outside surface of the container with any color paint you wish (it is shown unpainted in the photo); the microphone cartridge comes with a lustrous gold finish. To assemble the microphone, slip one end of an audio cable through the solder feed hole in the dispenser, and solder the cable to the terminals on the mike cartridge. Finish the job by stuffing a piece of synthetic rubber sponge into the dispenser, and secure the mike cartridge in place with epoxy cement.

—*Douglas C. Easton*

6 VOLTS PLUS 6 VOLTS EQUALS 12 VOLTS

To operate a 12-volt (up to 12-watt) auto accessory from a 6-volt electrical system doesn't require that you use a 6-to-12-volt "Upverter." A 6-volt ignition-type battery capable of delivering 1 ampere of current over an extended

period of time—connected in series with the car's battery—will provide the power needed. The switching arrangement shown in the drawing accomplishes two aims—in one position, it series-connects the two batteries; and in the other position, it uses the car's battery to recharge the ignition battery. The rate of recharge is determined by the value of the

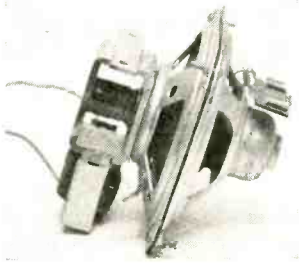


resistor. If it is 20 ohms, sufficient current will be delivered to the ignition battery if a 12-volt, 1-ampere accessory is operated for a half-hour each day and the ignition battery is allowed to recharge during the remainder of the day. Input and output of the ignition battery in ampere hours will be equal. A smaller value resistor is needed if the accessory is operated for a longer period of time

—James E. Hubbard

BOLT SPEAKERS TOGETHER TO PREVENT CONE DAMAGE

Loudspeakers are perhaps the most fragile and easily damaged "spare parts" to store. A punctured or torn cone can mean the total loss of a speaker. You could box each speaker individually, but this might present a space problem. Two same-size speakers can be bolted together as shown in the photo to protect the cones from damage. Take care not to overtighten the bolts, or you might bend the speaker baskets out of shape.



—James E. Arconati

POLYSTYRENE TUBING SERVES AS SPACERS

How often have you had to delay building a project because your local parts supplier did not stock spacers? If you had your old "think cap" on, you probably used two extra machine nuts for each spacer needed when you were in a hurry to get the project built. One

TIPS

(*Continued from page 97*)

way to avoid the delay, and the waste of hardware, is to keep a supply of commonly available 12"-long polystyrene tubes handy. These plastic tubes come with a variety of inside diameters, ranging from ⅛" to ⅞" in ⅛" increments. Select a rod with an inside diameter slightly smaller than the diameter of the screws you plan to use, and cut the appropriate spacer lengths needed with a hacksaw. (Although the tubing does not come tapped, you can easily drive the threads of a machine screw into the soft plastic—the screw will be held firmly in place and will not work loose.) Use one screw at each end of the spacer.

—*Lathan Welles*

TAKE ONE new literature

To obtain a copy of any of the catalogs or leaflets described below, simply fill in and mail the coupon on page 15 or 115.

Over 300 kits are represented in the 108-page 1968 *Heathkit* catalog. New this year is a line of test instruments (including a solid-state high-impedance volt-ohm-milliammeter), two solid-state guitar-music instrument amplifiers, and a 10-band SWL receiver with the same features and performance as the SB-series of amateur radio gear. The catalog also contains a stereo system planning guide.

Circle No. 90 on Reader Service Page 15 or 115

You'll find wintertime hobby items galore in *Edmund Scientific*'s latest catalog, No. 681. For example, the "DigiComp II" is an automatic digital computer that can actually be programmed, while the "Design-O-Graph" draws an infinite number of beautiful geometric patterns in color. Other featured items—in the total of 4000-odd—include fiber optic light trees, laser-produced holograms, and photomotion kits.

Circle No. 91 on Reader Service Page 15 or 115

A line of specialized electricians' wiring tools is described in an eight-page booklet recently published by *Ideal Industries*. Tools covered include fish tapes, pulling compounds, fuse pliers, electricians' pliers, crimping tools, wire strippers, and armored cable cutters and rippers. Also described are voltage and circuit testers and continuity testers.

Circle No. 92 on Reader Service Page 15 or 115

INFORMATION CENTRAL

(*Continued from page 71*)

lished considerable information on this subject in the May and June, 1967, issues.

Electronic VTVM Instability. *I have a Knight-Kit VTVM which I bought in 1956. It is now unstable; the meter continues to move around when the unit is turned on. How can I stabilize it?*

First, replace the two tubes (6AL5 and 12AU7). Next, clean all rotary switch contacts with a good contact cleaner. If these two operations do not solve your problem, check all resistors and potentiometers—the latter do wear after 10 years use, you know!

HA-350 Hum. *I recently bought a Lafayette HA-350 ham-band receiver and it worked fine until it developed what seems to be a 60-Hz hum. What could be causing this hum?*

First, check all the tubes for possible cathode-to-heater shorts. Next, check the filter capacitors (electrolytics) in the power supply section. Make sure all wiping contact switches are clean.

900-MHz Reception. *I live in an area where an AM program is relayed via a 900-MHz "STL" station. How can I receive this program?*

At 900 MHz, dish-type antennas are usually employed, and the signal is very "narrow" and of low power. Even if you are in line with the signal, close to its path, and have the appropriate receiver or converter/receiver, you may not receive it unless your antenna is sufficiently elevated.

Capacitor Capacitance. *I have two APC variable capacitors. One has 2 and the other 14 plates. What's the maximum capacitance for each?*

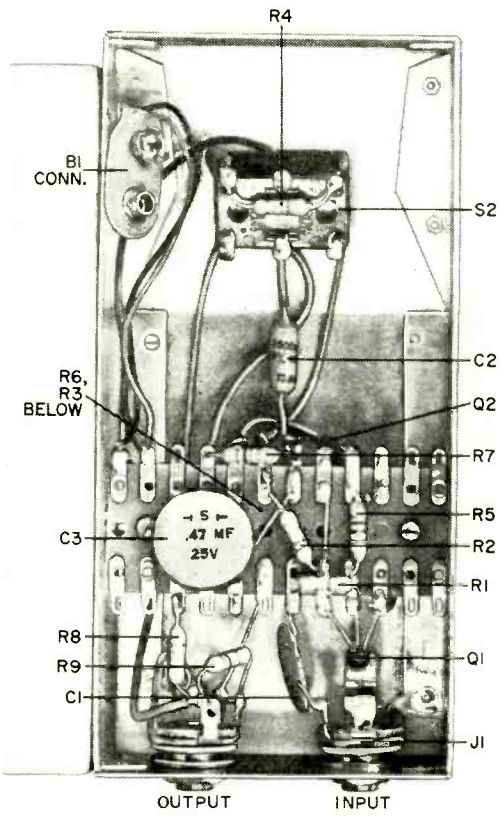
The two plate job is 3.87 pF and the 14 plate unit is 50 pF.

CB-23 Problem. *An in-line wattmeter indicates that my CB-23 transceiver (Hammarlund) is putting out 3 watts, but when it is connected to the antenna I cannot be heard 50 feet away on a walkie-talkie nor 5 blocks away at a base station. How do you account for this fact?*

Have you checked the transmission line to your antenna? Is the antenna connection good? It sounds as if your antenna system has a short either in the coaxial cable or at the antenna proper. —30—

FUZZ-BOX

(*Continued from page 42*)



Here is the completed Fuzz-Box as viewed from the bottom. You can make your own cabinet if you wish.

four rubber feet that are attached to the underside by self-tapping screws.*

The wiring of the "fuzz-box" is straightforward and was accommodated on a strip panel that contained 12 solder lugs on each side. Similar boards are available in the U.S. in the war surplus marketplace, or one may be cut down from a USECO terminal board Type 1100B (Allied Radio Stock Number 47 E 2910).

Using the Fuzz-Box. The "fuzz-box" should be used with a guitar that has a reasonably high level output. The actual

**The metal box shown in the photo on page 41 was made especially for this project by an Australian manufacturer. Somewhat similar steel boxes are believed to be available in the U.S. from electrical supply houses.*

HOW IT WORKS

When switched into the circuit, the load seen by transistor *Q1* is the sum of the values of resistors *R2* and *R4*. With the forward bias applied, this is sufficient to bring *Q1* nearer current saturation. Because *Q2* is d.c.-coupled to the collector of *Q1*, *Q2* will simultaneously be held near cutoff. When a sinusoidal signal (which has both positive and negative peaks) is applied to the base of *Q1*, this transistor will be driven alternately positive and negative. On the positive swing of the input signal, *Q1* will be driven into complete saturation, limiting the collector's voltage swing and resulting in a clipped signal peak at the collector of *Q1*.

However, the voltage across the load (*R2* and *R4*) is sufficient to allow a full and unclipped collector voltage swing on the other half-cycle. The resulting waveform is a sine wave with a clipped negative peak. At *Q2*, the unaffected signal peak will drive this transistor into complete cutoff, delivering a signal at the output that now has both peaks clipped.

Since a distorted signal appears at the emitter of *Q1*, the addition of higher frequency components from this out-of-phase waveform results in a large spike above the trailing edge of the initial, squared output waveform. Potentiometer *R6* is the emitter load for *Q2* and it is used to vary the fuzz-tone shape.

gain through the "fuzz-box" is largely a function of the output divider resistors, *R8* and *R9*. With the values chosen, there is a small signal gain of about 1.5.

You will have to remember to switch the "fuzz-box" off at the end of each performance, to obviate unnecessary drain from the battery. Fortunately, the penalty for occasionally forgetting to do so is not very great since the current drain is less than 1 mA and, overall, the battery should last about its natural shelf life. —30—

WHAT IS FUZZ-TONE?

Fuzz, or fuzz-tone, as applied to electric guitar music is intentional distortion. The electric guitar produces reasonably clean sinusoidal waves with strong consonant harmonics—depending on the playing technique and the position of the pickup coils. These sinusoidal waves are squared off, clipped, or otherwise distorted by adding multiple hormonics and dissonant frequencies through intermodulation distortion. The naturally "round" tone of the electric guitar takes on a strident quality.

Musicians seem to prefer electric guitar fuzz-tones with great sonic impact, and this is best accomplished through a concentration of spurious harmonics within the normal musical range of the guitar system—that is, up to about 3 kHz. Fuzz-tone is intended primarily to add stridency to single tones, or simple chords. It cannot be used with complex chords, and most guitars switch out the fuzz-tone circuit when such chords are being played.

AMATEUR RADIO

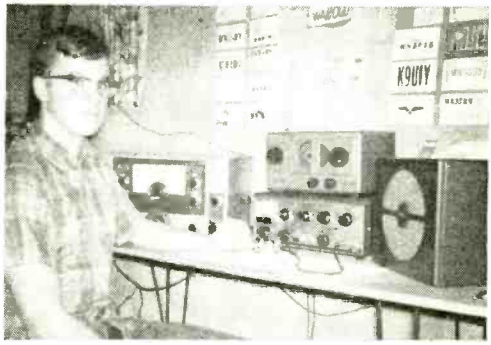
(*Continued from page 80*)

into four weekends—two for phone and two for CW: phone on February 3 and 4 and March 2 and 3; CW on February 17 and 18 and March 16 and 17. Each contest period starts at 0001 GMT (7:01 p.m., EST, Friday) and ends at 2359 GMT (6:59 p.m., EST, Sunday). United States and Canadian amateurs send signal reports and the names of their states or provinces to the DX stations they work, and the DX stations send signal reports and their transmitter power. A complete exchange earns three points, and the same station can be worked once per band.

Canadian and U.S. amateurs multiply their QSO points by the sum of the different countries worked on each band, and DX stations multiply their QSO points by the sum of the different states and provinces worked on each band. Scores go to American Radio Relay League, Inc., Newington, Conn. 06111. Once again the ARRL will send log and summary sheets on request, and will award certificates to high scorers.

Undoubtedly, DX contacts will be made on all bands from 160 through 6 meters in the contest, but low power stations with simple antennas will probably do best on 10 and 15 meters, both of which have been wide open for DX this season.

Although it is doubtful that any "banned countries" will be participating in the DX contest, remember that it is illegal for U.S. and Canadian amateurs to work Cambodia (XU), Vietnam (XW8), Indonesia (JZØ, 8F), and Thailand (HS). In addition, Canadians cannot work Laos (XW8) and Jordan (JY).



Anyone recognize the receivers that Giffith DeGolier, WAØOGD, Lincoln, Nebr., uses? The one on top of the EICO 720 transmitter is a well-aged Hallicrafters S-38, and the one at left is a National, model unknown, that he bought second-hand.

NEWS AND VIEWS

Gary Johnson, WAØKWO, 15700 North Eden Dr., Minnetonka, Minn., worked 28 states in seven months as a Novice. In 10 months as a General, his Heathkit DX-35 at 50 watts has worked all states, all continents, and 35 countries. A Knight-Kit R-100A does the receiving, and an assortment of antennas—including a home-brew, 3-element beam, Hy-Gain 14AVQ vertical, and an 80-meter dipole—do the radiating. Gary also operates RTTY and 6-meter FM, attends the University of Minnesota, and is an active member of the Minnetonka Civil Defense group . . . **Michael Welch, WA1GTH,** 23 South St., Williamstown, Mass., really had an adventurous Novice career. In eight months, he and his EICO 720 equipped with 25 crystals, Lafayette HA-350 receiver, an 80-40 meter inverted-V antenna, and a home-brew, 2-element 15-meter beam earned WAS and worked 57 countries—including Venezuela on 80 and Alaska on 40 meters. Station 5H3KJ, in Tanzania, was too low in frequency for Mike's lowest-frequency crystal; so while 5H3KJ was working CT3AS, Mike hurriedly took apart the crystal holder, coated one side of the crystal with pencil lead, and reassembled the crystal in the holder. This "operation" put the then WN1GTH on frequency to work 5H3KJ right after CT3AS! Mike has a 25-wpm code certificate and a Rag-Chewers Club certificate on his shack wall . . . Another WN1, waiting for his General ticket to arrive when he wrote us, was **Dan Shine, WA1GGN,** 9 Colonial Blvd., West Haven, Conn. Dan used a Johnson "Ranger I" transmitter and a Lafayette HE-30 receiver in conjunction with a 40-meter dipole 15 feet high to work 27 states—25 confirmed. He is also a member of the Rag-Chewers Club, and has a 15-wpm code certificate. With his General ticket in hand, Dan will sked you on 80, 40, or 20.

Gary Johnson, WAØKWO, located in Minnetonka, Minn., works phone, CW, and RTTY on all amateur bands between 3.5 and 54 MHz. See text above.

Ed Gribi, Jr., WB6IZF, reports that **Ray Meyers, W6MLZ,** became Civil Defense Administrator for San Gabriel, California, last October. Ray is also Phone Activities Manager and Emergency Coordinator and writes an amateur radio column for the *Los Angeles Herald-Examiner* . . . **Buff Fisher, WB2SIH,** 2 Barnard Rd., Armonk, N.Y., goes on 10 through 80 meters with a Swan-500 AM/CW/SSB transceiver (mostly on CW) and has worked 50 states and 113 countries. A dipole antenna fed through a Johnson "Match Box" does the radiating. Also available are home-brew 6- and 2-meter transmitters feeding 5- and 11-element beams, with reception being handled by Tapetone converters into a Hallicrafters SX-110 receiver. But Buff didn't say a word about results on the latter frequencies . . . **Jerry Felts, WN5TFU,** P.O. Box 38, Henryetta, Okla., worked 26 states in his first

Kenny Reynard, WA5QPA, Baton Rouge, La., has earned WAC and WAS certificates in addition to working 72 countries with his Heathkit "Apache" transmitter, SB-10 SSB adapter, and Drake R-4A receiver, all of which are housed in an attractive homemade console. Kenny is a member of Army MARS.

three weeks on the air. The scene was (and is) 40 meters, and the equipment a BC-455 (surplus) receiver, Knight-Kit T-60 transmitter, and a dipole antenna about 25 feet high. Jerry would like skeds with eastern call areas.

Tom Mann, WA8TWR, Box 669, Lewisburg, W. Va., does what he can to take West Virginia off the "rare" state list. His Knight-Kit T-60 transmitter, feeding an 80-40 meter inverted-V and 10-, 15-, and 20-meter vertical antennas, has worked 37 states and eight countries. A Hallicrafters SX-28 doubles as an SWL receiver (as an SWL, he has all states and over 90 countries logged). Tom is also an amateur astronomer and is interested in reading about unidentified flying objects . . . **Harry A. Tummonds, W8BAH,** 2073 West 85 St., Cleveland, Ohio, a youngster pushing 70, will soon start his 10th year of writing the "Ham Antenna" for the *Cleveland Sunday Plain Dealer*. He still uses a 203-A tube in his transmitter! Thirty-five years ago, most low-power amateurs dreamed of the day when they could scrape together $25 to buy a 203-A and run real high power—150 to 200 watts . . . **Carl Durnavich, WA9SXQ,** 6 East 140th Court, Riverdale, Ill., works 80 through 10 meters with a Heathkit SB-401 transmitter, Hallicrafters SX-110 receiver, and two antennas—a Mosley TA-33 Jr. tri-band beam for 10, 15, and 20 meters, and an inverted-V for 80 and 40 meters. In seven months the combination has worked all states and all continents and 52 countries. Carl is also an avid "county hunter"—he has 735 counties confirmed; but as there are 3079 counties in all in the United States, he has lots of hunting still before him.

Remember that the first step toward seeing your "News and Views" in *your* column is writing a letter; include a sharp photo of your station with you at the controls, if available, and keep those club bulletins coming, too, please. The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind. 46401.

73, *Herb, W9EGQ*

ANNUAL BANQUET

The Lake County Amateur Radio Club, Inc., will hold its 15th Annual Banquet at Teibel's Restaurant, U. S. 30 and 41, at 6:30 p.m. CST, February 13. Prizes, chicken, and entertainment will be provided. Tickets are $4 each and should be obtained from William De Geer, WA9MOE, 3601 Tyler St., Gary, Ind. 46408. No tickets will be sold at the door.

ON THE CITIZENS BAND

(*Continued from page* 81)

sharing the air waves on about a 50/50 basis. One incident was particularly deplorable. In the Libertyville/Mundelein, Ill., area north of Chicago, a young lady and four men discussed for at least 30 minutes the woman's middle name and how it came about. The ensuing "noise" consisted of giggles, one-liners from the men that Bob Hope used back in the 30's, and "breakers" from every direction.

On the next trip, we'll be looking for—and hoping to find—another community, large or small, with as clean a CB operation as was found in Denver, Colorado.

Highway Emergency Handling. Larry Ames, KFJ0255, Tacoma Citizens Band Radio Association, Tacoma, Washington, reminded TACBRA club members recently of a quick and effective method of locating emergency callers from our nation's highways. Many motorists may not be aware that the National Safety Act has decreed that all states number their main highways as Sign Routes. The routes begin at principal junctions or at state lines, and run continuously, regardless of old primary or secondary highway numbers, to a termination point at another major highway or state line.

In addition, Sign Route indicators on the highways are interspersed with milepost markers, usually set a mile apart (½ mile in some states), and identified only by a small reflective numeral posted on the side of the road. The numbering system starts at the highway's point of origin and increases in the direction of travel.

To make an emergency call from a main highway, the motorist should indicate the Sign Route on which he is located, and the milepost marker to which he is closest. For example, a motorist reporting that he is located on I-90, close to milepost marker 20, would be indicating that he is approximately 20 miles from the originating point of highway I-90. It is also important to give the direction of travel in the report.

CB'ers receiving pleas for help should be sure the information is complete before contacting authorities. Supplying the route, milepost, and direction could cut an ambulance driver's travel time by several minutes, and in some cases be the determining factor between life and death.

1968 OTCB CLUB ROSTER

The following are Citizens Band Clubs reporting to OTCB for the first time this year. If your association has not kept us posted over the last 12 months, ask your publicity people to forward your membership total; club or rescue team activities; photos of members, teams, or individuals in action; a sample club decal and membership card, and your club publication on a monthly basis. Send all material to Matt P. Spinello, CB editor, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016.

Chicago, Illinois—*Eyeballers Citizens Band Club.* Organized in May, 1967, with 12 members, the club now boasts a membership of almost 180, with 10-12 more joining each month. There is an affiliate group in Elgin, Illinois (40 miles northwest of Chicago). The ECBC's monthly publication, *The Eyeball*, is prepared by a staff of six, led by June Ong, editor. Club officers include: Harry Miklasz, Sr., president; J. Schweitzer, L. Stalley, D. Crement, and H. Miklasz, Jr., vice presidents; Don Tuszynski, secretary; Larry Henry, treasurer; and Art Chana, sergeant at arms.

Lexington, North Carolina—*Pioneer CB Club.* Organized in December, 1966, this club's current membership is 40. Members were instrumental in finding a home, furniture, and clothing for a family of seven after they lost all of their possessions in a fire. Co-chairmen for the drive to aid the family were the club's vice president, David Driver, and publicity chairman John Athay, Jr. Furniture for five rooms, and all necessary appliances and clothing for all members of the family were donated by local citizens. In fact, the drive was so successful that the Pioneer group is now looking for a building to store the surplus items so that they can be used as needs arise.

Ogdensburg, New York—*St. Lawrence Valley*

(*Continued on page* 110)

NOW OVER 190 RADIO SHACK STORES NATIONWIDE

ARIZONA — Phoenix
ARKANSAS — Little Rock
CALIFORNIA — Anaheim, Bakersfield, Covina, Downey, Garden Grove, Glendale, La Habra, Long Beach, Los Angeles, Mission Hills, Mountain View, No. Hollywood, Oakland, Pasadena, Pomona, Reseda, Sacramento, San Bruno, San Diego, San Francisco, Santa Ana, Santa Monica, Torrance, West Covina
COLORADO — Denver, Thornton
CONNECTICUT — Bridgeport, Hamden, Manchester, New Britain, New Haven, New London, Orange, Stamford, Torrington, West Hartford
FLORIDA — Cocoa Beach, Jacksonville, Orlando, W. Palm Beach
GEORGIA — Atlanta
ILLINOIS — Belleville, Chicago, Elgin, Harvey, Waukegan
INDIANA — Richmond
KANSAS — Kansas City, Wichita
KENTUCKY — Bowling Green, Newport
LOUISIANA — Baton Rouge, Gretna, Monroe, New Orleans, Shreveport
MAINE — Bangor, Portland
MARYLAND — Baltimore, Langley Park, Rockville
MASSACHUSETTS — Boston, Braintree, Brockton, Brookline, Cambridge, Dedham, Dorchester, Framingham, Leominster, Lowell, Medford, Natick, Quincy, Saugus, Springfield, Waltham, West Springfield, Worcester
MICHIGAN — Detroit, Lincoln Park
MINNESOTA — Duluth, Minneapolis, St. Paul
MISSISSIPPI — Jackson
MISSOURI — Kansas City, St. Joseph, St. Louis
NEBRASKA — Omaha
NEVADA — Las Vegas
NEW HAMPSHIRE — Manchester
NEW JERSEY — Pennsauken, Trenton
NEW MEXICO — Albuquerque
NEW YORK — Albany, Binghamton, Buffalo, New York, Rochester, Schenectady, Syracuse
NORTH CAROLINA—Charlotte
OHIO — Cincinnati, Cleveland, Columbus, Lima, Willowick
OKLAHOMA — Oklahoma City, Tulsa
OREGON — Portland
PENNSYLVANIA — Greensburg Philadelphia, Pittsburgh, Plymouth Meeting
RHODE ISLAND — Providence, East Providence, Warwick
TENNESSEE — Memphis, Nashville
TEXAS — Abilene, Amarillo, Arlington, Austin, Brownsville, Corpus Christi, Dallas, El Paso, Fort Worth, Houston, Irving, Lubbock, Midland, San Antonio, Sherman, Tyler, Waco
UTAH — Salt Lake City
VIRGINIA — Arlington, Hampton, Norfolk, Portsmouth, Virginia Beach
WASHINGTON — Seattle

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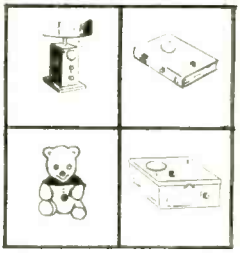

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RADIO SHACK

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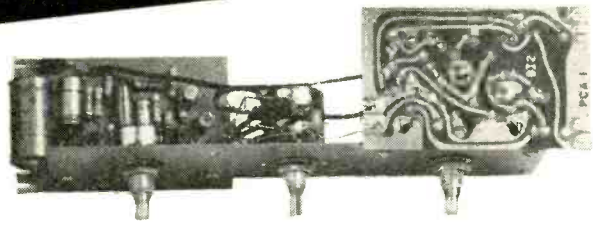

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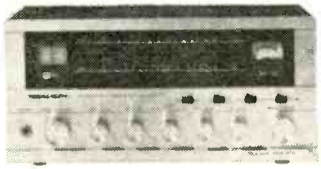

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CIRCLE NO. 27 ON READER SERVICE PAGE

CB'ers, Inc. Club newsletter is edited by Ed M. Althiser, KLP3951, who is interested in swapping with other club editors. Write Ed at Box 683, Ogdensburg, N.Y. Club officers: Don McAdam, KLP9735, president; Roger Ousterhout, KID0609, vice president; Margaret Molner, KIC5636, secretary; Dewey Grommon, KRP4929, treasurer; and John Molner, Jr., KIC3754, sergeant at arms.

I'll CB'ing you.

—*Matt, KHC2060*

FUNCTION QUIZ ANSWERS

(*Quiz appears on page* 45)

1 — H A BALLAST resistor drops the excess voltage placed across a filament string.

2 — C A BLEEDER resistor is used as a light load on a power supply to improve the voltage regulation by minimizing the voltage charge from no load to full-load current.

3 — A A BUFFER capacitor protects the contact points in a vibrator by absorbing the kickback voltage produced by the collapsing magnetic field in the vibrator transformer.

4 — I A DAMPING resistor lowers the Q of a coil and causes coil ringing to decay more rapidly.

5 — B A DECOUPLING capacitor prevents a.c. signals from entering a power supply by forming an L-section filter with a series voltage-dropping resistor.

6 — E A DEGAUSSING coil removes unwanted magnetized areas in the shadow mask of a color CRT.

7 — F A LOADING coil is inserted in series with a whip antenna to add series inductance and effectively increase its electrical length.

8 — D A NEUTRALIZING capacitor cancels internal grid-to-plate capacitance coupling in a triode by introducing an out-of-phase signal through an external plate-to-grid circuit.

9 — J A PARASITIC SUPPRESSOR is a low-value resistor inserted in series with a conductor to dampen oscillations which may occur due to the resonance effects of lead inductance and capacitance.

10 — G A PEAKING coil is placed in series with the plate load resistor of an amplifier tube to increase the plate load and amplification at high frequencies.

LETTERS (Continued from page 14)

semiconductor device, there is no guarantee that you'll be able to obtain it from all Amperex dealers. The TAA103 may be a tiny affair, but it has sufficient lead length to permit connections as needed.

SPECIAL CONSIDERATION FOR OM'S?

I read with interest your article about special consideration for YL's and XYL's in ham radio ("Why Not A Ham License Just For Ladies?" December, 1967). As a male operator, I heartily back such a possibility, but I feel there is another group that deserves special consideration—namely, the hams who are neither female nor electronics wizards.

Ham radio began as a hobby, and a hobby should be open to anyone interested in it, even if he is unable to acquire a technical background of some depth. I am a modern language instructor, and ham radio not only gives me some diversion, but it is also an ideal way for me to keep up and improve my technical skills. I, too, can serve my country and my hobby effectively as an ambassador, but not if the necessary communications channels are taken from me because I lack the time for extensive training in electronics.

JAMES D. RUPERT, KØYTE
Austin, Minn.

IMPROVED SOLDERLESS BREADBOARD

I propose an improvement on the "Solderless Breadboard" (December, 1966). Instead of white pine, a plexiglass plate can serve as the breadboard. In addition to providing better insulation, it can be used as a drawon work surface for the circuits you design or work with. A grease pencil is best for drawing on the plexiglass. When an experiment pays off with a working circuit, you need only redraw on a piece of paper the circuit that is grease-penciled on the plexiglass.

CHRISTIAN MUYLLE
Bruxelles, Belgium

This suggestion sounds like a useful idea, and certainly would make experimenting easier. A lot of our readers will be indebted to your ingenuity.

OUT OF TUNE

Modern Slot-Car Controller *(December, 1967, page 41)*. In Fig. 1, on page 42, the polarity of diode *D5* was inadvertently reversed. The cathode of the diode should go to the collector of *Q3* and the anode to the negative side of the power pack. Also, *Q3* is a 2N2491 as shown in Fig. 1, not a 2N491 as called out in the Parts List on page 43. —30—

SHORT-WAVE LISTENING

(*Continued from page 83*)

which is also part of the Administration of Papua and New Guinea. Another station is planned for Samarai, a tiny island just off the eastern tip of New Guinea, whose population is 1115.

A word of advice to those of you who are trying to log the six stations already in operation. The combination of low power and low frequency makes their transmissions seemingly impossible to receive. It will take a lot of fine tuning and patience on your part to log any one of them. In your favor, however, will be the combination of long hours of darkness and an absence of summertime lightning static. Your Short-Wave Editor knows that several of the transmitters have been heard on the West Coast and a scattered few DX'ers in Eastern areas of the U.S. have also been reporting them.

Our thanks go to George Schnabel, *WPE8EMO*, Rochester, N.Y., for his assistance in the compilation of the above list.

All-Round DX'ers Course. Commencing next month, *Radio Nederland* will broadcast weekly sessions of an All-Round DX'ers Course. Material is being gathered by Jim Vastenhoud, the compiler of previous courses given by *Radio Nederland*. Printed test material will be supplied free of charge to participants. Enrollment is now open. For details, write to *Radio Nederland*, P.O. Box 222, Hilversum, Holland.

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 identification, and the make and model number of your receiver. We regret that we are unable to use all the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Albania—*R. Tirana* has "broken out" with numerous new frequencies, among them: 6201 kHz, heard at 2300 closing; 7310 kHz, noted at 0040 with Eng. talks and commentary (closing is at 0058); 9510 kHz, from 0400 s/on where it is QRM'ed by the BBC, London; and 11,905 kHz, logged at 0000 with Eng. news.

Angola—*R. Clube de Benguela*, 5042 kHz, is again being heard from about 2240 to 2304 s/off with pop music and anmts in Portuguese. Do not confuse this station with *Emissora De Guine*, slightly higher in frequency.

Station CR6RB, *R. Ecclesia*, Luanda, 4984 kHz, has a strong signal with opening at 0500 in Portu-

guese. Station CR6RD, *R. Clube de Luambo*, Nova Lisboa. 5061 kHz, is also strong from its 0500 opening in Portuguese but fades badly by 0600.

Emissora Oficial is planning a number of regional stations. On the air already is *Emissor Regional de Menongue* at Serpa Pinto, with 1 kW on 1295 kHz. soon to be 5 kW. Scheduled for this year is a 5-kW xmtr on 4780 kHz at the same location. Coming later: 5-kW units at Henrique de Carvalhi on 4860 kHz. at Cabinada on 4925 kHz. at Luso on 4970 kHz. and at Texeira de Sousa on 4885 kHz.

Australia—*R. Australia* is presently broadcasting to N. A. at 0100-0300 on 17.840 and 15.320 kHz. and at 1214-1315 on 11.710 and 9580 kHz. A DX program is aired Mondays at 0215.

Bolivia—A new station is *R. Guayaramerin*, 4964 kHz, logged at 0130-0216. Station CP100, *R. Ibare*. Beni. 4959 kHz. was noted around 0200 with an irregular s/off; it can be heard daily but often suffers from RTTY QRM.

Brazil—Station ZYK21. *R. Tamandare*. Recife. 3265 kHz. is heard occasionally; the best listening time is around 2330 when a variety program in Portuguese is featured.

Ceylon—The Ceylon B/C Corp., Colombo. now has the European Service on 17,820 kHz (moved from 15.330 kHz) at 0655-0815, while the S. E. Asian Service is on 17.830 kHz at 0910-1030. The Commercial Service is in Eng. at 0130-0330 on 9720 (announced as 9670 kHz) and 15,230 kHz. and at 1230-1645 on 7190 and 15.230 kHz. A National Service is aired at 0200-1700 on 5076 kHz—has anyone heard it?

Colombia—*Ondas del Meta* (location not yet ascertained) is a new station on 4884 kHz. where it is heard from 0330 to 0402 s/off; news in Spanish is given at 0350. Also believed to be new is *R. Bogota*, 6172 kHz. heard best around 0200.

Czechoslovakia—*R. Prague* has a new schedule: Eng. to N. A. at 0100-0200 on 5930, 7345, 9630, and 11.990 kHz; to West Coast N.A. at 0330-0430 on the same frequencies except that 5930 kHz is replaced by 6090 kHz. "Magazine of the Air" is broadcast Sundays at 1400-1500 on 15,448, 17.705, and 21,450 kHz.

Egypt—Cairo is noted on 11.652 kHz from 0025 to 0032 s/off in native language, and on 11.655 kHz from 1905 to past 1930 with Arabic singing and talks.

El Salvador—Station YSS. *R. Nacional de El Salvador*, San Salvador, 9555 kHz, has a fair-to-good signal from 0146 to 0250, with news, time, music, and answers to letters, all Spanish.

England—London's schedule to the Western Hemisphere currently reads: to Canada, U.S., and Mexico at 2115-0030 on 6195 and 11,780 kHz. at 2130-0330 on 9580 kHz, and at 2245-0330 on 6110 kHz—a special Eng. xmsn is given at 1500-1730 on 21,610 kHz; to West Indies, Central America, and Northern South America, including Peru, at 2000-2115 and 2130-2245 on 15,200 kHz, at 2000-2115 and 2130-0330 on 11,750 kHz, at 2130-0330 on 9580 kHz, and at 2245-0330 on 6110 kHz; to Southern South America, except Peru, at 2000-2315 on 17,740 kHz, at 2115-0330 on 12.095 kHz, at 2200-0330 on 9510 kHz, at 2000-0215 on 15.260 kHz, and at 2245-0330 on 11.750 kHz; to all of South America at 2200-0415 on 15.140 and 11.865 kHz, via Ascension Island relay; to the Atlantic and Pacific Islands at 2200-

SHORT-WAVE ABBREVIATIONS

annmt—Announcement	QRM—Station interference
BBC—British Broadcasting Corp.	R.—Radio
B/C—Broadcasting	RTTY—Radioteletype
Eng.—English	s/off—Sign-off
ID—Identification	s/on—Sign-on
kHz—Kilohertz	V.—Voice
kW—Kilowatts	VOA—Voice of America
N.A.—North America	xmsn—Transmission
	xmtr—Transmitter

The BBC World Service, London, operates 22¾ hours every day. Shown here, left to right in foreground, are Robert Haviland, narrator of "The World Today;" Angela Dunnill, secretary; John Radcliffe (seated), member of the program's production team; and Robert Milne-Tyte, editor of "The World Today."

0330 on 7130 kHz, and to S. Atlantic areas at the same time on 9765 kHz.

Ethiopia—Station ETLF, Addis Ababa, has a new Eng. schedule. Xmtr I: 0400-0425 to E. Africa on 7245 kHz, and 0430-0455 to S. Africa on 11.920 kHz (both xmsns listed as tests); 0530-0555 to W. Africa on 11.805 kHz; 1330-1345 to India on 15,315 kHz; 1655-1710 to Ethiopia on 6065 kHz; 1900-1945 to W. Africa on 15,410 kHz; and 2300-2325 to "N. S. America" on 15,315 kHz and to "N. N. America" on 15,230 kHz. Xmtr II: 1330-1400 to India on 15,400 kHz; 1700-1715 to E. Africa on 9560 kHz; 1800-1815 to S. Africa on 9705 kHz; and 2330-2340 to "S. S. America" in Spanish and Eng. on 11.940 and 11,770 kHz. Both of the Americas xmsns are listed as "Thursday-Sunday."

France—Paris was noted on 21,525 kHz, broadcasting to the Middle East, to 1400 s/off.

Haiti—Station 4VWA, *R. Citadelle*. Cap Haitien, 6155 kHz, not heard from for many months, is again audible at 2330-0000, all-French.

Holland—*R. Nederland*, Hilversum, has this new Eng. schedule to N.A.: 1425-1445 on 17,880 kHz, 1525-1545 on 21,480 and 17,810 kHz, 1655-1715 on 21,570 and 11,730 kHz and 2030-2050 on 17,840 and 15,340 kHz (all Tuesdays and Fridays only); 2055-2150 on 15,425 and 11,730 kHz (Monday through Saturday); 0125-0220 on 9590 kHz (via Bonaire—daily). The "Happy Station Program" is aired Sundays at 1855-2020 on 15,425 and 11,730 kHz.

Honduras—Station HRSY, *Voz del Pacifico*, San Lorenzo, 4914 kHz, was noted at 0145-0200 with music and dedications in Spanish. *La Voz de Occidente*, Santa Rosa de Copan, has moved up to 5988 kHz (from 5960 kHz) and is heard best around 0000. Do not confuse with seemingly new *R. Occidente*, Venez., on 9750 kHz.

Indonesia—The regional station reported last month on 7285 kHz is definitely in Sorong; it broadcasts in Indonesian at 1130-1200. A new outlet for *V. of Indonesia*, Djakarta, is 6110 kHz, heard from 1100 s/on in Eng. but with weak modulation.

Italy—An Italian station being heard on 6060 kHz is *R. Umbra*, Piazza della Republica 1, Ancona; it has Italian at 1730 and Eng. at 1800. "Nocturne" is aired at 2320-0625 (from 2245 on Sundays) on 6060 and 9515 kHz (Caltanisetta), 899 kHz (Milan), and 845 kHz (Rome).

Korea (North)—Pyongyang now broadcasts to Latin America in Spanish at 2300 on 16,320 and 11,765 kHz, in Korean at 0000, and in Spanish again from 0100 to at least 0135. An xmsn has also been noted on 16,095 kHz from 0125 to 0147/

READER SERVICE PAGE

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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

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2 b

DX COUNTRIES AWARDS PRESENTED

To be eligible for one of the DX Countries Awards designed for WPE Monitor Certificate holders, you must have verified stations in 25, 50, 75, 100, or 150 different countries. ("Letters of Certification" will be issued to those who have over 150 countries verified in steps of 10.) The following DX'ers recently received their awards.

230 COUNTRIES VERIFIED

James Young (WPE6ENA), Wrightwood, Calif.

200 COUNTRIES VERIFIED

Frank Peters (WPE9EZI), Chicago, Ill.

190 COUNTRIES VERIFIED

Don Jensen (WPE9EZ), Racine, Wis.

180 COUNTRIES VERIFIED

Chuck Edwards (WPE4BNK), Fort Lauderdale, Fla.

150 COUNTRIES VERIFIED

Dave Glow (WPE1FKZ), Pepperell, Mass.

100 COUNTRIES VERIFIED

Richard Grab (WPE2HYM), Woodside, N. Y.
Rene Chicoine (VE2PE1JH), Montreal, Que., Canada
William Via (WPE3FHB), Baltimore, Md.
John Sgrulletta (WPE2MXF), Bedford Hills, N. Y.
Mike Finigan (WPE4ISQ), Monroe, N. C.
A. E. Glover (WPE7CGL), Port Angeles, Wash.
Dennis Ashworth (WPE7BZB), Corvallis, Ore.
Richard Davis (WPEØAKR), Denver, Colo.
C. Vernon Hyson (WPEØCNF), Evergreen, Colo.
Paul Slater (WPE1FRT), Medford, Mass.

75 COUNTRIES VERIFIED

Richard Pistek (WPE9HOA), Chicago, Ill.
Ira Schultz (WPE2NGG), White Plains, N. Y.
M. P. Frutchey (WPE4PC), Winter Park, Fla.
Peter Lisenco (WPE2OWX), Flushing, N. Y.
Timothy Armstrong (WPE6GGJ), Suisun City, Calif.
Viktor Decyk (WPE1FCD), Colrain, Mass.
Sheldon Chorney (WPE2AWZ), Brooklyn, N. Y.
Edward Shaw (WPE4JHP), Roanoke, Va.
Gary Ligon (WPE4JAX), Cliffside, N. C.

50 COUNTRIES VERIFIED

Bill Jacobus (WPE6GHL), Cleveland, Ohio
Glen Jenkins (WPE4IVJ), Camp Le Jeune, N. C.
Kerry Plantenga (WPE9ITC), Lafayette, Ind.
Bob Huber (WPE3GUN), Wilmington, Del.
Bruce Bublick (WPE2OTK), Passaic, N. J.
Marlin Field (WPE8FRE), Benton Harbor, Mich.
Edward Rosenthal (WPE9IEG), Middleton, Wis.
Roger Thering (WPE6FUB), Barstow, Calif.
Rick Charnes (WPE2PBV), Cherry Hill, N. J.
Charles Maier (WPE3FXJ), Baltimore, Md.
R. M. Turkel (WPE1HAC), Brookline, Mass.
John Osborne (VE3PE2HA), Toronto, Ont., Canada

25 COUNTRIES VERIFIED

John Zapisek (WPE2OKD), Wading River, N. Y.
Tony Bratton (WPE8FMX), Anderson, Calif.
Clarence Hagerman (WPE2NRU), Delaware, N. J.
Walt Green (WPEØEVK), Davenport, Iowa
Philip Jones (WPE6FOI), Whittier, Calif.
Clarke Greene (WPE1ECF), Forestville, Conn.
Jerry Hermann (WPE3GNQ), New Castle, Pa.
Leslie Nice (WPE5DRL), Dallas, Texas
Andrew Pappas (WPE9ISQ), Chicago, Ill.
Stanley Newman (WPE2PJS), Brooklyn, N. Y.
Steve Bradke (WPE2PJC), Oyster Bay, N. Y.
Ralph Perry (WPE9ITN), Westchester, Ill.
Robert Ulloa, Jr. (WPE6GST), Torrance, Calif.
Dave Krutz (WPE2PKA), Little Falls, N. Y.
Paul Hill (WPE4JCW), Virginia Beach, Va.
John Matz, Jr. (WPE1HDF), Weston, Mass.
John Wallis (WPE6GFZ), Larkspur, Calif.
Charles Harris (WPE2OGK), Rochester, N. Y.
Rick Abshier (WPE9IQX), Lisle, Ill.
Paul Mayo (WPE2NSG), Brooklyn, N. Y.
Bill Caffyn (WPE7CER), Great Falls, Mont.
Estill Hall, Jr. (WPE4GJC), McDowell, Ky.
Jeff Wilson (WPE3HIW), Hatboro, Pa.
Bob Wigelsworth (VE3PE2EN), London, Ont., Canada
Rodney Wilhelm (WPE2PCU), New Paltz, N. Y.
John Cazahous, Jr. (WPE6FLR), San Francisco, Calif.
Tom Nickels (WPE3HFW), Hatboro, Pa.
Robert March (VE7PE1CF), Victoria, B. C., Canada
A2C Robert Combs (WPE2PJU), APO, New York, N. Y.
Richard Vessell (WPE9EIL), Bloomington, Ill.
James O'Neill (WPE3GYT), Kensington, Md.
George Hauck (WPE8GZX), Cincinnati, Ohio
O Neal Chambers, Jr. (WPE8ISF), Lockport, Ill.
Marlin Field (WPE8FRE), Benton Harbor, Mich.
Henry Massey, Sr. (WPE4JKH), Fayetteville, N. C.
Terry Wiese (WPEØFBP), Madison, S. D.
Kevin Wiese (WPEØEZY), Madison, S. D.
Carl Hayman (VE3PE2KZ), Bowmanville, Ont., Canada
John Mraz, Jr. (WPE3HIT), Phoenixville, Pa.
Doug Wise (WPE8JMQ), Tiffin, Ohio
Jerry Cooley (WPEØEYK), Madison, S. D.
John Easterly (WPE2AEI), San Mateo, Calif.
S. L. Cooper, Jr. (WPE5EOZ), Houston, Texas
Joseph Basile (WPE1GKV), Brighton, Mass.
Daniel Thomas (VE3PE2IR), Burlington, Ont., Canada
Ethel Fogleson (WPE8JEA), Cleveland, Ohio
Frank Galdo (WPE2POG), Riverside, N. J.
John Flynn (WPE2NME), Brooklyn, N. Y.
Harry Hines, Jr. (WPE2OFS), Newark, N. J.
Robert Buckner (WPE2NMO), Rush, N. Y.
Alan Rhodes (WPE2OQU), Mountainside, N. J.
Richard Collier (WPE3HIE), Hyattsville, Md.
Lin Robertson (WPE6GVK), Palm Springs, Calif.
Barry Tuttleman (WPE8JGK), Oak Park, Mich.
David Coelho (WPE1HBW), Danbury, Conn.
Craig Rice (WPE2OXR), Webster, N. Y.
Victor Tan Yew Seng (9V1PE1B), Raffles Park, Singapore
Richard Van Halanger (WPE3HJL), Turtle Creek, Pa.
Larry Beat (WPE8JJX), Toledo, Ohio
Joseph Rotello, Jr. (WPE7CGI), Tucson, Ariz.
Alan Perkins (WPE4JJT), Alexandria, Va.
William Snyder (WPE2ONK), Levittown, N. Y.
Milton Coleman (WPE3EAE), Levittown, Pa.
Thomas Feeney (WPE1GZC), Newport, R. I.
Darrell Neron (WPE2OXL), Williamstown, N. J.
Alan Braun (WPEØEWW), Prairie Village, Kans.
Paul Farmanian (WPE6GVG), Glendale, Calif.
Elaine Walton (WPE8JLR), Bedford, Ohio
Bill Kaiser (WPE8JLL), Paw Paw, Mich.
Montie Fisher (WPE5ESZ), Oklahoma City, Okla.
Gary Phillips (WPE8HND), Dearborn Heights, Mich.
Gary Bywaters (WPE3GZA), Burgettstown, Pa.
James Stimeck (WPE3HMU), Philadelphia, Pa.
Sherman Klem (WPE2OKU), N. Merrick, N. Y.
Edward Berkeley, Jr. (WPE1GGM), Danvers, Mass.
Roy Carroll (WPE2QAA), Neptune, N. J.

close in Spanish. English can be noted at times from 1100 to 1130 on 7580 kHz, news and commentary.

Luxembourg—*R. Luxembourg* is now on 15.245 kHz, relaying 233 kHz in French. Does anyone have the schedule?

Maldive Islands—The Maldive Islands B/C Service, Male, 4900 kHz, has VOA news at 1400 and Eng. at 1500-1730. The s/off is with "Auld Lang Syne," which is the tune of their national anthem.

Monaco—*Trans-World Radio*, Monte Carlo, opens at 0630 in Eng. on 7295 kHz with a good signal.

Netherlands Antilles—*Trans World Radio*, Bonaire, has been noted on 15,335 kHz in Spanish from 0000 to 0025 s/off, and on 6110 kHz with tests at 0820-0900.

New Caledonia—Noumea is loggable in mid-USA on 7170 kHz in French with closing varying from 1104 to 1110. A positive ID in French precedes the "La Marseillaise."

Peru—Station OAX7L, *La Voz del Altiplano*, Puno, 5817 kHz, is noted around 0200 with typical Peruvian music and listeners' requests. Station OAZ4R, *R. San Juan*, Tamra, 4891 kHz, is heard with request music until 0500/close. Station OAX7T, *R. Sicuani*, Sicuani, 4837 kHz, is weak with pop tunes and anmts until past 0430. All of these Peruvian broadcasts are in Spanish.

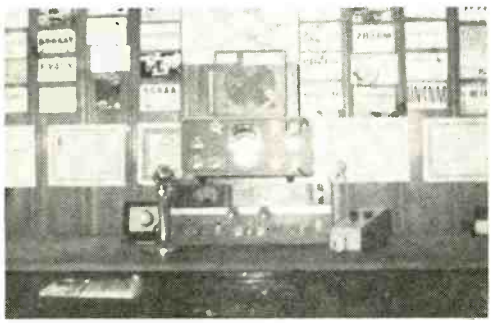
Philippines—Station SEARV, Dumaguete City, is testing on 15,240 kHz at 2330-0130 and 1100-1300. The xmtr is at Bulacan but reports should be sent to South East Asia Radio Voice, Box 4148, Manila.

Poland—After a long absence, *R. Warsaw* has resumed service to N.A. at 0315-0345 on Tuesdays in Polish and Saturdays in Eng. on 7205 kHz (until Jan. 31), 9655 kHz (Feb. 1 to 29), and 11,870 kHz (March 1 to April 20). Reports are requested; send them to Polish Radio, P. O. Box 46, Warsaw, Poland.

South Africa—*R. RSA*, Johannesburg, was found with a strong signal on 15,245 kHz at 0230 with Eng. s/on, but there was considerable QRM from a Brazilian.

Sweden—*R. Sweden*'s complete Eng. schedule reads: to East Coast N. A. at 1100-1130 on 15,240 kHz, at 1400-1430 on 21,585 kHz, and at 0030-0100 and 0200-0230 on 5990 kHz; to West Coast N.A. at 1600-1630 on 15,240 kHz and at 0330-0400 on 11,705 kHz; to South America at 2245-2315 on 11,705 kHz; to Europe at 1100-1130 and 2045-2115 on 6065 kHz, and at 2315-2345 on 1178 kHz; to the Middle East at 1900-1930 on 11,705 kHz; to the Far East at 1230-1300, 1600-1630, and 2045-2115 on 9625 kHz and at 2245-2315 on 9705 kHz; to Africa at 1230-1300 on 21,690 kHz and at 1900-1930 on 15,240 kHz; to Asia at 1400-1430 and 0515-0545 on 15,240 kHz.

Switzerland—Berne's new complete schedule in



The listening post of Carl Durnavich, WPE9IFO, Riverdale, Ill., features a Hallicrafters SX-110 receiver. Carl had verifications from 16 states and 3 countries at the time he sent in this picture. The QSL he values the most is from Radio Caroline, one of Great Britain's off-shore pirate stations.

SHORT-WAVE CONTRIBUTORS

Charles Washburn *(WPE1FO)*, Machias, Maine
Conrad Baranowski *(WPE1GXX)*, Boston, Mass.
Arnold Skemer *(WPE2FSY)*, Flushing, N. Y.
Eric Lebowitz *(WPE2JJY)*, Jackson Heights, N. Y.
William Graham *(WPE2LMU)*, Binghamton, N. Y.
Robert Kaplan *(WPE2MJR)*, Bronx, N. Y.
R. A. Sgambato *(WPE2NZS)*, Bronx, N. Y.
Michael Lampert *(WPE2ONS)*, Massapequa Park, N. Y.
Edward Sobota *(WPE2PJR)*, Fulton, N. Y.
Barry Glassberg *(WPE2PNG)*, Brooklyn, N. Y.
James Riviello *(WPE2POK)*, Cherry Hill, N. J.
Steve Temple *(WPE2PYS)*, Ulster Park, N. Y.
Edward O'Connor *(WPE2PZA)*, Englewood, N. J.
Roy Carroll *(WPE2QAA)*, Neptune, N. J.
Jim Neff *(WPE2RS)*, Springville, N. Y.
William Via *(WPE3FHB)*, Baltimore, Md.
Mike Hunnicutt *(WPE3GOV)*, Washington, D. C.
Bob Barr *(WPE3HNC)*, Willow Grove, Pa.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
David Meisel *(WPE4IRS)*, Charlottesville, N. C.
Edward Henley *(WPE4JHC)*, Mobile, Ala.
Henry Massey, Sr. *(WPE4JKH)*, Fayetteville, N. C.
Don Kenney *(WPE6AET)*, Santa Monica, Calif.
W. W. Mosby *(WPE6EXA)*, San Jose, Calif.
Trevor Clegg *(WPE6FAF)*, Santa Cruz, Calif.
Jon Biemer *(WPE7CKL)*, Phoenix, Ariz.
Bill Eisinger *(WPE7COQ)*, Gooding, Idaho
Robert French *(WPE8FGH)*, Bellaire, Ohio
Henry Gac *(WPE8JST)*, Detroit, Mich.
Wayne Jay *(WPE9IED)*, U. S. Embassy, Quito, Ecuador
A. R. Niblack *(WPEØKM)*, Vincennes, Ind.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Clarence Wahl *(WPEØEQI)*, Wichita, Kans.
Thomas Rohrs *(WPEØEYV)*, APO, Philippines
Jack Bacon *(WPEØFDJ)*, Bloomington, Minn.
Jack Perolo *(PY2PE1C)*, Sao Paulo, Brazil
Roland Wahlgren *(VE7PE1CR)*, N. Vancouver, B. C., Canada
David Alpert, Morton Grove, Ill.
Leo Alster, Rahway, N. J.
Greg Barman, Evanston, Ill.
Dwight Denison, Canfield, Ohio
Russell Dixon, Cherry Hill, N. J.
Richard Flack, Troutdale, Ore.
John Janowick, Detroit, Mich.
Terry Perkins, La Grange Park, Ill.
Paul Seyffer, San Pablo, Calif.
Bruce Smith, San Diego, Calif.
Rod Williams, Rossville, Ga.
Radio Australia, Melbourne, Australia
Radio Prague, Prague, Czechoslovakia
Radio Voice of the Gospel, ETLF, Addis Ababa, Ethiopia
Radio Nederland, Hilversum, Holland
Radio New York Worldwide, New York, N. Y.
Radio Sweden, Stockholm, Sweden
Sweden Calling DX'ers Bulletin, Stockholm, Sweden

Eng. reads: 0130 to N. A. (East) on 6120, 9535, and 11,715 kHz; 0445 to N. A. (West) on 6120 and 9695 kHz; 0700 to Australia and New Zealand on 9590 and 11.775 kHz; 0700 to Europe (weekdays) on 3985, 6165, and 9535 kHz; 0845 to Japan and China on 15.135 and 17.830 kHz; 1000 to Africa (I) on 15.305, 17,830, and 21.520 kHz; 1130 to United Kingdom and Ireland (I) on 9665 and 11,865 kHz; 1315 to S. E. Asia, India, and Pakistan on 15.305, 17,845, and 21.520 kHz; 1500 to the Near East on 11.775, 15.305, and 17.830 kHz; 1815 to Africa (II) on 11,775 and 15,305 kHz; 1930 to United Kingdom and Ireland (II) on 6015 and 9665 kHz. Each xmsn is one hour in length.

Uruguay—Station CXA13, *R. Carve*, Montevideo, was noted on 6135 kHz at 0200 with commercials, ID, and news.

Venezuela—A new station is *R. Occidente* on 9750 kHz, noted at 2230 with Spanish ads and native language programming. *R. Tovar* had been operating here; has anyone found it on another frequency?

Vietnam (North)—Hanoi's latest schedule lists Eng. at 1000-1030 on 9760 and 7210 kHz, at 1300-1330, 1530-1600, and 2300-2330 on 11,840 and 9840 kHz. However, Eng. at 1000 and 1300 is being reported only on 11,760 kHz. —30—

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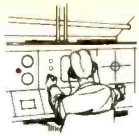
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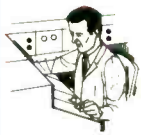
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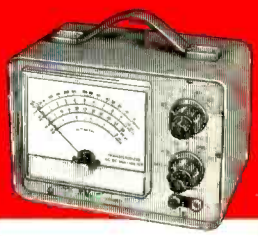

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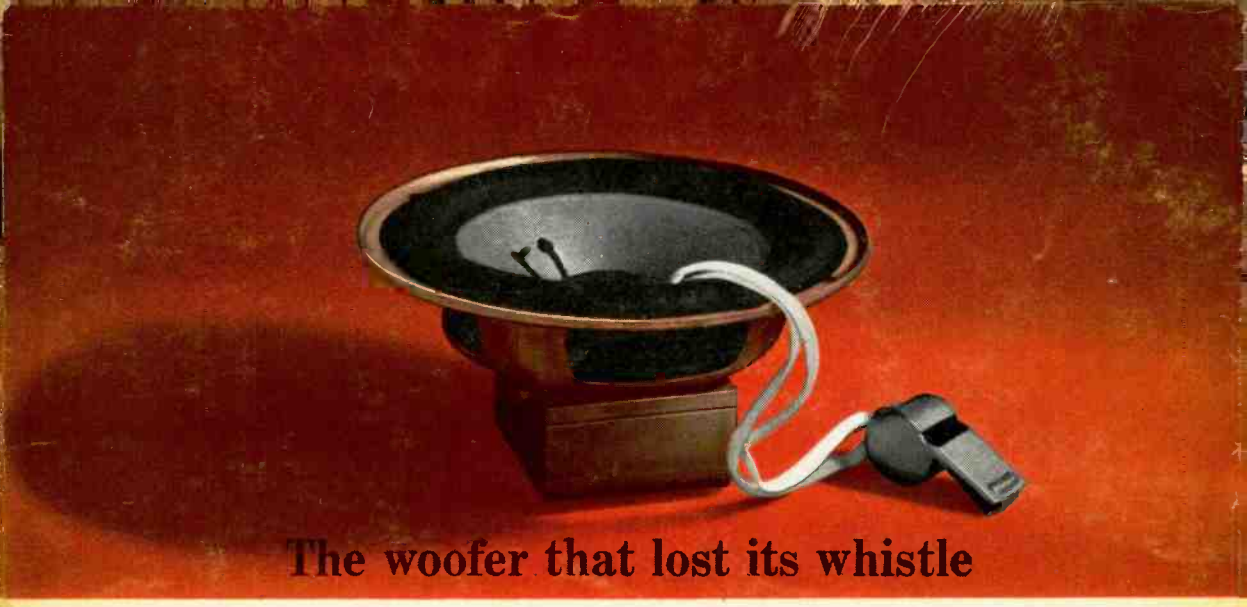
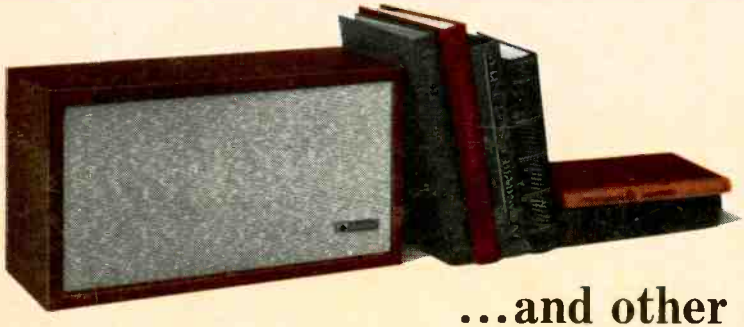


The woofer that lost its whistle



...and other stories.

The woofer cone in a very small enclosure must move a long way to provide all the bass you want to hear. In the new E-V EIGHT, for instance, the 6-inch cone moves back and forth over one-half inch. But in most woofers something strange happens as it moves. It whistles!

You see, the air trapped inside the speaker is literally "pumped" in and out past the voice coil. The whistle is almost inevitable. Except, that is, in the E-V EIGHT.

We did two things almost nobody else bothers to do. First, we vented the woofer. Air can't be trapped inside. Then we punched six big holes in the voice coil form. Air can't be pumped back and forth. And that's how the E-V EIGHT lost its whistle (and gained almost 2 db extra efficiency in the low bass in the bargain)!

The E-V EIGHT tweeter was another story. We aimed to eliminate the "buzz" and "fuzz" so typical of modestly priced speaker systems. What was needed was a better way to control cone motion at very high frequencies. And it literally took years of testing to solve the problem.

The answer looks deceptively simple. We put a ring of short-fiber polyester felt behind the cone, and a precisely measured amount of viscous vinyl damping compound under the edge. Plus a light-weight aluminum voice coil to extend the range to the limits of your hearing. Highs are remarkably uniform and as clean as a (oops!) whistle!

Even the E-V EIGHT enclosure is unusual. examine the walnut grain carefully, especially at the corners. It's a perfect match because we use one long piece of wood, folded to form the cabinet! And we add a clear vinyl shield on every finished surface, to protect the E-V EIGHT from the mars and scratches of day-to-day living.

There are so many good ideas inside the tiny new E-V EIGHT, you may wonder how we found room for them all. Chalk it up to top-notch engineering talent and facilities, plus a very real dedication to the ideal of better value in every product.

Listen to the E-V EIGHT with the whistle-free woofer at your nearby Electro-Voice high fidelity showroom today. Then ask the price. At no more than $44.00 it's the best story of all.

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