SEPTEMBER • 35¢

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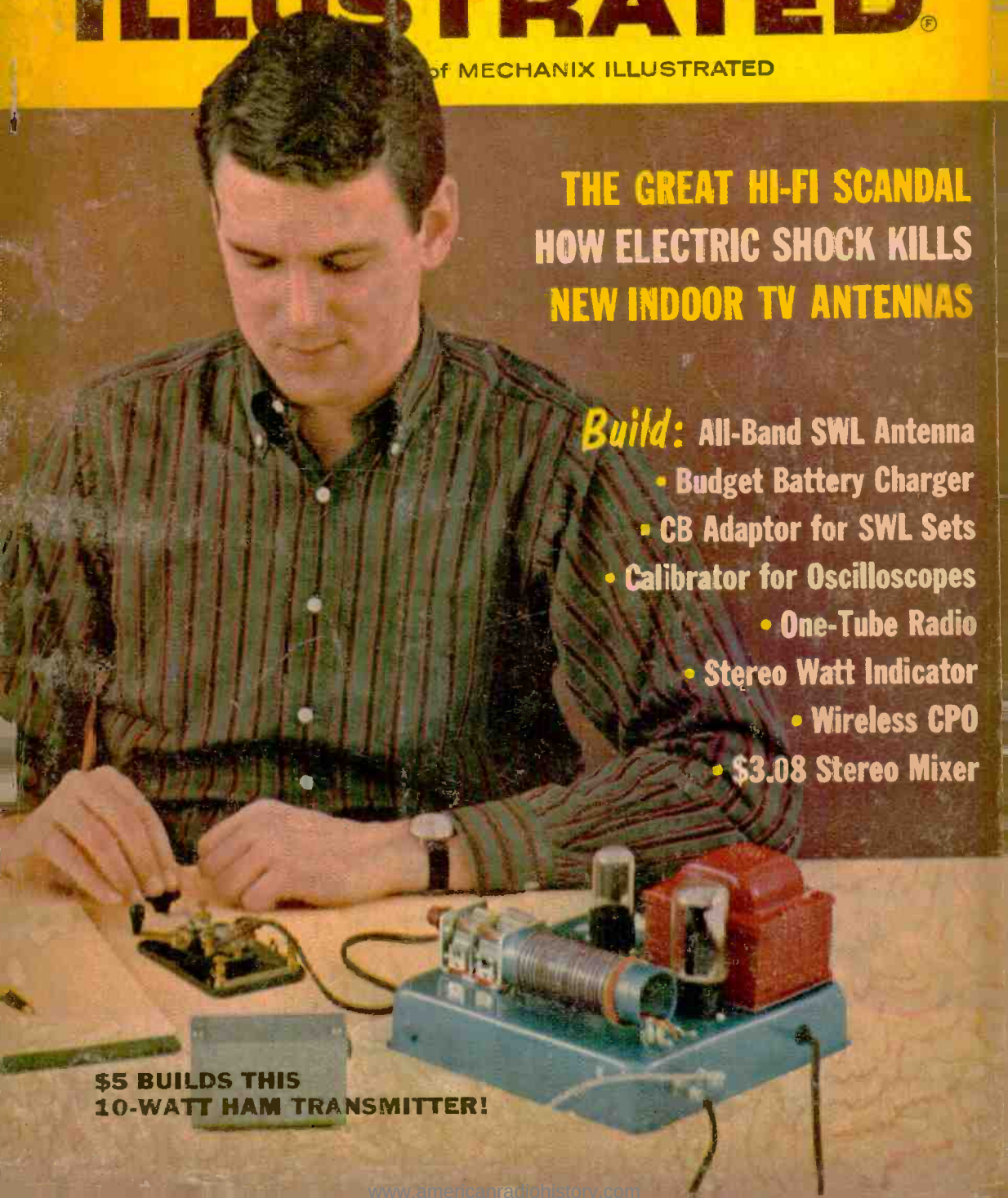
of MECHANIX ILLUSTRATED



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- CB Adaptor for SWL Sets
- Calibrator for Oscilloscopes
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- Stereo Watt Indicator
- Wireless CPO
- $3.08 Stereo Mixer

$5 BUILDS THIS
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To make your home-study diploma a true symbol of knowledge—to have a thorough understanding of electronics—you must learn with your hands as well as your head. You must create, experiment, explore, discover. How? By combining NRI's "bite-size," programmed lesson texts with NRI training equipment that remarkably brings to life the theory and practice you read about. NRI pioneered and perfected this on-the-job technique of training at home and combined it with lesson texts as direct and well-illustrated as 50 years of teaching experience can make them. Together, they make learning Electronics an exciting adventure . . . a fast-moving flight to fulfillment.

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1958..,the RCA Radio-Phone Series
1959...the RCA Mark VII
1963...the RCA Mark VIII

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the latest and greatest RCA CB radio of them all

Look at some of the new features...

NEW! Combination "S" Meter and Relative RF Output Meter

"S" Meter indicates the relative strength of incoming signal in "S" units. RF Output Meter (EO) indicates relative strength of the signal being transmitted.

NEW! Spotting Switch

Permits precise manual tuning of receiver without use of receiver crystals. Receiver can be tuned (or "spotted") quickly to any incoming channel. This means, when you buy crystals for extra channels, you can (if you wish) omit the RECEIVE crystals and buy only TRANSMIT crystals.

RCA, a pioneer in the development of citizens' band radio, has been providing quality equipment since the inception of the Class D Citizens' Radio Service in 1958. Now, these years of experience culminate in the great new RCA Mark Nine.

NEW! External Speaker Jack

Lets you connect an external speaker to the set, so incoming calls can be heard in remote locations.

- 9 fixed crystal-controlled TRANSMIT/RECEIVE channels, separately controlled
- All-channel continuously tunable receiver
- Illuminated meter and working channel indicator
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Commercial Engineering Dept. 1134W
415 South Fifth Street, Harrison, N. J.

Please send more information on the RCA Mark Nine CB Radiophone

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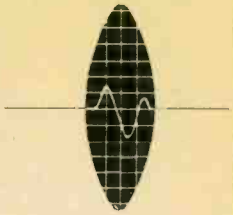
ELECTRONICS ILLUSTRATED

SEPTEMBER 1964 A Fawcett Publication Vol. 7, No. 5



General Features

Special Construction Projects

Radio: CB • Amateur • SWL

Audio & Hi-Fi

Theory & Practice

Regular Departments

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COVER — Ektachrome by Francis Duval

Profits That Lie Hidden in America's Mountain of Broken Electrical Appliances

By **J. M. Smith** *President, National Radio Institute*

And I mean profits for you — no matter who you are, where you live, or what you are doing now. Do you realize that there are over 400 million electrical appliances in the homes of America today? So it's no wonder that men who know how to service them properly are making $3 to $5 an hour — in spare time or full time! I'd like to send you a Free Book telling how you can quickly and easily get into this profitable field.

THE COMING OF THE AUTO created a multi-million dollar service industry, the auto repair business. Now the same thing is happening in the electrical appliance field. But with this important difference: anybody with a few simple tools can get started in appliance repair work. No big investment or expensive equipment is needed.

The appliance repair business is booming — because the *sale* of appliances is booming. One thing naturally follows the other. In addition to the 400,000,000 appliances *already* sold, this year alone will see sales of 76 million *new* appliances. For example, 4,750,000 new coffee makers, almost 2,000,000 new room air conditioners, 1,425,000 new clothes dryers. A nice steady income awaits the man who can service appliances like these. And I want to tell you why that man can be *you* — even if you don't know a volt from an ampere now.

A Few Examples of What I Mean

Now here's a report from Earl Reid of Thompson, Ohio: "In one month I took in approximately $648 of which $510 was clear. I work only part time." And, to take a big jump out to Oregon, here's one from Oscar W. Wikman of Astoria: "I can't do hard manual labor. That's why I'm more than thankful for your appliance course. It actually put me back on my feet. I started a full time repair shop half-way through the course and make as high as $30 some days."

Don't worry about how little you may now know about repair work. What John D. Pettis, of Bradley, Illinois wrote to me is this: "I had practically no knowledge of any kind of repair work. Now I am busy almost all my spare time and my day off — and have more and more repair work coming in all along. I have my shop in my basement."

We Tell You Everything You Need to Know

If you'd like to get started in this fascinating, profitable, rapidly growing field — let us give you the home training you need. Here's an excellent opportunity to build up "a business of your own" without big investment — open up an appliance repair shop, become independent. Or you may prefer to keep your present job, turn your spare time into extra money.

You can handle this work anywhere — in a corner of your basement or garage, even on your kitchen table. No technical experience, or higher education is necessary. We'll train you at home, in your spare time, using methods proven successful for over 45 years. We start from scratch — *tell* you in plain English, and *show* you in clear pictures — everything you need to know. And, you will be glad to know, your training will cost you less than 20¢ a day.

FREE BOOK *and Sample Lesson*

I think that our 32-page Free Book will open your eyes to a whole world of new opportunities and how you can "cash in" on America's "Electrical Appliance Boom."

I'll also send you a Free Sample Lesson. It shows how simple and clearly illustrated our instruction is — how it can quickly prepare you for a profitable future in this big field. Just mail coupon, letter, or postcard to me: *Mr. J. M. Smith, President, National Radio Institute, Dept. 504-94, Washington 16, D.C.* (No obligation, of course — and no salesman will call on you.)

EARN WHILE YOU LEARN
with this APPLIANCE TESTER

— Yours at No Extra Charge

Your NRI Course *comes complete* with all the parts to assemble a sturdy, portable Appliance Tester that helps you earn while you learn. Easy-to-follow manual tells how to assemble and use the Tester *right away*. Locate faulty cords, short circuits, poor connections, etc. in a jiffy; find defects in house wiring, measure electricity used by appliances; many other uses.

With this Tester you save time and make money by doing jobs quicker, making sure appliances operate correctly after repairs.

MAIL THIS FOR FREE BOOK and SAMPLE LESSON

Mr. J. M. Smith, President
NATIONAL RADIO INSTITUTE
Dept. 504-94, Washington 16, D.C.

Tell me how I can "cash in" on the "Electrical Appliance Boom." Send me your illustrated FREE BOOK that outlines the whole NRI Course, tells what opportunities are open to me, answers my questions, describes success of other students, and much more. Also send me the FREE SAMPLE LESSON so I can see how clear and easy your instructions are. I am particularly interested in:

☐ Spare Time Earnings ☐ Business of My Own ☐ Better Job

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ELECTRONICS ILLUSTRATED is published bi-monthly by Fawcett Publications, Inc., Fawcett Place, Greenwich, Conn. W. H. Fawcett, Jr., President; Gordon Fawcett, Secretary and Treasurer; Roger Fawcett, General Manager; Roscoe K. Fawcett, Circulation Director; Donald P. Hanson, Assistant General Manager.

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Second-class postage paid at Greenwich, Conn., and at additional mailing offices.

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Subscription price $4 for 12 issues in U.S. and possessions and Canada. All other countries $6 for 12 issues. Foreign subscriptions and sales should be remitted by International Money Order in U.S. funds payable at Greenwich, Conn.

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An Omni-Directional Vertical Ground Plane Antenna which overshadows all other antennas of similar type available today. This antenna has an extreme low angle radiation and a complete revolutionary matching system. These superior features combined with the world famous Mosley construction assures the CB'er of an out standing antenna for dependable communications.

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The SWL-7 is inexpensive 7-band receiving dipole that uses little space yet offers real "DX-Ability". This is a complete antenna which is very easily installed. The SWL-7 is resonant over the full width of each of the seven bands.

In request of further information pretaining to above antennas write for literature code # (11)

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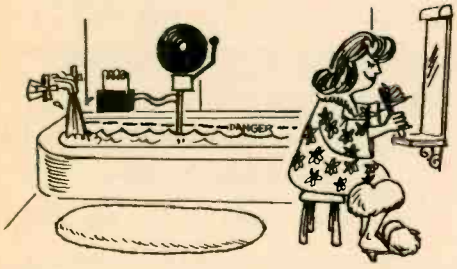
FEEDBACK
from our readers

Write to: Letters Editor, Electronics Illustrated, 67 West 44th Street, New York, N.Y. 10036

● PEACEMAKER



Thought you might like to know how I used that idea of yours for an electronic water switch (July '64 EI). My wife is always running the bathtub over and last time she did it I got so mad she didn't speak to me for a week. Anyway, I put one of those switches on the tub and she hasn't stopped talking since. Just thought you'd like to know about how you help people out, like husbands. Thanks a lot, fellows.

A. S.
Indianapolis, Ind.

We're sorry about that, A. S. We really didn't mean to help you that much. Maybe you could short the thing out when you want to quiet things down a little.

● NOT QUITE AOK

Although your article SEAT BELTS AOK in the May 1964 EI does not mention it, I am the designer and builder of the seat-belt-safety system. I feel that I have not been given due credit.

D. Stephen Toback
Pomona, Calif.

Now you have, Steve. AOK?

● DENTAL DILEMMA

Could you please include an article on super-miniature transmitters. Also how to build these tooth-size transmitters out of standard components to operate on the standard broadcast band.

Stephen Southworth
Fort Atkinson, Wis.

Afraid we're not quite reading you there, Steve. True super-miniature transmitters (integrated type) are mostly industrial and military and not in our field. Tooth-size BCB radios? Well . . .

● BEGINNER

I enjoy your magazine very much but there are a few abbreviations in it I don't quite understand, such as SWL, CB and DX. Would you please tell me what these mean?

Jenell Braun
Fredericksburg, Iowa

SWL: short-wave listener (or listening); CB: Citizens Band; DX: distance, distant, long-distance (reception).

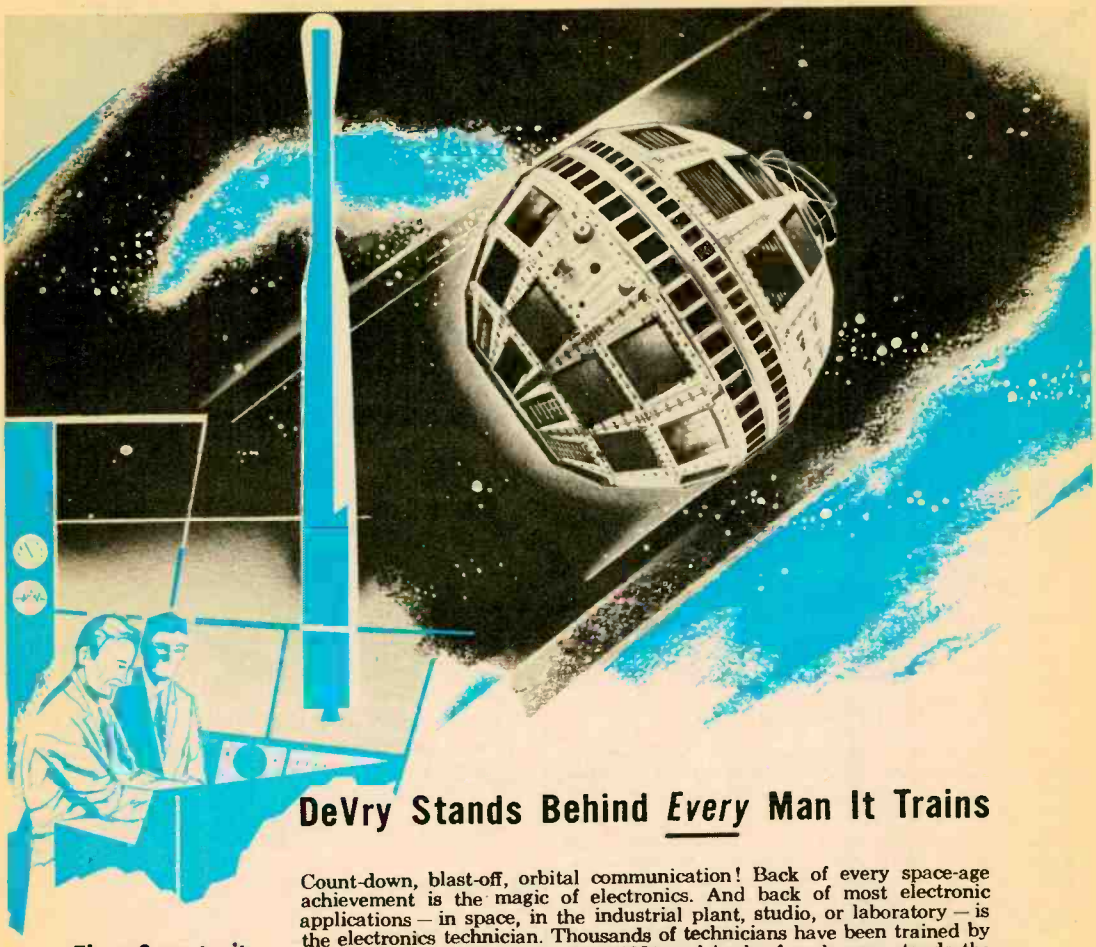
● JOKER

Your article on AWARDS FOR THE HAM SHACK (July '64 EI) spelled out a lot of awards hams can get, but you only presented one side of the picture. What does an OM like myself do when he finds himself with so many awards there's no room for equipment?

H.P.
West Hartford, Conn.

Take up home movies.

[Continued on page 8]



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- ☐ Television and Radio
- ☐ Microwaves
- ☐ Radar
- ☐ Automation Electronics
- ☐ Communications
- ☐ Computers
- ☐ Broadcasting
- ☐ Industrial Electronics
- ☐ Electronic Control

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DeVry ---Tops in Electronics

Chicago — Toronto

FEEDBACK

Continued from page 6

● HONEST INJUN

I would appreciate any information you would supply me concerning the honesty, integrity and reliability of the majority of TV repairmen. Or if this goes in the opposite direction and there are more dishonest men than honest in the TV business, I would like to have this information also.

J. A. Misuraca
Garden Grove, Calif.

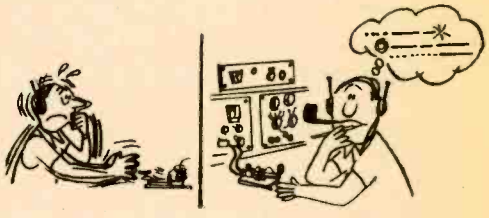
Who wouldn't?

● INVERTED

An addenda to your article on European tubes (THOSE EUROPEAN TUBE NUMBERS, July '64 EI) is how Europeans identify premium tubes. They just invert or mix up the designation, so a tube like ECC83 becomes E83CC.

R. Sovereign
Grand Rapids, Mich.

● SOLD AT LAST



Although I don't like to admit it, I'm one of those people who has always wanted a ticket but never quite got around to taking the test and getting one. Your article about those first few hours on the air (A HAM'S GREATEST THRILL, July '64 EI) has done more to inspire me than anything I can remember. I'll probably be so nervous I'll end up sending pig Latin the first time I fire up the rig, but my course is clear from here on out. It's ticket or bust!

Richard Navara
Los Angeles, Calif.

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- ★ SQ. WAVE GENERATOR
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- ★ AMPLIFIER
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YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

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

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

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 20 Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $26.95. The Signal Tracer alone is worth more than the price of the entire kit.

THE KIT FOR EVERYONE

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

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

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble-shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and technlques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

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

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 20 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, etc.

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

FREE EXTRAS

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

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

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

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

PRINTED CIRCUITRY

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

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

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

UNCONDITIONAL MONEY-BACK GUARANTEE

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1186 Broadway, Dept. 556 AE, Hewlett, N. Y.
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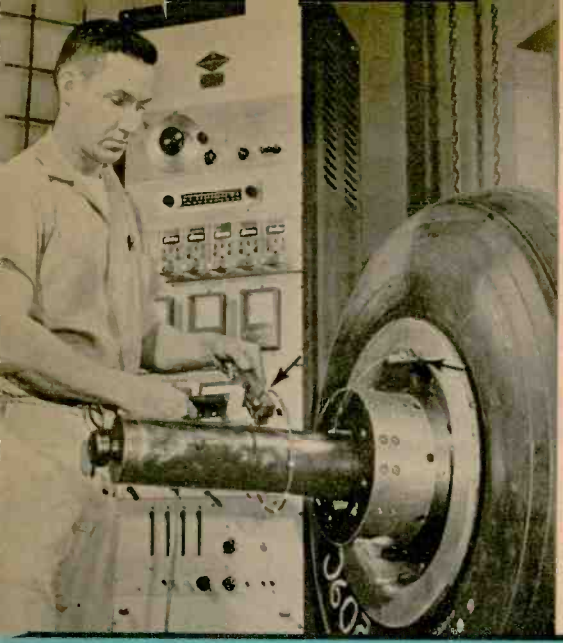
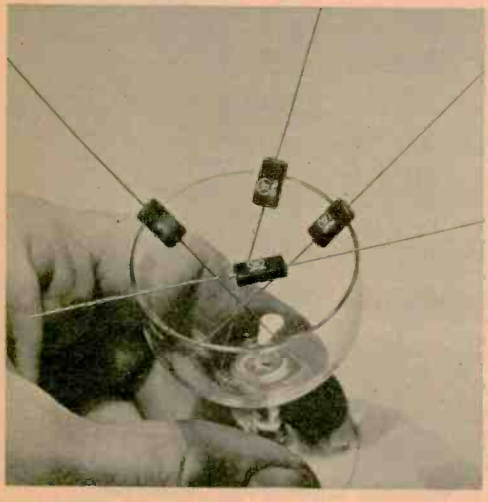


...electronics in the news

TALKING TIRE . . . Though it may not speak your language, this big rubber doughnut at Goodyear Aviation Products chatters away to a recorder all the time it is on a test stand. Time was when Goodyear relied on an old-fashioned pressure gauge and thermocouple to tell them about what a tire was doing—as soon as it had stopped doing it. Solution: a tiny five-channel FM transmitter (left arrow) which, bolted to the revolving wheel, is fed data by pressure transducer (right arrow) and four thermistors embedded in tire. Put the whole rig together and you've got an A-1 blabbermouth.



Swizzle Sticks? . . . Nope, but these new capacitors have a lot more in common with the glass in our photo than you might suspect. They're actually glass capacitors, designed for use in radar, telemetry and other types of electronic equipment where high quality and close tolerance can be extremely important. Westinghouse, the manufacturer, says the little fellows come through with about all the stability you could want, despite severe changes in environmental conditions.

Hello, Louie . . . Pinkerton, the outfit famed for keeping a protective paw on bankrolls, has added a new sheep to its fold: the New York World's Fair. But how do you go about protecting the world's most densely populated mile—which the Fair, during periods of peak attendance, represents? Easy, said the Pinkerton people, and promptly set to work. Nerve center of the company's security installation at the fair is a communications panel hidden away near the main entrance. Nixie lights give quick-as-a-wink identification of trouble spots, while some 60 two-way radios (see photo) put headquarters within instant reach of every member of the Pinkerton force.

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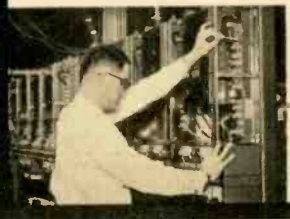

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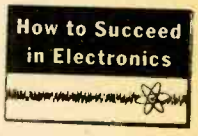

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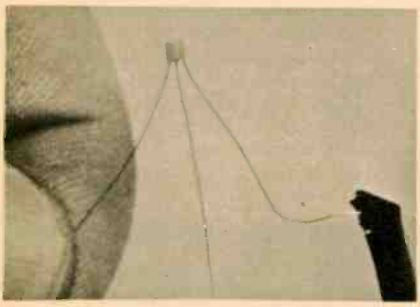
...electronics in the news

Handy Dandies . . . It's getting so you need the dexterity of a watchmaker to work in some areas of electronics, though that's not quite the case if it's a new ceramic micro-transistor you're handling. Since National



Semiconductor Corp., designed these real microminiatures with long leads and rugged housing, the gnat-size jobs can be picked up and handled with the same equipment used for ordinary transistors. Result: no need for costly special handling techniques.

DC Again . . . Though some few power lines in New York City still carry DC electricity, most areas of the nation forgot about Tom Edison's preference for DC ages ago. This installation near Portland, Ore., however, proves that direct current isn't done for yet. Setting the stage for an intensive DC research program to be conducted by an agency of the U.S. Dept. of Interior, the test center shown here will help officials learn more about the design and operation of DC transmission lines. Heart of the setup is an extremely flexible power supply. With its eight towering transformers and six rectifier columns (shown), the supply will energize a five-mile transmission line to obtain data on corona and radio interference. The voltage? A mere 1.1 million volts. That very small speck at the bottom of the photograph in the center is a man.

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1919

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...electronics in the news

Atom Powered . . . Though it looks like magic, it's really a case of static electricity, pure and simple. Shake the plastic container and the beads inside stick to the plastic sides

as though glued there. But expose the gadget to a radiation level of as little as 3 roentgens per hour and the beads drop to the bottom. A radioactive fallout detector, the device relies on static electricity to hold the beads in place. Radioactivity neutralizes the electrostatic field, causing the beads to fall.

Mighty Magnet . . . Winding this one yourself could prove quite a challenge, considering that there are over 20 miles of wire involved. The device, of course, isn't meant for do-it-yourselfers. A new superconducting magnet by Westinghouse, it delivers a magnetic field of some 100,000 gauss—roughly 200,000 times the average strength of the earth's magnetic field and some five times the saturation point of conventional electromagnets. Westinghouse says it knows of only four magnets that can equal it, all of which draw upwards of 1 million watts. Their device, in contrast, needs nothing more than an ordinary storage battery for power. And even this is disconnected, once current starts to flow.

ELECTRONIC MARKETPLACE

VERSATILE . . . 6 VDC, 12 VDC or everyday 117 VAC powers EICO's Model 777 CB transceiver, and its pi-network output matches most any antenna. The re-

ceiver section uses dual-conversion IFs for improved selectivity; the transmit section comes complete with dummy antenna load and ceramic microphone. Kit, $119.95; wired, $189.95. EICO, 131-01 39th Ave., Flushing, N.Y. 11352.

Three in One . . . Take your choice of any three frequencies between 200 kc and 3 mc, plug the required crystals into the TC-3 oscillator and you've got it made. A battery-pow-

ered RF oscillator supplied complete with three crystals of your choice, the TC-3 can be used anywhere a source of fixed-frequency RF is required. Additional crystals, all factory-calibrated, are available from the manufacturer. $29.95. Texas Crystals, 2100 Crystal Dr., Ft. Myers, Fla. 33901.

MARKETPLACE

Hybrid . . . AM/FM receivers have been around for years, but Pilot's R-707 is a stereo receiver with a difference. For one thing, it tunes both AM and FM and also has a multiplex circuit to handle stereo-FM broadcasts. Then, too, its 70-watt (IHF) stereo amplifier has power enough to raise most any roof you

have a mind to. And there's still another twist: the amplifier in the R-707 is solid-state. The job measures a mere 6 x 17 15/16 x 14⅛ in. Other features include a tuning meter, an automatic stereo-FM indicator and a front-panel stereo-headphone jack. $349.50. Pilot Radio Corp., Yonkers, N.Y. 10700.

Keeps the Lid On . . . Shout as loudly as you want but the modulation of the Escort CB transceiver never will exceed 95 per cent. (A built-in modulation limiter is the secret.) Its rugged aluminum cabinet with reversible mounting cradle and a 117 VAC or 12 VDC transistor power supply mean operation anywhere. A tuned RF stage and two IF stages

give it a sensitivity of 1 microvolt for a 10db signal-to-noise ratio; a triple-function panel meter lets you monitor every aspect of its operation. $229.95, complete with two crystals. Pearce-Simpson, Inc., 2295 N.W. 14th St., Miami, Fla. 33135.

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As field director of Berean Mission Inc., I have complete charge of our radio work. With the expert advice and training I am receiving from you I can do my own repairs on our recorders and P.A. systems, besides keeping our radios going. My training from N.T.S. helps keep us on the air. I feel privileged to be a member of such a fine institution.

Rev. Enoch P. Sanford

Thanks to N.T.S. I have a business of my own right in my home. I have paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tabat

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it has been going real good. I started part-time but I got so much work that I am doing it full-time. Thanks to National Technical Schools.

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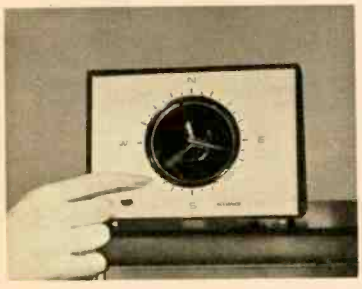
TV-Top Antenna Control . . . A transistorized antenna rotator will save a lot of running up and down ladders. Instead of making hairline antenna adjustments for top-notch color TV and stereo-FM reception the hard way, let your fingers do the climbing with the C-225 Tenna-Rotor. The C-225 looks much like a small desk clock and makes even less noise. Constant synchronization between indoor control and roof-top motor assures precise antenna orientation at the turn of a dial;



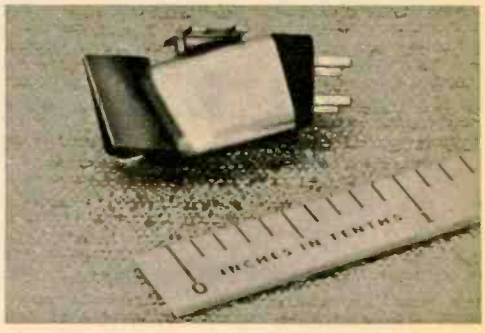
an instantly reversible motor resists corrosive outdoor living with stainless-steel-plated parts. Magnetic brakes and a lifetime factory lubrication make for smooth operation. $59.95. Alliance Mfg. Co., Inc., Alliance, Ohio 44601.

MARKETPLACE

Bandspreader . . . Seven tubes in the new HA-63 receiver cover the range from 550 kc to 31 mc. Aimed at the beginning SWL or the Novice ham, the HA-63 offers full electrical bandspread on all frequencies plus

a built-in S-meter for accurate tuning. Other features include an automatic noise limiter and an antenna trimmer control. $59.95; speaker is an additional $7.95. Lafayette Radio Electronics Corp., 111 Jericho Tpke., Syosset, L.I., N.Y. 11791.

Teensy . . . Though its total weight is less than the tracking force of a good many other cartridges, Stanton's 500 AT is as complete a stereo pickup as any. Roughly the size of your thumbnail, the new cartridge is designed for use with automatic turntables using low-



mass tone-arm systems. The manufacturer claims response from 20 to 20,000 cps; interchannel crosstalk is said to be —35db. A variety of styli is available. Stanton Magnetics, Inc., Terminal Dr., Plainview, L.I., N.Y. 14534.

BROADSIDES

Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

A leaflet called What You Should Know About All Channel TV offers useful information on the **UHF TV** channels, now back in the picture. Also included is a discussion on how to go about converting your present VHF TV set to pick up UHF broadcasts. Copies can be obtained by writing the National Better Business Bureau, Inc., 230 Park Ave., New York, N.Y. 10017.

The complete line of Sony **tape recorders,** microphones and other recording accessories is pictured and described in catalog B-64. A copy is yours for the asking from Superscope Inc., 8150 Vineland Ave., Sun Valley, Calif. 91352.

For good TV and FM reception, a first-class antenna is a must. Improved TV and FM Reception describes the seven basic **antenna designs** for TV and FM and tells about the use of an antenna rotor for proper orientation. Request your copy from Cornell-Dubilier Electronics Div., 50 Paris St., Newark, N.J. 07101.

Before you build your next project, think about the space you can save by using **ceramic capacitors.** Aerovox's new 38-page catalog gives you sizes as well as other specs for disc, feed-through and stand-off types. For a free copy, write the Aerovox Corp., Hi-Q Div., Olean, N.Y. 14760.

A new eight-page brochure describing Ray-Tel **CB radios** and accessories is available from the Raytheon Co., 213 E. Grand Ave., S. San Francisco, Calif. 94080.

Tape Considerations For Continuous Recording is the topic of Sound Talk Bulletin No. 40. The booklet goes into the problems of **continuous loop recordings** and discusses such matters as tension, slack and tape speed. For a free copy write the 3M Co., 2501 Hudson Rd., St. Paul, Minn. 55119.

Wire and Cable Catalog No. W-4 gives data on 7000 **wires and cables** for use by those in electronics. The catalog is free from Alpha Wire Corp., 180 Varick St., New York, N.Y. 10014.

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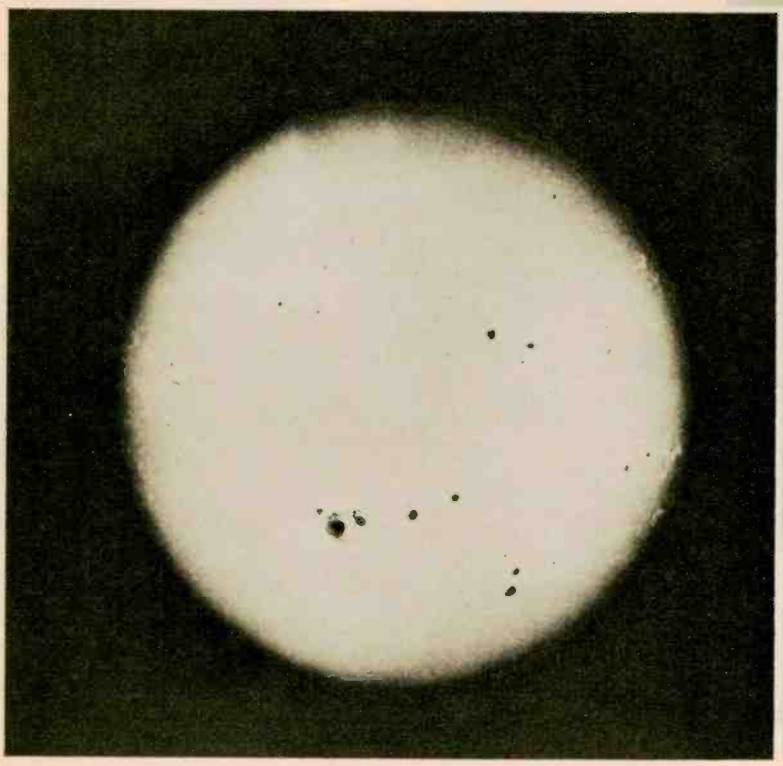
SUNSPOTS ARE COMING!

Radio forecast sees better DX but not right away.

Short-wave radio reception will take a turn for the better in the not-so-distant future. But first it's going to get worse. No one questions the prediction for improving ionospheric or skip reception (DX) because of one immense fact. DX is so poor right now that it can't get much worse, and then nothing will be possible but improvement.

The dearth of long-distance radio reception is traceable to the steadily declining number of spots on the sun's surface. For several years now we've been talking about being on the downswing of

SUNSPOTS



a sunspot cycle and some hobbyists wondered what it would be like when we hit bottom. Pretty soon they will know because between this October and May 1965 we'll hit rock bottom—absolute sunspot minimum.

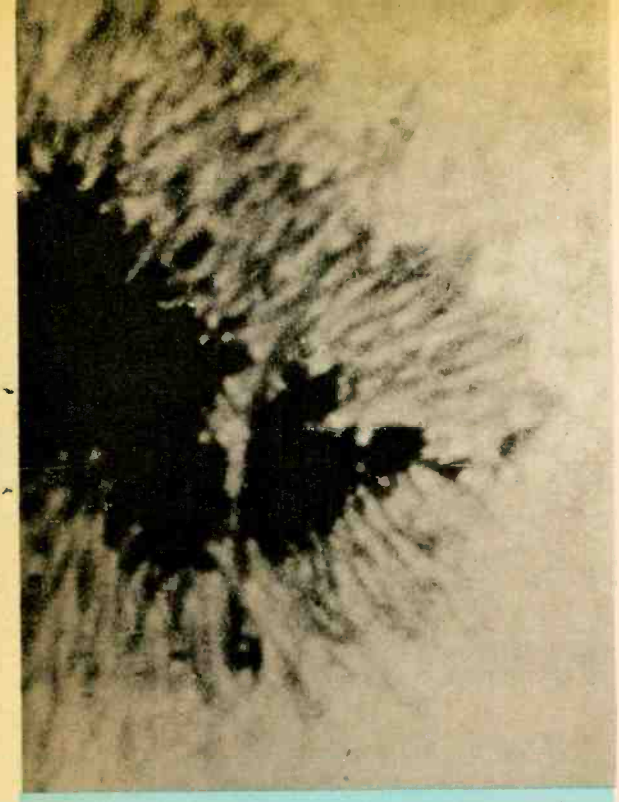
Since sunspots alternately are villains and the angels in the DX picture, we might examine these phenomena more closely. To begin with, sunspots have a direct bearing on the range of frequencies the ionosphere will reflect. As a rule of thumb, the more spots, the higher the frequencies that are usable and the better the DX. But as the number of spots on the sun decreases, so do the usable frequencies. Result is that DX today is the worst in over a decade.

The Ionosphere. Long-distance high-frequency communications are made possible by the ionosphere. This electrified region above the earth reflects radio waves in much the way a mirror reflects a beam of light.

The thing responsible for the ionosphere is ultraviolet radiation from the sun. The ultraviolet acts on the gases in the upper atmosphere. The more ultraviolet radiation there is, the more electrified the region becomes and the higher the frequencies it is capable of reflecting.

Naturally, the amount of ultraviolet radiation illuminating the ionosphere varies from hour to hour, season to season, and from one location on earth to another. We say *naturally*, because the quantity of ultraviolet obviously depends on the relative position of the earth with respect to the sun. At night, for example, with no ultraviolet reaching it directly, the ionosphere becomes less electrified than during the day. As a result, it's simply not capable of reflecting frequencies as high as those it can reflect during daylight hours.

In addition to the effects just mentioned, year-to-year changes take place in the ionosphere which are of paramount importance. These depend on the number of sunspots on the sun. Sunspots are the prime source of



What's a sunspot? No one really knows but scientists have had a pretty good idea of what they look like since Galileo invented the telescope way back in 1611. View of sun at left reveals a number of spots scattered about its surface; close-up above looks more like an entrance to a cave than the sunspot it is.

ultraviolet which, in the end, shapes the ionosphere.

Since the number of spots on the sun varies over an approximate 11-year cycle, the frequencies the ionosphere can reflect also vary over a similar period. During the years 1956-60, record numbers of sunspots appeared on the sun. As a result, DX conditions were better than ever before in the history of radio communications. Since 1958, however, the number of sunspots has been decreasing, and conditions have been growing worse.

What are Sunspots? Sunspots are massive cyclonic storms that appear as black spots on the surface of the sun. Though their nature isn't understood completely, we do know that they were observed by pre-Christians in China, Egypt, Greece and Rome.

Unfortunately, no accurate records of sunspots could be kept until the invention of the telescope, since most sunspots cannot be seen with the naked eye. And while Galileo and his contemporaries began to draw pictures of sunspots, regular records weren't kept until the middle of the eighteenth century.

Credit for discovering the cyclical nature of sunspots goes to Hendrick Schwabe, a pharmacist by trade who also was an amateur astronomer. After observing the sun on every clear day for nearly 20 years, Schwabe concluded that sunspots come and go in periodic fashion. According to his calculations, the number of sunspots went from minimum to maximum and back to minimum again in about ten years. However, subsequent studies by other scientists show sunspot cycles average a little more than 11 years in duration. And even then there is some variation, with individual cycles running between nine and 14 years.

Sunspots and Ultraviolet. One of the most significant discoveries concerning sunspots was made some 30 years ago by Dr. Edison Pettit and his associates at the Mount Wilson Observatory. Dr. Pettit found a direct relationship between the number of sunspots and the intensity of ultraviolet radiation from the sun. During years of maximum sunspot activity, ultraviolet is at a maximum. Furthermore, it declines as the sunspot number decreases.

From the communications standpoint, this finding is extremely important. Since the range of frequencies the ionosphere will reflect depends directly on the amount of solar ultraviolet, all you have to do is count the number of sunspots to predict which frequencies the ionosphere will be capable of bouncing back.

Where We Are. Back during the high part of the last sunspot cycle—during the winter of 1958-59, say—the 10-meter amateur band was open several hours every day. So, too, was the 26-mc international short-wave broadcast band.

But things have changed drastically, as we've already mentioned. For instance, there'll be no TV-DX this coming winter, no 10-meter amateur openings to Western Europe during the day and not much DX above 20 mc for the SWL.

Instead, only the lower bands will be useful to the ham and the SWL, while the Citizens Bander will face little likelihood of skip. For the radio amateur, 15 meters will be about the highest band that will open to Western Europe from the East Coast. And even this will occur only for a few hours

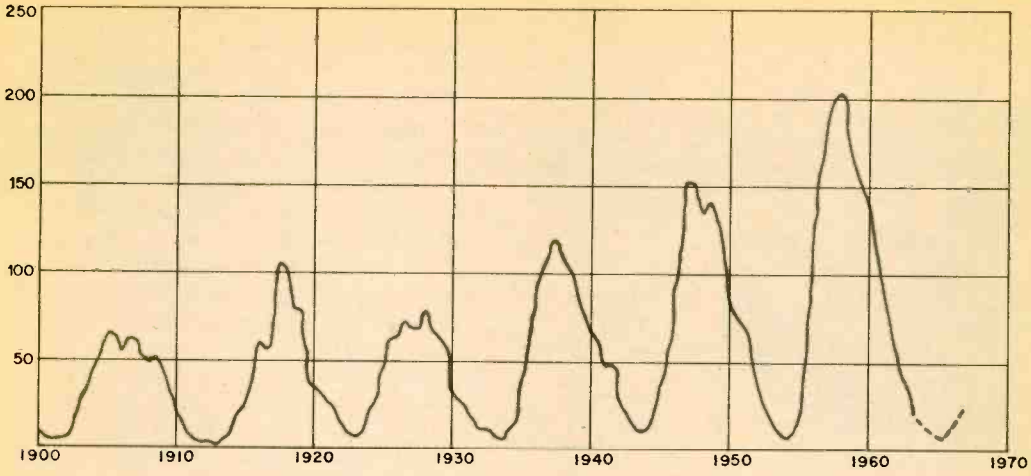


Chart plots variations in number of sunspots over the years from 1900 to present. Note that sunspot count rises and falls in an 11-year cycle and that peak number has been increasing with each successive cycle.

SUNSPOTS

at best. The 40- and 80-meter bands will see more use than at any time since 1954.

But on the plus side, medium-wave DX will roll in far better than it ever did during sunspot-maximum conditions. Last winter medium-wave DX was extremely good. And the winter of 1964-5 should be the best in history for broadcast-band DX.

What's Ahead. Since sunspots are not well understood, a study of past cycles is about the only clue we have. But the current cycle is the 19th recorded since regular observations of sunspot numbers was begun in the eighteenth century, so we do have something to go on.

Looking at our chart of sunspot activity from 1900 on, it can be seen that the number of sunspots has declined steadily from the record high of 1958. But it also can be seen that it takes an average of a little under seven years for sunspot conditions to go from maximum to minimum. A reasonable conclusion is that the minimum of the present sunspot cycle is nearly at hand, as we said, being expected sometime between October 1964 and May 1965. We, therefore, can conclude that the winter of 1964-65 will be the last really poor DX season, after which conditions will begin to improve markedly.

Also on the encouraging side is the fact that maximum sunspot numbers aren't necessary to give us good conditions. The last sunspot minimum occurred in 1954 and by the end of 1955 conditions had improved noticeably. In short, it looks like the worst is almost over. Assuming everything works out as expected, DX has no place to go but up.

—Stanley Leinwoll

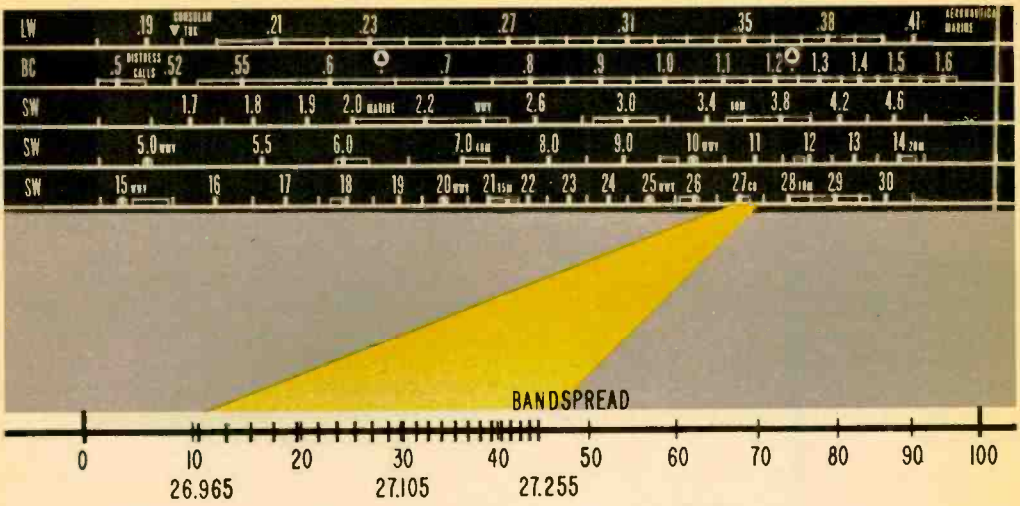
DX OUTLOOK FOR THE SIX MONTHS AHEAD

	NIGHT	DAY
Ham Radio:		
10 meters	almost non-existent	poor
15 meters	almost non-existent	fair
20 meters	poor	fair to good
40 meters	good to excellent	fair
80 meters	fair to good	almost non-existent
International Short Wave:		
11 meters	non-existent	very poor
13 meters	almost non-existent	fair to poor
16 meters	almost non-existent	fair
19 meters	fair to poor	good
25 meters	fair	fair
31 meters	fair	fair to poor
41 meters	fair	poor
49 meters	fair	poor

Broadcast Band: Excellent at night, normal minimum during day.

Citizens Band: Minimum skip (good or bad, depending).

TV-FM: Almost non-existent.



Calibrated Bandspread for CB

This RF amp and crystal calibrator makes for easy CB tuning on SW sets.

By LEN BUCKWALTER, KBA4480

NOT even ignition noise from a truck parked in your back yard can be heard on most shortwave receivers tuned around 30 mc. Trouble with these popular four- and five-tube sets is that they begin to fizzle out around 20 mc, making it almost impossible to use them to listen to the Citizens Band. But add a tuned RF stage and their performance at 27 mc improves to an amazing degree.

Our preamp can beef up the sensitivity and selectivity of a budget SW receiver to about that of a CB transceiver. And, as a bonus, the preamp includes a crystal calibrator to enable you to pinpoint each CB channel on the SW receiver's bandspread dial.

But before you start the project, check to see whether there's an RF amplifier in your receiver. Look at the tuning capacitor; if there are only two sections with movable plates, there is no RF stage and you can use ours. If there is a tuned RF stage, our preamp may not help matters much.

Construction. The preamp's tube is mounted somewhat unconventionally on the bottom of the U-section of a 3x5x7-inch Minibox. Make a pair of small brackets 1½ inches long by ⅜-inch wide from scrap metal and bend them to form a right angle as shown on the last page of this story. Mount the assembly on the bottom of the Minibox as shown in the pictorial. Cut a 1⅛-inch-diameter hole in the rear of the Minibox to permit cooling and to allow the tube to be inserted. Note that ground lugs are used liberally throughout.

To avoid an expensive pilot-lamp assembly, use the mounting method we show. We used a bayonet socket and soldered one of its lugs directly to the case of RF gain con-

Preamp fits in 3x5x7-inch Minibox. Attach receiver and antenna to it permanently. Switch at left connects antenna to receiver directly or through preamp.

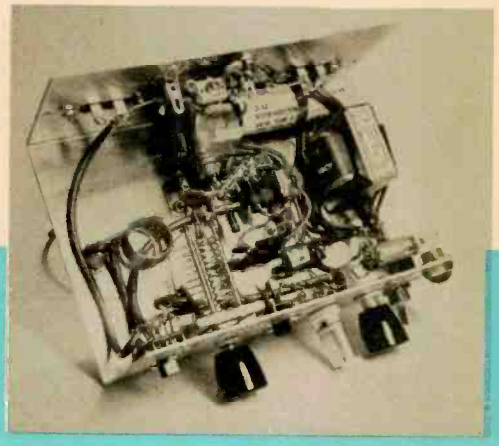
Calibrated Bandspread for CB

trol R1. Use the lug nearest the socket's metal shell. The other lug is insulated and has a lead from power transformer T1 connected to it.

The tuning coils should be prepared in the following way to prevent them from being damaged: coils L2 and L4 are cut from a piece of standard coil-form stock (see Parts List). To slice off the length needed (8 turns each), cut through the plastic bars with a heated razor blade or cut away two or three turns of wire beyond the required number. This leaves an opening large enough for you to use a pair of wire cutters to cut the plastic. Be sure to leave long leads at both ends of the coil for mounting purposes.

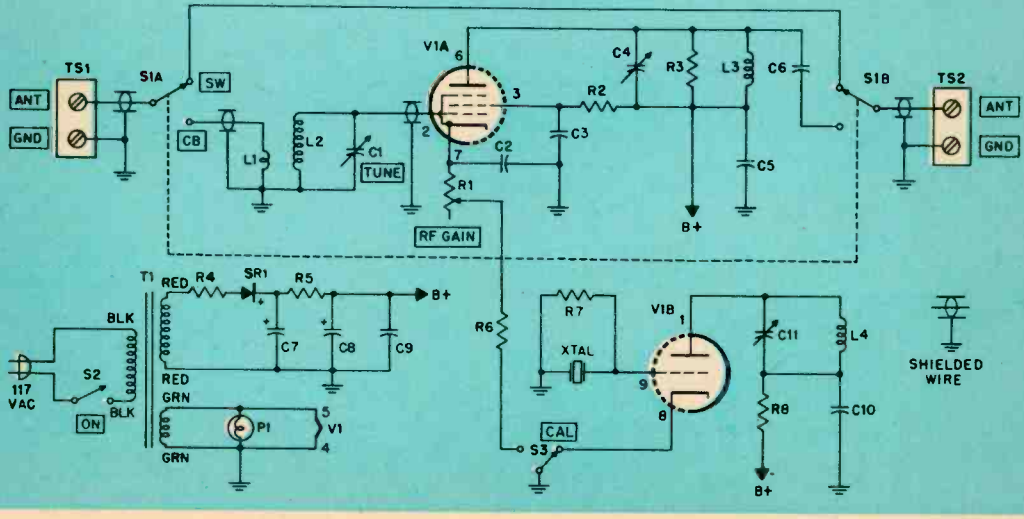
Coil L1 is made by winding three turns of No. 20 plastic hookup wire around a ¾-inch-diameter screwdriver handle (or other round object). Mount L1 on the terminal strip below L2 as shown in the photo. Form the leads so L1 is right up against L2.

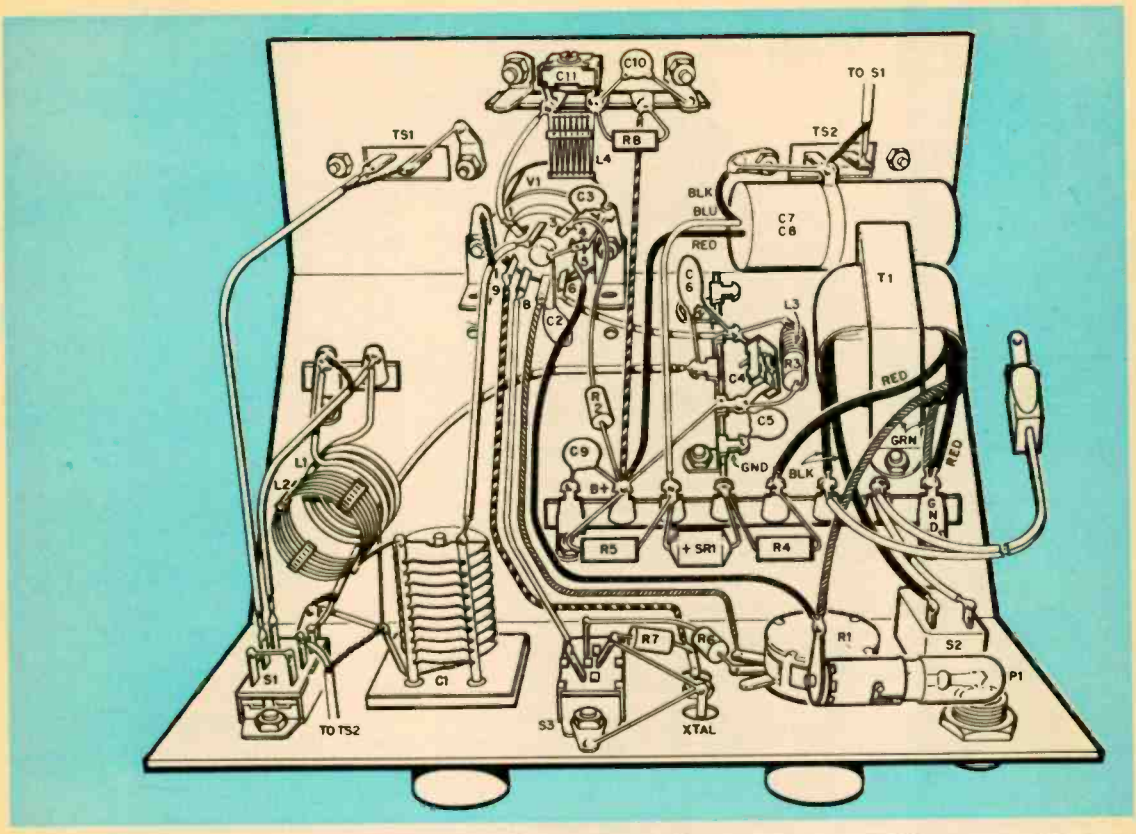
Coil L3 also is a home-brew job wound on a 6800-ohm, 2-watt resistor. Scrape the insulation from the end of a piece of No. 28 enameled wire and solder it to one resistor lead. Then wind 20 turns on the resistor and solder the other end of the wire to the other resistor lead. (The resistor also broadens the tuning of this part of the circuit.) To prevent



Inside of preamp, right. Space is tight so follow closely layout in pictorial on next page. Mount V1 and wire its socket before making other connections. Then mount terminal strips on bottom of U-section of Minibox and install components on them. Keep leads short and near cabinet or there may be self-oscillation because of high gain of RF amplifier V1A. Coil L2 is at the left near center.

When S1 is in CB position, tuned RF amplifier V1A boosts signal from antenna (TS1) to receiver (TS2). When S1 is in SW position, antenna is connected directly to receiver. When S3 is in CAL position, output of crystal oscillator V1B (which radiates internally to V1A) is fed from TS2 to the receiver's antenna terminals.





Wiring and parts placement are critical since you are working with RF. Be sure all coils are mounted exactly as shown. Note how L1, wound of insulated hookup wire, mounts under L2. Note also which ends of the shielded wires are grounded.

coil turns from slipping off, file a thin groove in both ends of the resistor body. Don't put coil dope on the turns until after the preamp is operated because you may have to add or remove turns or change spacing. More about this later.

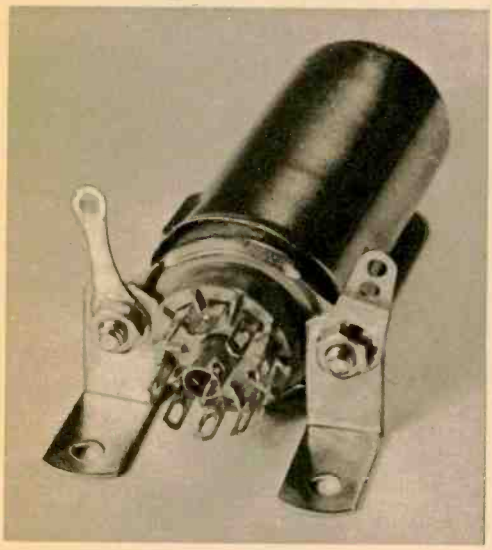
As you can see in the pictorial, shielded wire is used for several connections. Be sure to ground the shield only at the end shown. At the ungrounded end, always trim the shield back to the cable jacket. Note in the pictorial that a lug on one of the tube-mounting brackets is the ground connection for the shielded wire from C1.

Tune-Up. The preamp should be aligned with its cover removed and while connected between antenna and SW receiver. (The lead between preamp and receiver should be shielded.) Connect the preamp to the receiver as you would the feedline from a sin-

PARTS LIST

Capacitors: 500 V ceramic disc unless otherwise indicated
C1—5.2-30 mmf variable capacitor (Hammarlund HF-30-X, Allied 13 L 596)
C2, C3, C5, C9, C10—.001 mf
C4—8-60 mmf, miniature trimmer capacitor (Arco-Elmenco type 404 or equiv.)
C6—.02 mf
C7, C8—30/50 mf, 150 V electrolytic
C11—1.5-20 mmf miniature trimmer capacitor (Arco-Elmenco type 402 or equiv.)
L1—Link coil: 3 turns No. 20 plastic insulated hookup wire, ¾-inch diameter
L2, L4—Coil: 8 turns cut from Barker & Williamson ¾-inch diameter No. 3011 Miniductor (Newark Electronics 40F940)
L3—20 turns No. 28 enameled wire on R3
P1—No. 47 pilot lamp and socket
Resistors: ½ watt, 10% unless otherwise indicated
R1—2,000 ohm, 5 watt pot
R2—100,000 ohms R3—6,800 ohms, 2 watts
R4—33 ohms, 1 watt
R5—2,200 ohms, 1 watt R6—150 ohms
R7—47,000 ohms R8—10,000 ohms
S1—DPDT slide switch
S2—SPST toggle switch
S3—SPDT slide switch
SR1—Silicon diode: 50 ma or higher, 400 PIV
T1—Power transformer: primary, 117 V; secondaries, 125 V @ 15 ma, 6.3 V @ 0.6 A (Stancor PS8415 or equiv.)
TS1, TS2—2-screw terminal strip
V1—6U8 tube

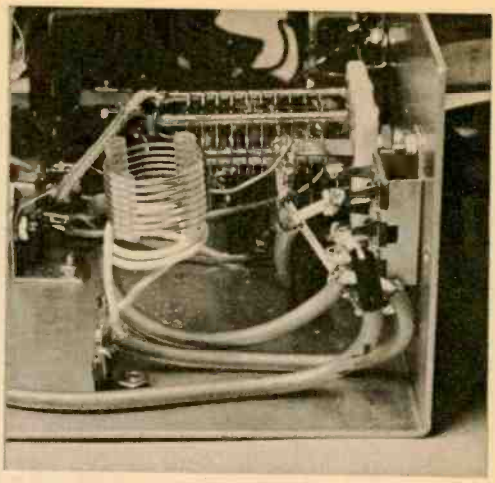
Calibrated Bandspread for CB



Closeup of V1's socket shows how brackets are used for mounting. Don't forget the ground lugs.

gle-wire antenna. Turn on the preamp, set S3 to CAL and tune the SW receiver to near 27 mc. Plug a channel 1 transmit crystal into the crystal socket. (*Important*: When adjusting C11, hold the screwdriver by its handle to avoid shock because there's B+ on C11). Turn the screw on C11 until the oscillator starts. Oscillation can be detected by listening for a whistle (BFO on) or by noting a strong deflection on the S-meter as you tune the SW receiver around 27 mc. It is normal to pick up the calibrating signal at two points on the dial; however, select the stronger signal. The other is an image. Once the calibrating signal is located on the SW dial, open C11 as far as possible (without losing the signal) and leave it at this adjustment.

To align the RF amplifier, flip switch S3 to its other position and turn gain control R1 to full clockwise. Rotate the tune knob (C1) and you should notice a rise in noise level from the SW receiver. If noise doesn't increase substantially, adjust trimmer capacitor C4 while turning C1, to find the



View into left side of preamp. Front panel is at right. Coil L2 is at left (top) and coil L1 is directly below. Tuning capacitor C1 is behind.

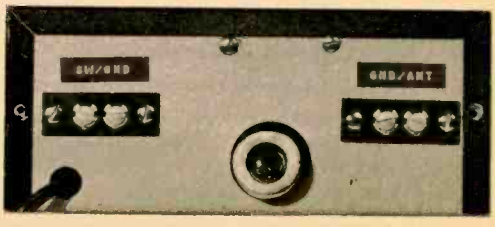
spot where noise level is highest.

Calibrating a Bandspread Dial for CB. Set the bandspread dial so the bandspread capacitor plates are fully meshed. (On our receiver this corresponded to the number zero on the dial.)

With the BFO on and the crystal still in the socket, turn the SW receiver's main tuning knob until you hear a whistle (the louder of two whistles if you pick up a second one nearby). The zero setting on the bandspread dial now corresponds to CB channel 1 *when the main-tuning pointer is at its present location.* Jot down the pointer's location in respect to the logging scale or some other scale so you will be able to reset it to this exact point later.

Plug in a channel 23 transmit crystal. Turn the bandspread pointer higher on the dial until you hear the whistle again. This number

[*Continued on page* 118]

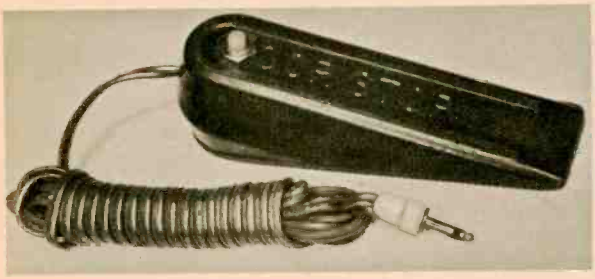


Rear view of preamp. V1 sticks out of 1⅛-inch-diameter hole in center. Connect receiver to terminal strip at left. Connect antenna at the right.

Tape Tips

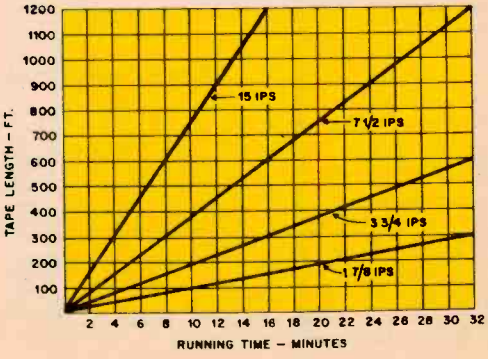
A bulk eraser is the best thing to use to erase a complete tape. But a cheaper way to do the job is to use a strong permanent magnet held against the shiny side of the tape during fast rewind. Remember, though, that you'll be erasing all tracks at once. The residual hiss left on the tape will be removed when you make a new recording. And you can get some unusual fade-in and fade-out effects by moving the magnet slowly away from or toward the tape as you make the recording.

Lose patience trying to get a tape started on a reel? Then use Velcro, a fastener that consists of two nylon strips. The inner side of one strip has tiny hooks like a plant burr. The other strip has a fleecy surface. When they touch they interlock; but they can be pulled apart easily. Glue the hooked material to the tape hub and glue the other material to the tape leader—a few inches back from the end. To start a tape, just pull the leader against the reel hub gently.



You can make a cheap foot switch for tape recorders with a remote-control jack by using a rubber doorstop and a normally-open push button. Mount the push button near the top of the doorstop and connect it to a plug that matches the remote-control jack. It will be much easier to transcribe tapes now.

Many tables of recording time vs tape length are incorrect because they have been rounded off to increments and multiples of 15 minutes. Use the graph at the right and you can determine the length of a reel of tape exactly by measuring the time it takes to run through the machine. Just run the tape through the recorder at the fastest playback speed (not fast forward) and clock the time in minutes and seconds. If it takes 24 minutes for the tape to go through at 7½ ips, the length is 900 feet. Working it the other way, at 1⅞ ips, a 300-foot tape will last 32 minutes.



The COMPACT BCer

- *1-Compactron Circuit*
- *Big-Speaker Sound*

By HOMER L. DAVIDSON

BACK in the early days of radio everyone wore earphones and sat around a table while Dad carefully adjusted the catwhisker for best reception. Time passed and eventually a tube was used as a detector. Not long after that more tubes were added for amplification and some sets came to have more tubes than a cat has lives.

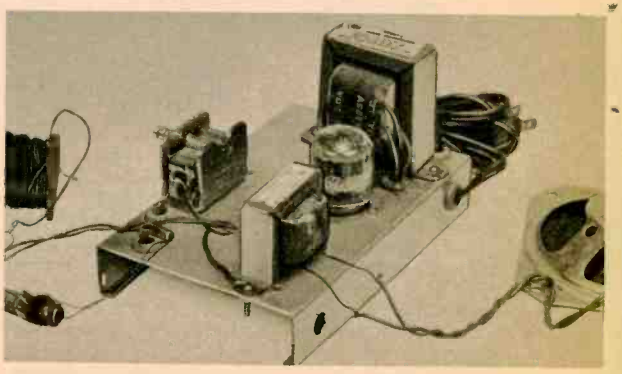
But the all-American five design trimmed the number of tubes somewhat. Today some cut-to-the-bone superhets have only three tubes, thanks to clever bottles that pack everything from diodes to pentodes into one envelope. Think the rise and fall in tube count has ended here? Not by a long shot.

The Compact BCer has only one tube but in terms of performance it's a mighty far cry from that one-tube job of 30 or more years ago. The BCer's sensitivity and tone will surprise you. Secret of its simplicity and performance with only one bottle is a Compactron. It's a dual pentode job, one section of which is a hot regenerative detector. The other section is a power pentode that can deliver up to 2 watts of audio to the speaker.

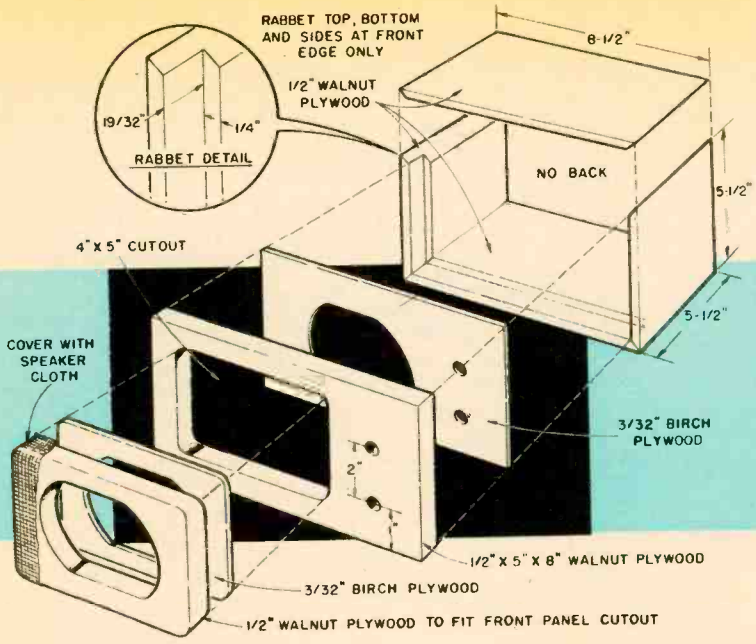
And there aren't many other parts in the BCer—all together there are 11 capacitors and eight resistors. All components are standard, there is only one simple coil to wind and the circuit is transformer-powered to eliminate the shock hazard associated with AC/DC sets. You'll find the Compact BCer a snap to get together and it will make a wonderful one-evening project.

Construction

The BCer fits on a standard 6⅛x4x1-inch aluminum chassis. Follow as closely as possible our layout shown in the photo and pictorial. Don't worry about mounting the



Completed radio ready for installation. If you build cabinet we show here, mount speaker first and attach loopstick near back of the cabinet.

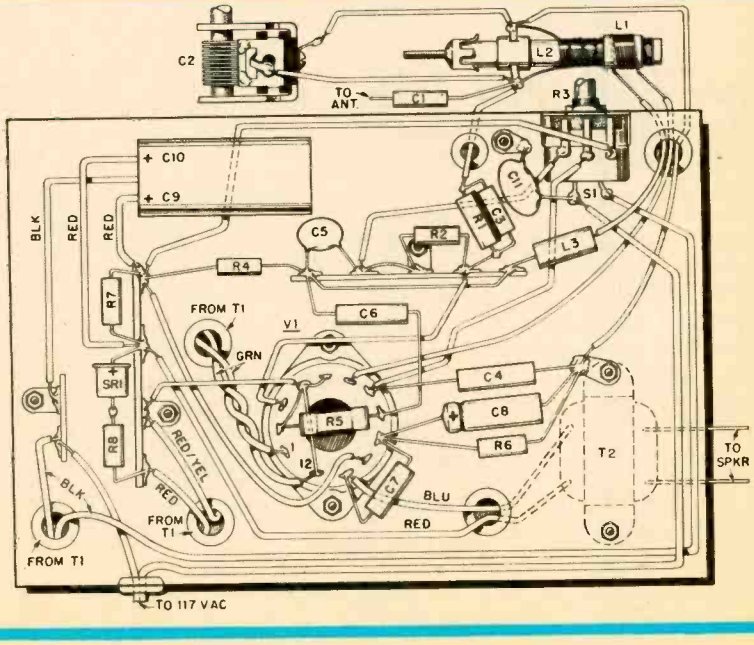


Use this wooden cabinet and you'll get excellent tone. Front panel construction can be simplified by using a piece of ⅜-inch plywood instead of the arrangement shown. Leave the back off the cabinet to provide for ventilation.

speaker at this time. It and the loopstick antenna can be attached to the cabinet after the chassis is installed.

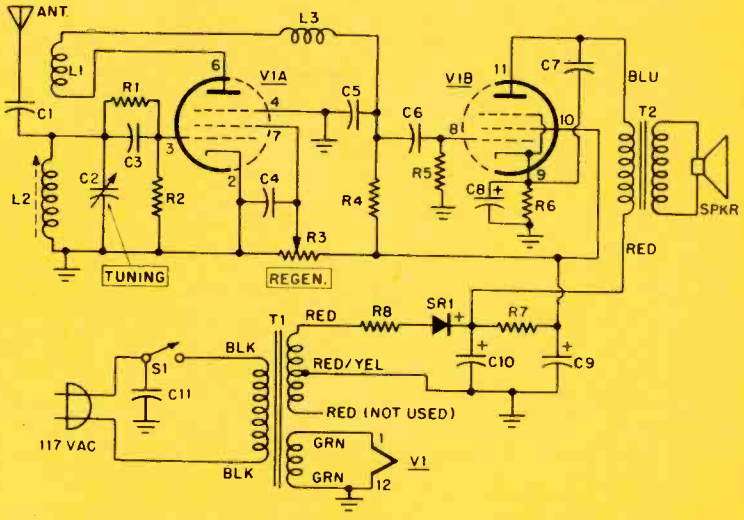
Take your time when wiring V1's socket. There are a lot of connections to it and it's easy to short something. L1, the detector's feedback coil, should be wound over the bottom end of the loopstick's coil. First, wrap a turn or two of tape over the loopstick's coil, then wind 35 turns of No. 36 enameled wire on the tape. The width of the coil should be about 5/16 inch. After L1 has been wound, wrap a turn or two of tape over it to keep it from unwinding. L1's leads should be covered

There's plenty of room under the chassis we specify in the Parts List. Watch the pin numbers on V1's socket—the spacing between lugs 1 and 12 isn't much greater than between the other lugs. R3 and C2 can be mounted anywhere on the top of the chassis to match a different cabinet design. Be sure to use spaghetti on leads to loopstick antenna.



PARTS LIST

Capacitors: 500 V ceramic disc unless otherwise indicated
C1—.005 mf, 400 V tubular
C2—10-365 mmf variable (Lafayette MS-214 or equiv.)
C3—100 mmf
C4—.1 mf, 400 V tubular
C5—250 mmf C6—.01 mf
C7—.005 mf
C8—50 mf, 25 V electrolytic
C9, C10—50/50 mf, 150 V electrolytic C11—.05 mf
L1—35 turns No. 36 enameled wire wound over L2 (see text)
L2—Loopstick antenna (Lafayette MS-11 or equiv.)
L3—10 microhenry RF choke (J. W. Miller 4612 or equiv.)
Resistors: ½-watt, 10% unless otherwise indicated
R1—5.6 megohms
R2—15 megohms
R3—200,000 ohm linear-taper potentiometer with switch
R4, R5—1 megohm
R6—68 ohms
R7—1,500 ohms, 1 watt
R8—33 ohms
S1—SPST switch on R3
SR1—Silicon diode, 750 ma, 400 PIV (Lafayette SP-196 or equiv.)
T1—Power transformer: primary, 117 VAC; secondaries, 250 V @ 25 ma and 6.3 V @ 1 A. (Stancor PS8416 or Allied 62 G 008)
T2—Output transformer: primary, 2,000 ohms; secondary, 4 ohms; 5 watts (Stancor A3876 or Allied 62 G 065)
V1—6AL11 tube
Misc.—Speaker, 6⅛x4x1-inch aluminum chassis (Bud CB-1620)



V1A is a regenerative detector. Regeneration is controlled by the amount of B+ applied to V1A's screen grid (pin 7) by R3. Feedback is achieved by winding L1 over L2. V1B, a power pentode, delivers up to 2 watts to speaker.

The COMPACT BCer

with spaghetti, and should be about 8 inches long to reach the connection points under the chassis.

If your cabinet design is different from ours, don't worry about mounting tuning capacitor C2 on the chassis. Put it wherever you like but don't forget to run a wire from its frame to the chassis. If there's a trimmer on the side of the capacitor you use for C2, open it all the way. It is necessary to use the size transformer specified for T1 to provide current for V1's heater (900 ma). Be sure to cut short and tape one of T1's red leads.

Tune-Up and Adjustment

After you've double-checked your wiring, plug in the tube, turn on power and slowly turn regeneration control R3 clockwise. Eventually you will hear a squeal or rushing sound. If you don't hear this with R3 full clockwise, reverse the connections of L1's leads.

To calibrate the dial, open C2 to a point corresponding to that of the tuning capacitor in another radio tuned to a station whose frequency you know. Advance R3 until the BCer squeals, then back off R3 a bit. Without touching the antenna lug on the loopstick, adjust the loopstick's slug until the same station comes in loud and clear. If necessary, readjust L1's slug if a station is missing at either end of the dial.

To find and tune in a station, turn R3 almost full clockwise and turn C2 slowly. When you hear a squeal, it means there's a station at that point; then back off R3. You'll get the knack of this quickly. A 10- or 15-foot antenna will be adequate for local stations. For distant stations use a longer outdoor antenna and a good ground.

HI-FI TODAY

By John Milder

- Bargains abundant in reissued recordings
- Something Red on the antistatic front
- Savory samplings at the World's Fair

BIG NEWS in hi-fi these days—which may or may not have reached your local record dealer—is that most record companies now offer budget-priced LPs. The new low-cost labels include Everyman Classics (Vanguard), Paperback Classics (Capitol), Richmond (London), Victrola (RCA Victor) and Wing (Mercury). Most are reissues of some fairly standard material. And what makes them possible is that a good part of the recording costs already have been written off.

Also in the act are Dover (a book publisher) and Elektra, which has sprouted a new classical-record label called Nonesuch. Both these companies are reissuing recordings bought from other labels, here and abroad. And they also are making brand-new recordings on their own.

Top prices for all these bargains are $1.98 for mono LPs and $2.98 for stereo (when available). Throw in the discounts offered by most big-city record stores, and you'll likely ask yourself whether records at these prices can be worth much of anything. The answer is a loud yes. Sure, not all these discs offer the last word in sound. But I'd say at least half sound as good as many of today's premium-priced releases. Anything but the scratchy, muddy-sounding cheapies of yesteryear, their quality definitely is good right down the line.

What's really worth shouting about in most cases, though, is the performances. Many are of the kind that you could—or should—kick yourself for passing up on their first time round. I won't plug for my own favorites, but I will say there are plenty of gems for all musical tastes. In fact, it's just plain silly not to search them out. Since only the big stores have room to stock a good sampling of such low-priced items, you'll have to rely mainly on company catalogs and lists.

Before I leave the subject, I ought to point out that E.M.I., the international combine that owns Capitol and Angel records, has just put about a thousand LPs on the American market. These discs (bearing the Odeon, Pathe, Discophile Francais, Ducretet Thomson and who-knows-what-other labels) contain a lot of material never available in this country before—and probably never again.

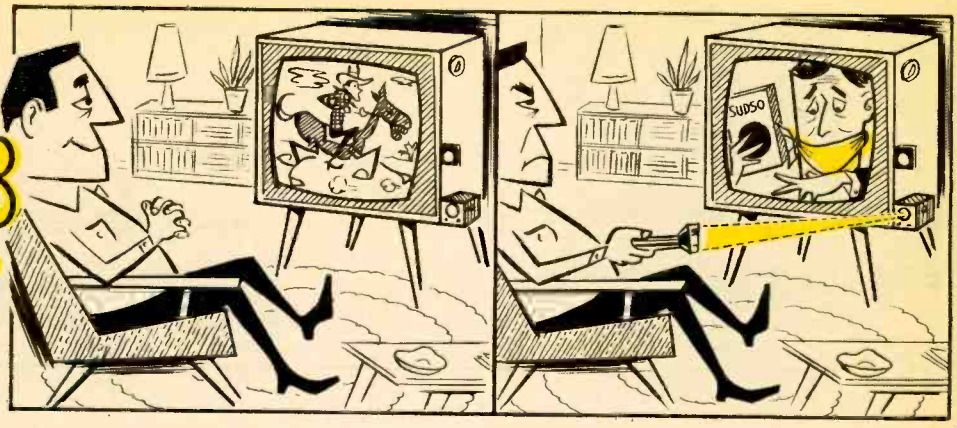
This particular batch isn't low-priced—the tabs are $4.98 (10″ mono), $5.98 (10″ stereo and 12″ mono) and $6.98 (12″ stereo)—but it contains all kinds of collector's items. For my money, a two-record set called the Best of The Goon Shows preserves some of the looniest broadcasts (thanks to Peter Sellers and Spike Milligan) in the history of radio. I don't have room to run down the other gems in the series, so I'll leave the looking

[Continued on page 109]

Great names and great performances are yours for a pittance in the windfall of reissues now on the market. Albums shown here include one of famous composers playing their own works, one of Rossini overtures and one of Brahms' second symphony—the latter conducted by the late Willem Mengelberg, noted Brahms interpreter and one of the greatest conductors of all time.

TV BLAB OFF

By GREGG BRUCE



DOUBLE your pleasure, double your fun with very-dry, extra-tough rubbery gum . . . Brand X tastes good like a shoe polish should . . . Look ma, no teeth! . . . Corn-cob smokers would rather sit than switch.

Had enough of that stuff? Then build the TV Blab-Off and hook it up to your TV set pronto! It'll let you put a gag on those loud-mouthed pitchmen every time they bark their all-too-frequent spiels at you.

And remember the times you felt like putting a bullet through the TV to silence it? In a very safe way the Blab-Off lets you do almost the same thing with a flashlight. Shoot the light beam at a photocell in the Blab-Off's main box and off goes the sound. Because its circuit latches, you do not have to hold the flashlight on-target during the commercial. Aim the beam at another photocell in a small box above, and on comes the sound.

The Blab-Off shouldn't cost you more than $8 to build. You can either wire it to the TV set permanently or install it so it can be unplugged.

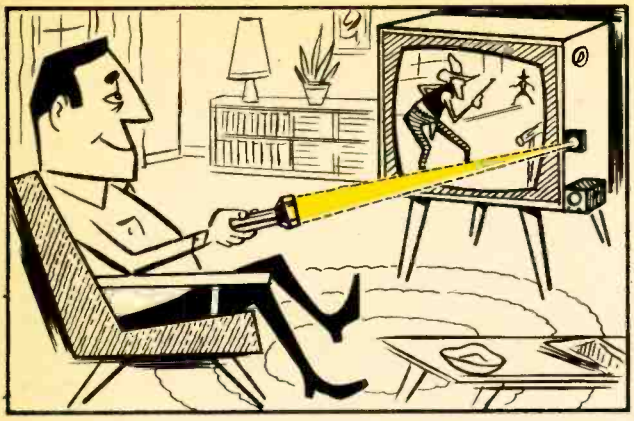
Construction. A look at the pictorial on the next page and you'll see that construction won't take more time than all the commercials during the Late Show. Wiring and layout are not critical. Use a terminal strip for tie points for C1 and other connections; don't connect any leads to the box. Do not make substitutions for PC1, PC2 and RY1. The circuit was designed around these low-cost parts and may not operate if you go off on your own.

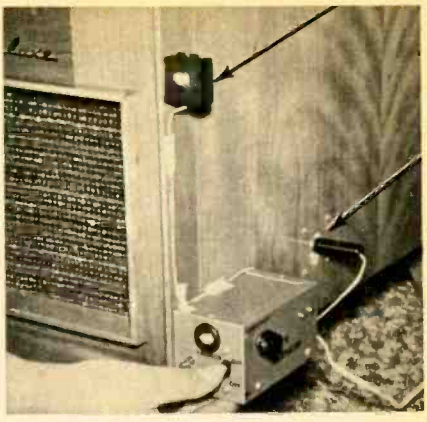
Checkout. Connect a battery and buzzer (or a flashlight bulb) in series to PL1. The buzzer, which now takes the place of the TV set speaker, should sound. In subdued room light, plug in the Blab-Off and turn on power; neon lamp NL1 should light. Set sensitivity control R2 full clockwise (minimum resistance). Back away about 10 feet and aim a flashlight at PC1. The buzzer should go off and stay off after the light beam is removed. Wait a few seconds to be sure nothing happens. Then flash the light beam at PC2. The buzzer should sound again. Repeat this several times to make sure lighting PC1 turns the buzzer *off* and lighting PC2 turns the buzzer *on*.

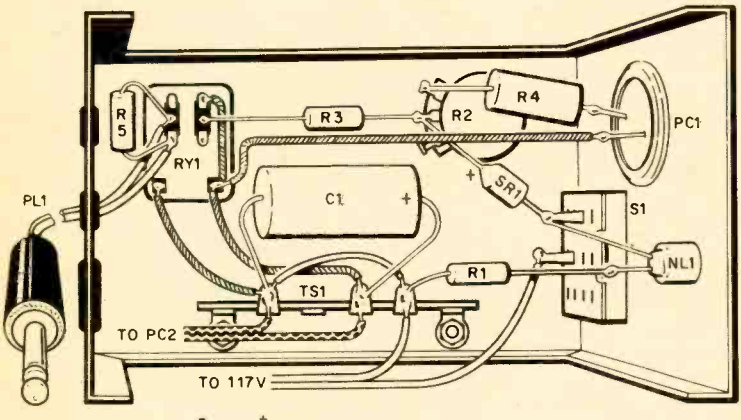
Now start turning on (one at a time) the lights in the room where you watch TV. At some point the buzzer will go off. Turn R2 slightly counterclockwise and flash the light beam at PC2 to start the buzzer. If after you remove the light from PC2 the buzzer goes off again, give R2 another small counterclockwise turn. Eventually you will find a setting of R2 that will allow the TV sound to remain on under normal room-lighting conditions. Again, try hitting PC1 with the flashlight beam to turn the sound off. Aim the beam at PC2 and the sound should come back on.

Reducing the sensitivity of the Blab-Off so it won't be triggered by ambient room light may mean you'll need a more concentrated beam of light or a brighter flashlight. Be patient when finding R2's correct setting if the Blab-Off doesn't work the first few times you try it.

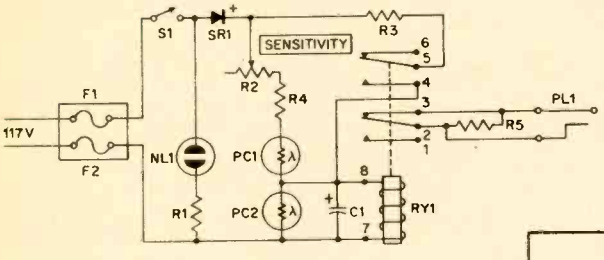
To connect the Blab-Off to your TV set, break one of the leads going to the speaker and connect each end to a phone jack, which you can mount on the rear of the TV set. PL1 plugs into this jack. For a permanent hookup, connect the leads going to PL1 to each of the broken speaker leads.



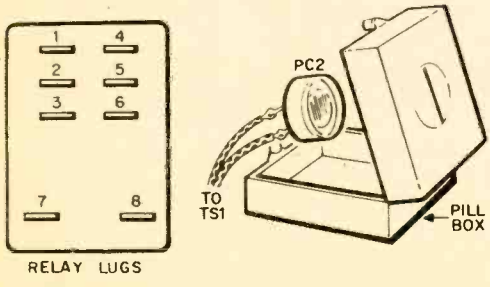




Upper arrow (photo above) points to photocell PC2 at which you aim light to restore sound. Mount photocells at least one foot apart so light beam doesn't hit both at same time. Author designed his model so it can be removed from TV set, hence plug (lower arrow) in side of cabinet. Parts layout (left) is not critical, but do not make any connections to cabinet directly. Mount PC1 in a ½-inch grommet.



Light on photocell causes its resistance to fall. When light hits PC1, current flows through RY1 and contacts 2, 3 open; contacts 4, 5 close and apply DC to coil to keep it energized. Light on PC2 diverts current from RY1 and causes contacts 2, 3 to close; contacts 4, 5 to open.



Use diagram above as a guide when wiring relay. Mount PC2 with glue in close-fitting hole in a small pill box. Paint inside of the box black.

PARTS LIST

C1—10-mf, 150-V electrolytic capacitor
F1, F2—1/16 amp fuses and fused plug
NL1—NE-2 neon lamp
PC1, PC2—Cadmium-sulfide photocell (Lafayette MS-922. Do not substitute)
PL1—Phone plug
R1—100,000-ohm, ½-watt resistor
R2—5,000-ohm miniature potentiometer (Lafayette VC-33)
R3—33,000-ohm, ½-watt resistor
R4—4,700-ohm, 2-watt resistor
R5—470-ohm, ½-watt resistor
RY1—DPDT miniature relay: coil resistance, 5,300 ohms (Lafayette F-332)
S1—SPST slide switch
SR1—Silicon diode: 60 ma, 400 PIV (Lafayette SP-266 or equiv.)
TS1—4-lug terminal strip
Misc.—2¼x2¼x4-inch Minibox, plastic pill box

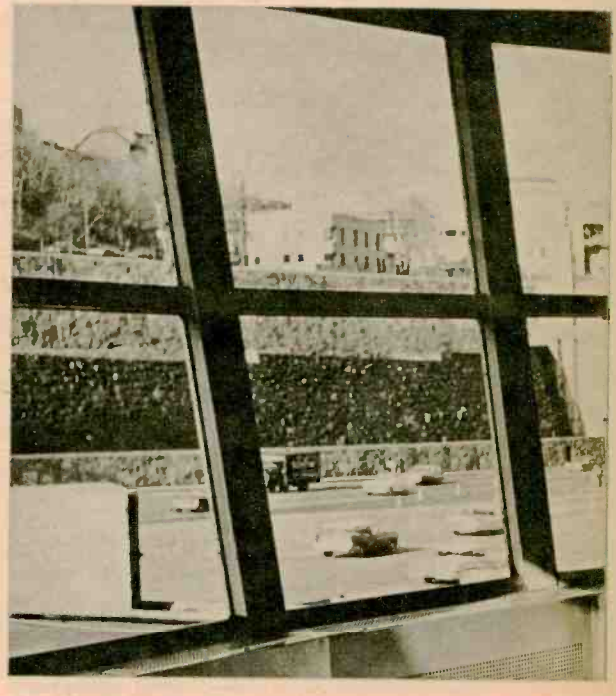
Handset in hand, officer relays important data to other officials. TV gives him complete picture.

TUNNEL

WHAT with everything from traffic lights to ignition systems going electronic these days, it's getting so the electron means as much to transportation as it once did to communication. In New York City—long one of the most densely populated and traffic congested areas anywhere in the world—electrons control cars and trucks far better than policemen alone ever could. And in New York's famed Lincoln Tunnel, electrons soon will turn would-be chaos into orderly traffic flow.

A busy thoroughfare under the Hudson River, the Lincoln Tunnel is one of Metropolitan New York's major arteries. Thousands of cars, trucks and buses speed daily between midtown Manhattan and neighboring New Jersey via the tunnel, while giant ocean liners chug toward their docks in the river above.

Though the Lincoln seemed tunnel enough when it was opened back in 1937, it became something of a bottleneck in the years following the war. Since then, two more tubes have been added, but even they didn't solve the problem fully. Traffic tieups became routine as crumbs on a breadboard. The ants ran from all directions into this anthole, all right, but their timing was such that too many were trying to get through at once. Worse yet, let one have a little trouble en route, and traffic likely would be backed up for miles and miles.



Television, computers, electric eyes and two-way radios traffic in New York's busy Lincoln Tunnel. Here, officer

Control panel for TV camera, made by Foto Video Electronics, is located at Jersey end of tunnel.

TELEVISION

are all part of the elaborate system designed to unsnarl talks with associates stationed at other control points.

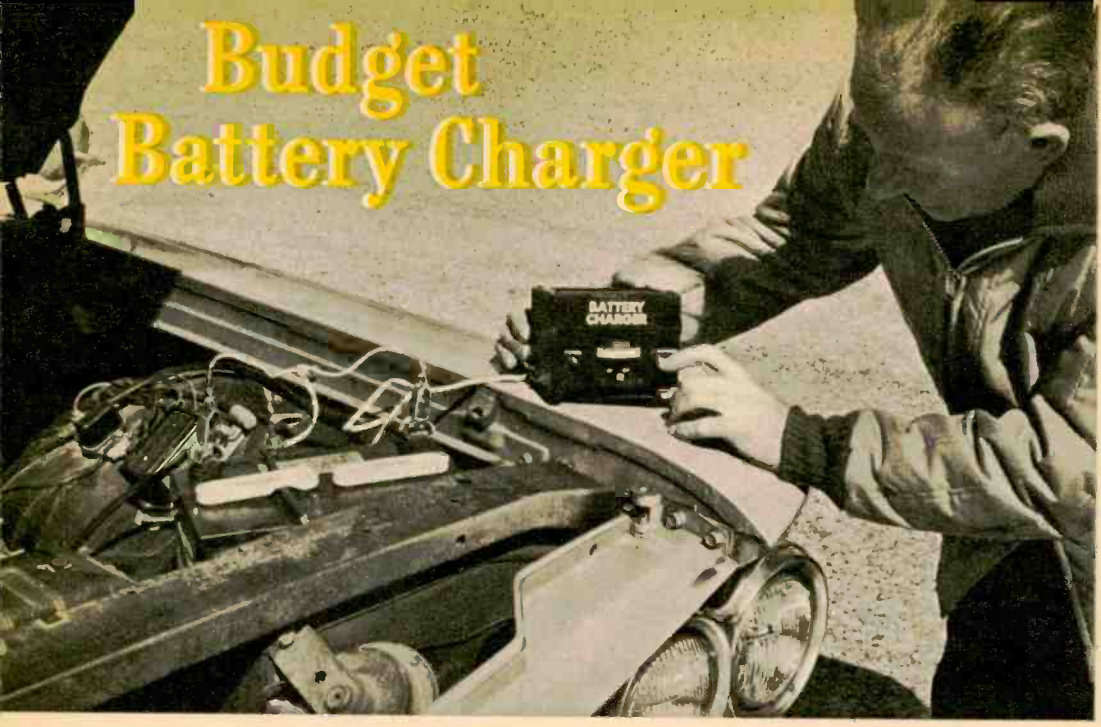
It was at this point that engineers went to the electron for help. What was needed, they reasoned, was a way to keep traffic moving constantly and consistently. It took some thinking, of course, but they eventually came up with an electronics array that promises to end the tunnel tribulations once and for all.

Though only one of the three tubes has been equipped to date, all eventually will boast a battery of electronic gear ranging from TV cameras to computers. And, in a nutshell, here's how the system will work.

Photoelectric cells will sense traffic flow automatically, then pass this information on to computers. These electronic thinking machines, in turn, will control traffic lights at the tunnel entrance and thus govern the number of vehicles admitted. The goal here is to keep drivers moving at speed somewhere between 20 and 25 mph and spaced some 55 feet apart.

Also as part of the system, television cameras will scan the tunnel's entire mile-and-a-half length to show policemen exactly what's going on. Should trouble—a blow-out, a stall or other mishap—develop at any spot along the way, five radio-equipped catwalk cars stand ready to carry patrolmen to the point in seconds. Meanwhile, other TV cameras will give supervisors the traffic picture on every major approach to the tunnel, leaving nary a stone unturned.—*Alan D. Haas*

Budget Battery Charger



Pep up 6 or 12 volt car batteries for cold-morning getaways.

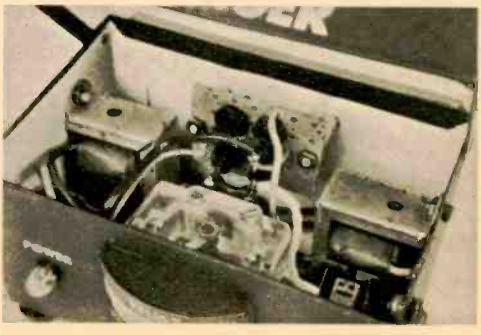
IT'S ANNOYING to hop into your car on a cold morning and find that the engine barely turns over because of a weak battery. Best way to protect yourself against this headache is to build our budget charger and put the battery on an overnight charge to pep it up for a quick morning start.

Most commercial trickle chargers cost at least $10. Our charger will set you back only about $7 and that includes a meter. Without a meter it will cost about $4. To provide either 6- or 12-volt outputs at 2- and 1-amps, respectively, the charger uses two 6.3-volt, 1-amp filament transformers which are connected in series or parallel by switch S1. The charger will fit in a common dime-store 3x5-inch card file box.

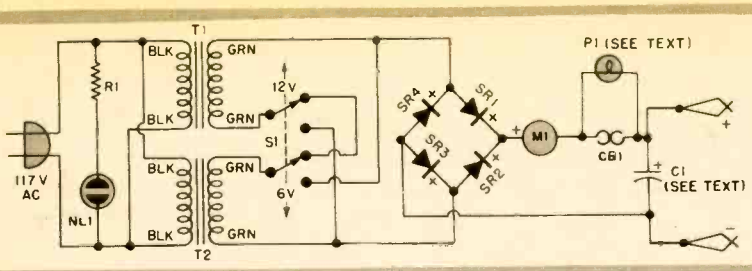
Construction details are covered in the pictorial's caption. It is important to get T1 and T2 phased properly or the charger won't work. To do this, connect a voltmeter set to AC to the junction of SR1,SR4 and SR2, SR3 and turn on power. With S1 set to 6 volts you should measure about 6 volts. If there is no indication, turn off the power and reverse the black leads (or the green leads) of either T1 or T2.

A shunt made from a piece of nichrome heater-element wire must be connected across M1's terminals so M1 will indicate 2 amps full scale. Attach a short length of nichrome wire across M1's screw terminals. Connect the shunted meter in series with a 2-ohm, 1-watt resistor across a 1.5-volt #6 battery. Increase or decrease the length of the shunt wire (be sure to disconnect the battery each time the shunt is disconnected) until M1 indicates about 35ma. Clip off the excess nichrome wire and tighten the screws, being careful not to change the wire's length.

Operation. Always connect the charger clips to the battery before plugging the line cord into the 117-volt outlet. And on cars equipped with an alternator, disconnect one battery cable before connecting the charger.



Charger fits in 3x5-inch card file box. Cut out top and bottom to simplify wiring and to provide ventilation. Diodes mount on board at the rear.



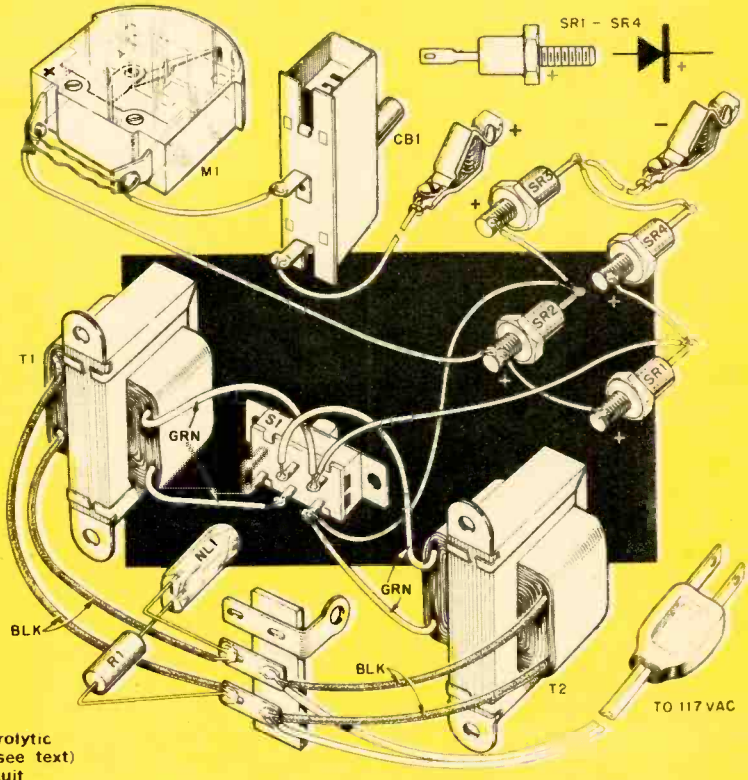
When S1 is in 12-volt position, secondaries of T1 and T2 are connected in series. When S1 is in 6-volt position, secondaries are in parallel. P1 is optional and is used to indicate when circuit breaker is open.

Connect the positive clip to the positive battery terminal and the negative clip to the negative terminal. Set S1 to either 6 or 12 volts. Plug in the charger and the neon lamp should light and M1 should swing upscale.

If you have connected the clips backwards —selected the 12-volt output for a 6-volt battery—or if the charger is incorrectly wired or the battery is shorted internally, the circuit breaker will open. (An optional pilot light, P1, will light if the breaker is open.) After locating and correcting the trouble reset the circuit breaker by pushing in and releasing the button. If the breaker opens after a short charging time and the meter is indicating near full scale, you can be sure your battery is in bad shape and charging is a

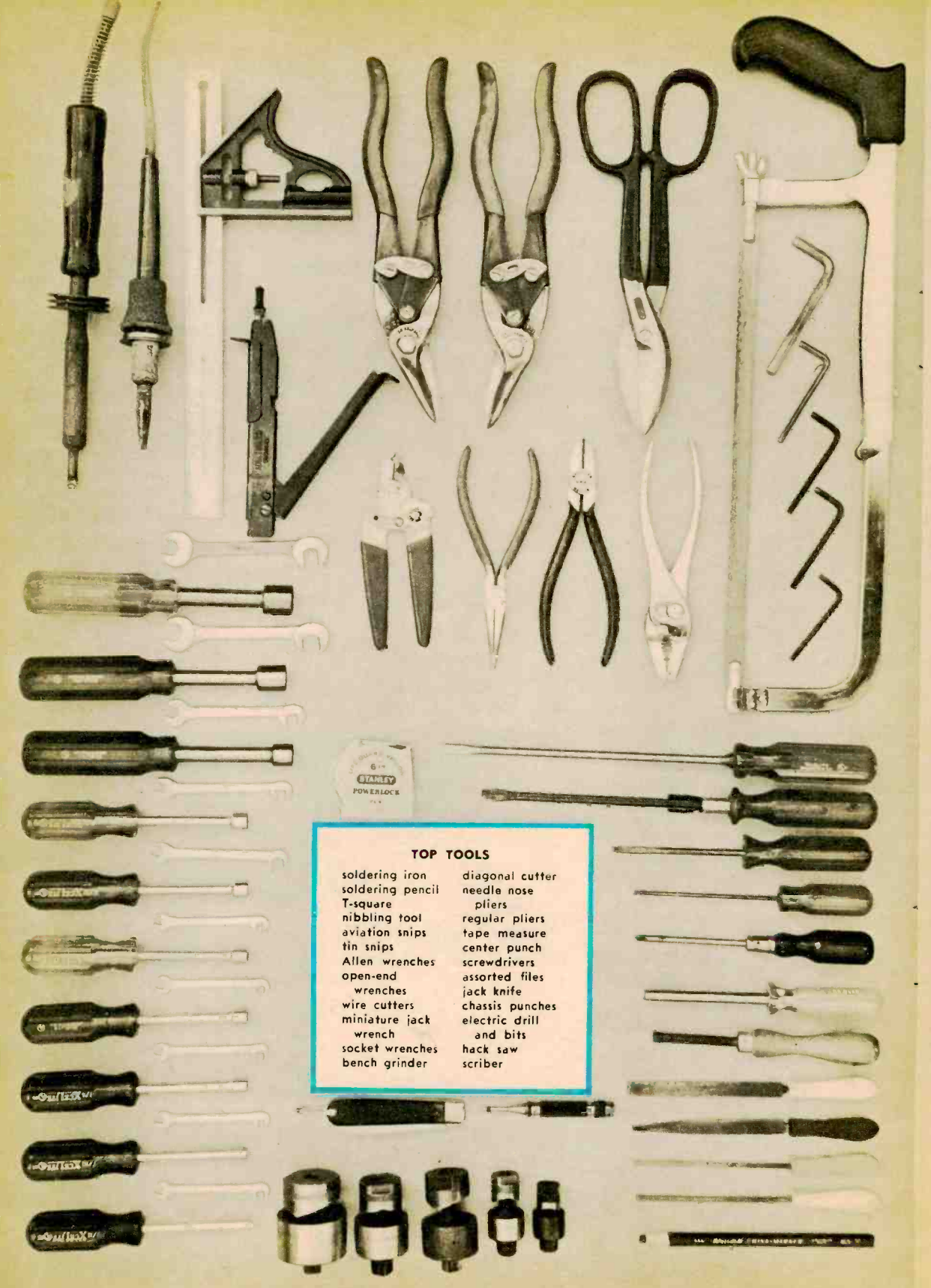
[Continued on page 109]

Layout is not critical but don't use wire smaller than #20. Photo at left shows location of parts in author's model, but you may rearrange them to suit yourself. T1 and T2 should be bolted firmly (with their frames vertical) to the box, which acts as their heat sink. Cut out the top and bottom of the box for cooling. The four silicon diodes are mounted on a piece of perforated board as a subassembly, which is then mounted on back of box with standoff insulators. After wiring is completed, cover top and bottom of box with wire screening.



PARTS LIST

C1—100 mf, 25 V electrolytic capacitor (optional, see text)
CB1—Mel-Rain 2-A circuit breaker (Allied Industrial catalog stock No. 33 B 982; 80¢ plus postage)
M1—0-100 ma DC milliammeter (Emico Model 13 edgewise type. Allied 66 F 029)
NL1—NE-2 neon lamp
P1—#47 pilot lamp and socket (optional, see text)
R1—100,000-ohm, ½-watt resistor
S1—DPDT slide switch
SR1-SR4—Silicon diode: 2 A, 50 PIV (Allied 39 A 720-D or equiv.)
T1, T2—6.3-V, 1 A filament transformer



TOP TOOLS

soldering iron	diagonal cutter
soldering pencil	needle nose pliers
T-square	regular pliers
nibbling tool	tape measure
aviation snips	center punch
tin snips	screwdrivers
Allen wrenches	assorted files
open-end wrenches	jack knife
wire cutters	chassis punches
miniature jack wrench	electric drill and bits
socket wrenches	hack saw
bench grinder	scriber

TOOLS

FOR THE ELECTRONIC HOBBYIST

By BERT MANN

EQUIPPING A WORKSHOP is like building up a wardrobe. The man who lives in San Francisco needs a heavy winter coat like a hi-fi fan needs a BFO. But the San Franciscan does have use for a shirt or two if he's to pass in polite society, just as the audio buff needs a soldering iron if he wants to build anything.

By and large, what you need and what you buy depends on what you intend to do with it—and how much money you have to spend. We're not going to tell you how you can have a complete shop for ten bucks, since we think there's more to a shop than completeness. What we are going to tell you about are the tools you'll need for a craftsman's shop . . . a shop so good that even cutting a two-inch hole in a heavy chassis is a pleasure rather than a chore.

But what'll it cost?, you're asking. Plenty, but you'll hardly notice if you take it on the slow side. Buy the tools—good tools—you need as you have use for them and as you can afford them. The drain on your pocketbook won't be all that bad. Much more important, top-quality tools actually will be a lot cheaper in the long run than any of the dime-store variety.

First off, you'll need some hand tools. Heading the list is a pair of *needle-nose pliers*. But not the usual ones—anyone can have those. We suggest the Kraeuter 6-in. pinned electronic nose cutting pliers (there's a long name for you).

These pliers have the wire cutter located ¼ in. back from the tip. You wrap the connection, slide the pliers forward slightly and then cut off the excess wire. There's no switching back and forth from pliers to cutters, so be prepared to save at least two hours on every kit you build. In addition, the tips are extra thin; a quick twist and you have a locked-tight wrap.

Next comes a *diagonal cutter*. Nothing is more frustrating than trying to cut a capacitor's heavy lead with worn cutters. So get the right cutters right off: 6-in. hard-wire diagonal cutters. Yep, the words are hard wire, and don't let the salesman fool you (he just may not stock them). And see to it that you avoid unusual sizes. The teensy cutters (they look great in tool kits) poop out on heavy wire; the extra-large, heavy-duty cutters won't fit cramped corners. Stick with the 6-in. size and you're in business.

Hold tight for the *screwdriver*, a most innocuous tool which has bloodied more fingers, scratched more cabinets and broken more screws than any other. Remember, only a worn or improper size screwdriver slips; the right size with a square blade never slips. And a screwdriver should be the best money can buy. Further, since you're bound to use it as a chisel or a paint-can opener, the blade should be made of hardened steel.

First off, you can't get equipment out of a cabinet until you remove the knobs, so you'll need a setscrew driver. Don't get talked into those dinky 15¢ jobs; the blade cracks and forever after you're breaking setscrews. Obtain a standard 6½-in. screwdriver with an ⅛-in. blade. The Xcelite R-184 is a good choice, since its extra length gives extra leverage and solid pressure against the screw.

For general use, the Stanley 200083IN—a 6½-in. driver with a 3/16-in. blade—is a

TOOLS

FOR THE ELECTRONIC HOBBYIST

good bet. And for those really tight screws, an Xcelite R-148—a 12-in. driver with a ¼-in. blade—is ideal. (While this *is* a big one, the blade is a perfect fit for electronic screws, particularly the binder-head type.) Throw in a good quality No. 1 Phillips screwdriver, and you're set for 99% of your screwdriver needs.

Though you'll need a *wire stripper*, don't go in for those big, expensive, automatic models. The G-C Electronics Type 760 stripper is quite adequate. It has a calibrated lock adjustment for all the popular wire sizes, so you can't cut through a wire if you set the lock to the correct size. Strange as it seems, this little job works faster and easier than the automatic strippers.

You'll also want *socket wrenches*. Stay away from kits with one handle and lots of sockets; nothing gets lost faster than a loose socket. Select wrench sets with all the electronic sizes—the 3/16, 7/32, ¼, 9/32, 5/16, 11/32 and ⅜ inches are must-haves. For volume control and switch nuts, you'll need 7/16, ½, 9/16 and ⅝ jobs. Since wrenches get rough wear, they should be of high quality, though not necessarily the best going. Snap-on, Williams and Xcelite (among others) make excellent socket wrenches.

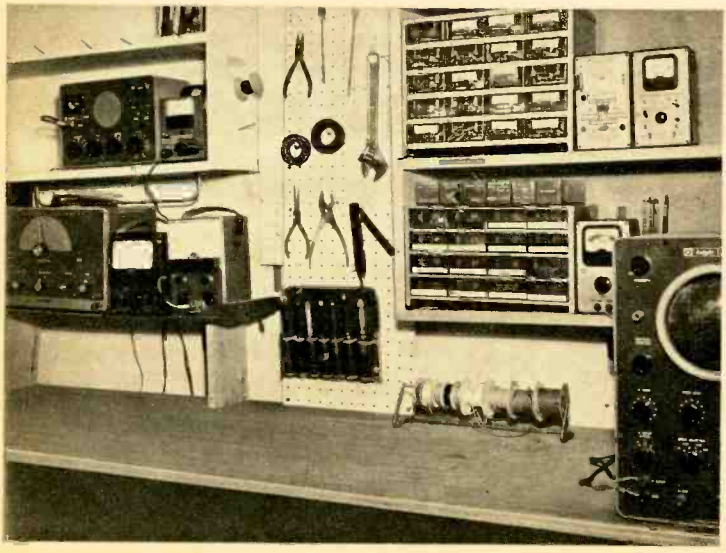
If you do any work with those itsy-bitsy sub-miniature jacks (like on transistor radios), stop chewing them with pliers. A G-C Electronics Type 9308 *miniature jack wrench* makes little jacks seem like big ones.

Another offbeat but valuable tool is the Mallory MW-100 *capacitor mounting wrench*. This item lets you twist capacitor mounting tabs without breaking them off.

Don't forget to throw in a pair of regular *pliers* and a set of *small files* in assorted shapes. And for that tool that proves you're something other than a plumber or a mechanic, we're going to suggest a *soldering iron*. Note that word *iron*. Don't get a soldering gun right away. If you're building a kit or a project, you're soldering constantly—and triggering a gun on and off is a sure way of burning it out (as well as slowing yourself down). Also, using a high-wattage gun when soldering a transistor is a good way to bury a transistor.

Choose a soldering *pencil* of about 50 watts as your general-purpose iron. An Ungar with a type 4033 high-temperature tip is a good bet. The high temperature melts solder fast—so fast that you can solder a transistor lead before the body of the transistor

[*Continued on page* 110]



Having the right kind of tools is only half the battle that most electronics hobbyists face. Equally important is having those tools properly cared for and arrayed neatly, since this is the only way they can have the life expectancy and usefulness their cost demands. Though the workshop shown here doesn't always look this neat, it's fully representative of the kind of shop every hobbyist should aim for.

GOOD READING

By Tim Cartwright

INSIDE ELECTRONICS. By Monroe Upton. The Devin-Adair Co., New York. 262 pages. $5.95

Well, Monroe Upton's done it again. Using the same approach he took in *Electronics For Everyone,* he's produced a fine, lively explanation of three topics most likely to interest the general reader. His subjects: radio, TV and stereo/hi-fi.

A writer who knows what he's doing, Upton seems to work on the premise that his readers are intelligent. He doesn't talk down to them, doesn't give a painful ABC explanation of his subjects. Nor does he over-simplify a topic for the sake of a zippy style. Instead, he simply writes the kind of book *he* would like to read about an unfamiliar subject.

Open this book to the chapter on hi-fi speakers, and you might expect to see the pet theories, overgeneralizations and dated facts you've read before. But you won't. For lo and behold, this book offers a tightly written and completely accurate summary of a very complex topic. Matter of fact, it's better and more up-to-date in this area than the great majority of hi-fi books. And it's also much, much easier to read and comprehend. Go back to the beginning of the book, and you'll find everything from the initial explanation of electricity to the final chapter on the principles of stereo sound just as good.

This book could and should serve as a model for authors who want to write a popular treatment of a technical subject. It's a superb job, recommended for anyone who would like a fill-in on its three subjects.

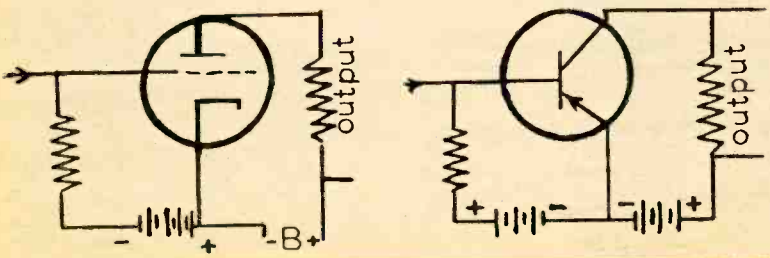
ON THE SENSATIONS OF TONE. By Hermann Helmholtz. Dover Publications, New York. 576 pages. $2.95

A hundred years ago, Hermann Helmholtz startled the scientists and pseudo-scientists of the day with this treatise on the nature and perception of sound. Among other things, he provided the first thorough explanation of the sound of music and musical instruments. And he demolished—with carefully reasoned experiments—the most popular misconceptions about the nature of sound.

What makes this reprint particularly welcome today is that many of Helmholtz's discoveries have since been distorted somewhat. In fact, the learned gentlemen dealing in psychoacoustics have turned it into an almost-science as ridiculous as phrenology. It's good to go back to the beginnings and see what the man himself had to say. And while this book hardly rates as light reading, it is a storehouse of information for anyone with an acoustic bent.

TRANSISTOR CIRCUITS FOR MAGNETIC RECORDING. By N. M. Haynes. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 384 pages. $9.95

Transistor tape recorders, chiefly of the $29.95 toy variety, have been around for sometime now. But engineers are just beginning to explore the transistor's real potential for magnetic recording. And, with plenty of tables and charts, here is a good, comprehensive analysis of transistor applications in recorder circuitry. It covers both the transistor's advantages and disadvantages.



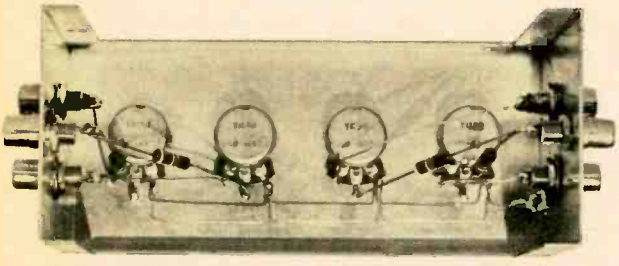
Tubes and transistors no longer are treated separately in many modern texts, since they are horses of the same color. Our illustration, taken from Inside Electronics, shows the triode side-by-side with its transistor counterpart.

all-purpose STEREO MIXER

FOR about $3 you can stop envying the professional disc jockey and be your own daddy cool when you're making tapes. How? By using EI's Stereo Mixer to combine your voice with music or speech from records, tapes or an FM tuner.

The mixer permits you to fade smoothly from one program source to another or to emphasize one over another. And you can feed just about any two types of program source—such as microphone, record player or tuner (even another tape recorder)—through the mixer to each channel of the recording tape machine.

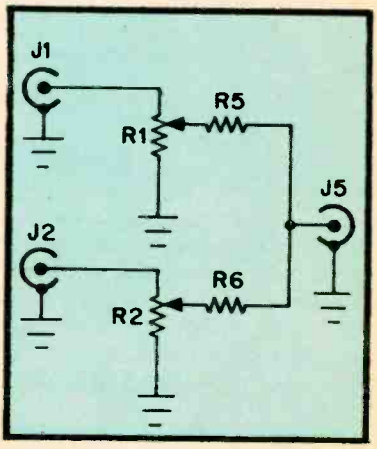
Construction is a snap because there are so few parts. The photo and caption below show and explain how it's done. If you don't need a mike input, all resistance values can be changed to 100,000 ohms. Compensate for signal loss in the mixer by turning up the tape recorder's gain.—*Lawrence Glenn.*

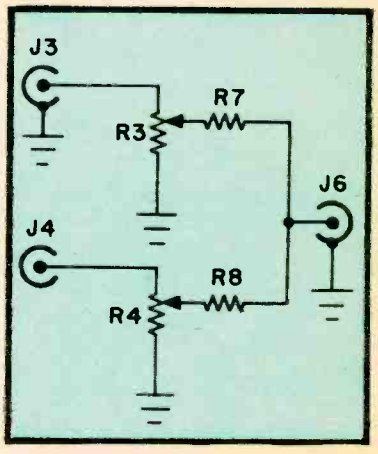


Mount all parts in main section of Minibox. Top and bottom jacks on both sides are inputs. Center jacks are the outputs.

PARTS LIST

J1-J6—Phono jack
R1-R4—1-megohm miniature audio-taper potentiometer (Lafayette VC-38 or equiv.)
R5-R8—470,000-ohm, ½-watt, 10% resistor
Misc.—2¼x2¼x5-inch Minibox, knobs





Inputs are J1-J4; outputs are J5, J6. R5-R8 prevent the signal at one input from being grounded by the setting of other input's pot. Increase tape recorder's gain to offset mixer loss.

Those KILOCYCLE KOPS

By TOM KNEITEL, WB2AAI

MOST EVERYONE is familiar with the Federal Communications Commission —the Washington bureau responsible for the who, what, where, when and how of the public airwaves. Pretty routine stuff, you say, what with applications, licenses, rules, regulations and all that sort of thing? Well, yes. Also no.

Least publicized FCC department is the Field Engineering and Monitoring Division. It is charged with keeping the peace on the kilocycles, much as troopers keep peace on the highways. The FCC's kilocycle kops are scattered around the country in some 18 monitoring stations. And it's here they tune the airwaves constantly, listening to static and chatter and hullaballoo for hours on end. Bore though it sounds, this aspect of the business can be pretty fascinating. Matter of fact, the kilocycle kops turn up enough far-out antics to make the division's files read like radio's own Believe It Or Not.

Let's take the Denver office as a for-instance. Seems the kilocycle kops out that way were summoned to the Utah State Prison to investigate a situation that was hardly routine. It turned out that the wife of an inmate who was a Citizens Bander had smuggled in a CB rig to keep her husband amused while he was serving time. The CBing prisoner sold the unit to another prisoner (unlicensed), assisted him in setting up a station in a dormitory and even threw in his call sign as part of the sale. Though the warden confiscated the gear and subjected the two men to 30 days solitary confinement, the FCC only could write warning letters to the two parties of this inside job.

In another incident down in Georgia, the offender wound up in a correctional institution, though he didn't start out that way. This time a ham radio operator informed the FCC's Atlanta office that he had intercepted a message of crucial importance. A Russian submarine had fired on a shrimp boat off the Georgia coast—or so the message read.

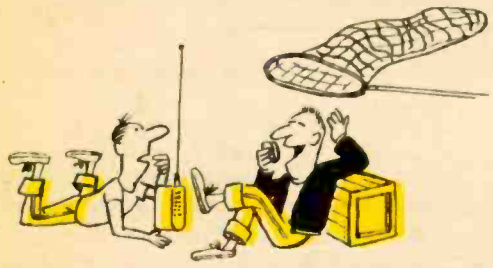
Thing was, the ham suspected the whole business was a hoax right from the start. So did the FCC, and it didn't take long to prove that both were correct. Another such message sent over the airwaves brought its perpetrator to the attention of the FBI and U.S. Naval Intelligence. The shrimp boat, when finally run to ground, turned out to be a 17-year-old youth with a long record of misbehavior. He pleaded guilty in court and was ushered into an institution where he will remain until he becomes 21 years old.

Persons trying easy-money schemes at race tracks have come up with all manner of ingenious contrivances to beat the odds. In one case, officials at a California race track heard voice transmission of numbers on a CB channel immediately following the start of each race. Investigating, they spotted a man operating a walkie-talkie from the top deck of the grandstand. Then they discovered that

KILOCYCLE KOPS

the messages were being received by a rather innocent-looking accomplice stationed near the betting window. His earplug was in sight, all right, but the half-pint-size receiver was hidden in his hat.

In another race case, the Jefferson Downs track was visited by a kilocycle kop from the FCC's New Orleans office to check for illegal use of radio in the beat-the-bookie game. Such activity usually involves the use



of unlicensed transmitters. But on this occasion the FCC investigator discovered that a low-power device was employed to speed race results from inside the track to a confederate in an auto parked outside. From there, the second man sent the results via a transmitter licensed in the Domestic Public Land Radio Service.

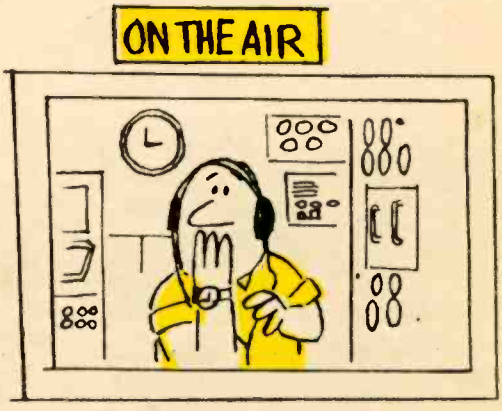
Occasionally, the kilocycle kops get involved in matters that really don't call for cops of any sort. Take the FCC's Baltimore office as a case in point. It received a complaint from a listener who claimed he was held captive by a broadcast station. One station's programs were blanketing the entire dial on his receiver, said he, and this he disliked not a little.

Before the FCC could investigate, however, the complainant called again and offered his red-faced discovery. Seems he had looked into his problem a little more carefully and uncovered the source of his trouble. The diagnosis: his receiver's dial cord had snapped, causing the tuning capacitor to remain stationary when the dial was turned.

The police in Kansas City once notified the FCC that they had stumbled across a transmitter in an auto owned by an alien who had been arrested on another charge. Inquiry showed that the alien's entire family had been using unlicensed CB gear for personal and business purposes. The head of the family said that he had been misinformed as to the need of a license when he purchased the equipment and had it installed in his car. He finally explained that he had no idea *citizens* licenses are not issued to aliens.

Theft pure and simple was the diagnosis not long ago when thieves took two CB transceivers from a store in a Chicago suburb. Discovering his loss, the proprietor used one overlooked set to notify his wife, at home a block away, who also had a CB rig. She continued to monitor the channel and eventually heard youthful voices who didn't seem to know a 10-2 from a 10-10. She suspected she had the thieves on the hook and engaged the youngsters in conversation long enough to learn that they lived nearby. This tip led to the arrest of two boys and recovery of the stolen sets. However, further check by the Chicago FCC office showed that neither the store owner nor his wife had CB licenses.

But hams, CBers and other individuals aren't alone in feeling the long arm of the kilocycle kops. Even staid commercial broadcasting stations run afoul of the FCC's regulations now and then. In one 20-month period FCC field engineers conducting field-strength measurements of some 600 broadcasting stations found that more than 10 per cent were



deficient in signal coverage. Typical causes were deteriorated ground systems, leaky base insulators and corroded tower joints.

Lastly, there was the kilocycle kop who drove into a Vermont community to inspect the local radio station. As he pulled up to the station, listening to it on his car radio, he heard a disc jockey spin a current hit—called Oh, Oh—Trouble's Back in Town.

THE SCROUNGER...

Being a 2-band ham rig you can lash up for as little as 5 clams!

By HERB FRIEDMAN, W2ZLF

REAL CHALLENGE used to be ham radio's keynote. No one in the early days ever thought of flipping through a catalog, ordering gear galore and then going on the air the same day the stuff arrived. Most everyone rolled his own in those days.

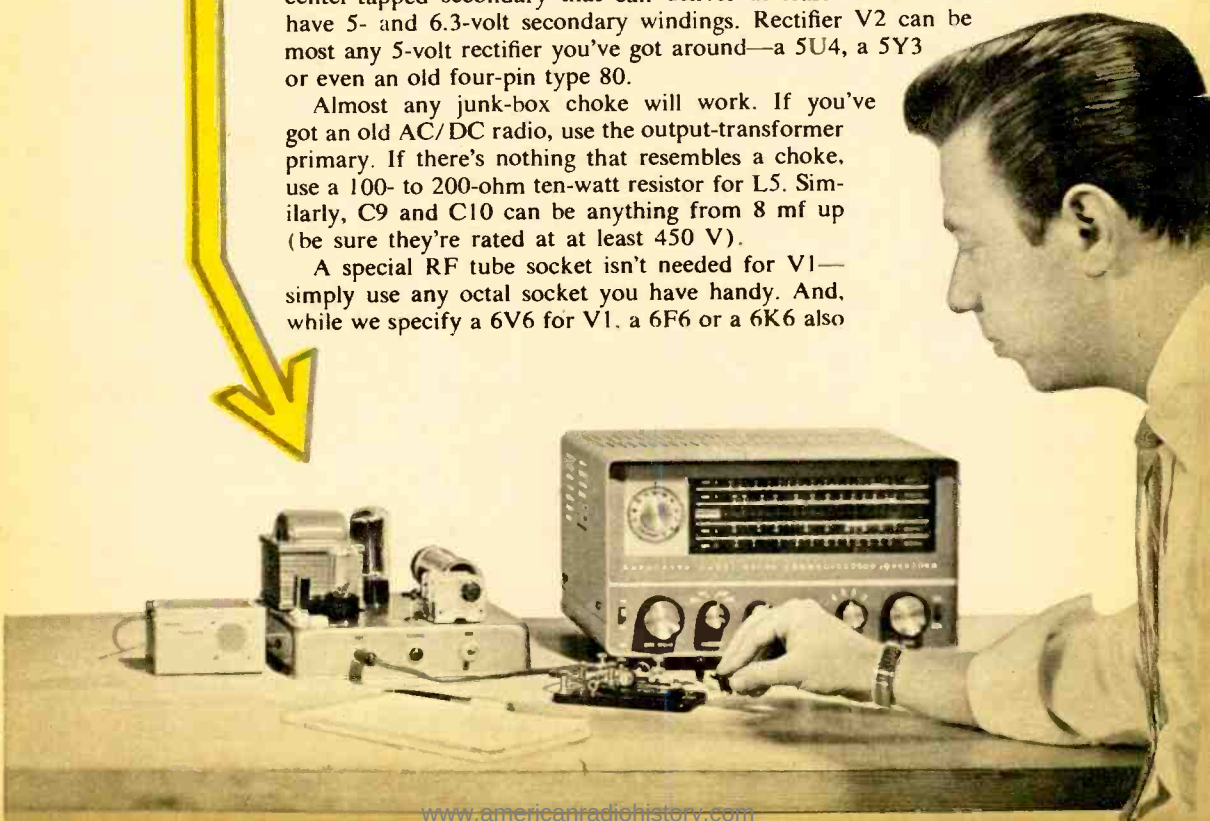
Today, this kind of fun is pretty much gone with the wind. But not quite: build EI's Scrounger, and you're in for all the thrills and satisfactions that can only come from building your own equipment. Whether you're a new General, a Novice or an old timer, the Scrounger can put real enjoyment into amateur-radio construction and operation. And what's the Scrounger? Why, a crystal-controlled 80- and 40-meter CW transmitter with an input power of up to 10 watts—more than enough to enable the sharp operator to paper his walls with QSL's.

It's designed as a junk-box project and most of the parts can be swiped from old TVs, radios or scrapped home-brew projects. If there's an electronic schlock house (surplus dealer) in the neighborhood, you probably can bargain the components for a buck or two. On the chance you don't have a junk box everything can be bought new for less than $25.

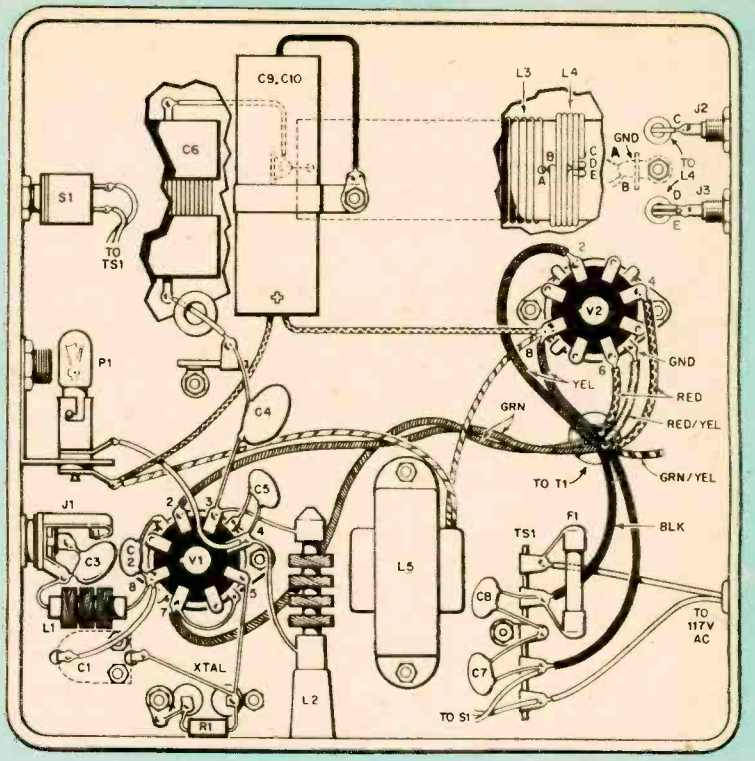
Construction. We built our Scrounger on a 9x9x2-inch cake pan. Power transformer T1 can be just about any type as long as it has a 400- to 600-volt center-tapped secondary that can deliver at least 40 ma. T1 also must have 5- and 6.3-volt secondary windings. Rectifier V2 can be most any 5-volt rectifier you've got around—a 5U4, a 5Y3 or even an old four-pin type 80.

Almost any junk-box choke will work. If you've got an old AC/DC radio, use the output-transformer primary. If there's nothing that resembles a choke, use a 100- to 200-ohm ten-watt resistor for L5. Similarly, C9 and C10 can be anything from 8 mf up (be sure they're rated at at least 450 V).

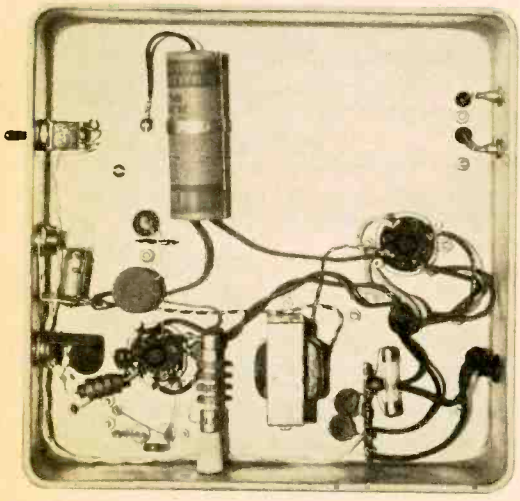
A special RF tube socket isn't needed for V1—simply use any octal socket you have handy. And, while we specify a 6V6 for V1, a 6F6 or a 6K6 also



Use a 9x9x2-inch cake pan and follow our open layout and you won't have any construction problems. Mount the power transformer last to keep it from bending the pan. We've shown the pan cut away under C6 and L3/L4 so you can see the connections. Terminal strips are used at each end of L3/L4 to support the coil about ¼ inch above the pan and to provide a tie point at the left end and a ground point at the right end. Remember that both lugs on P1's socket are insulated from ground. Mount C1 and the crystal socket above the pan. A keying monitor, described on the last page of this story, plugs into J3 to enable you to hear your own fist when sending.



THE SCROUNGER...



There's so little in the Scrounger that you should be able to get it on the air in an evening—even if you spend time rummaging through a junkbox.

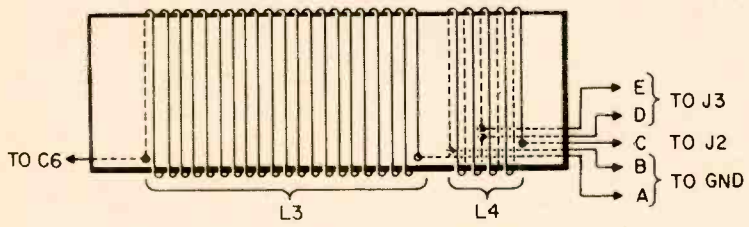
will work, though the input power will be lower.

Tuning capacitor C6 is the RF section (the large one) of a scrapped superhet tuning capacitor. Modify it for the transmitter by removing the trimmer screw and the trimmer-capacitor strip. RF chokes L1 and L2 (2.5 mh) can be the same type, though if you purchase these we suggest the miniature type for L1. The value of keying-adjust trimmer capacitor C1 isn't critical as long as its range is at least 7-35 mmf.

The critical parts are L3 and L4, but even here there's some leeway. Their form is a cardboard tube from a roll of bathroom tissue. Place a pencil mark about ½ inch from one end and a second mark 3 inches from the first. Then punch a small hole through each mark. For L3 you can use #18, #20 or #22 enameled, hookup or bell wire—just be sure it's insulated. Pull the wire through one hole from inside the form and wind 22 evenly spaced turns between the two holes. Then cement the wire in place with airplane glue or household cement. When the cement

PARTS LIST

Capacitors:
C1—7-35 mmf trimmer (Centralab 820-C or equiv.)
C2—100 mmf, 500 V ceramic disc
C3—.02 mf, 500 V ceramic disc
C4—.05 mf, 1600 V ceramic disc
C5, C7, C8—.005 mf, 500 V ceramic disc
C6—Superhet variable capacitor (Allied 13 L 529)
C9, C10—20/20 mf, 450 V electrolytic
F1—1-A pigtail fuse
J1—Phone jack
J2, J3—Phono jack
L1—2.5 mh RF choke (J. W. Miller 6302 or equiv.)
L2—2.5 mh RF choke (National R-100U or equiv.)
L3, L4—Coils (see text)
L5—8.5-hy, 50-ma, 400-ohm choke (Allied 62 G 136 or equiv.)
P1—40-ma, 28-V pilot lamp (G.E. 1819 or equiv.) and socket
R1—82,000 ohm, ½-watt resistor
S1—SPST toggle switch
T1—Power transformer: 480 V c.t. @ 40 ma, 5 V @ 2A, 6.3 V @ 2 A. (Allied 61 G 427 or equiv.)
V1—6V6GT tube V2—5U4G tube
Misc.—80-meter crystal (Texas Crystals, Inc.)



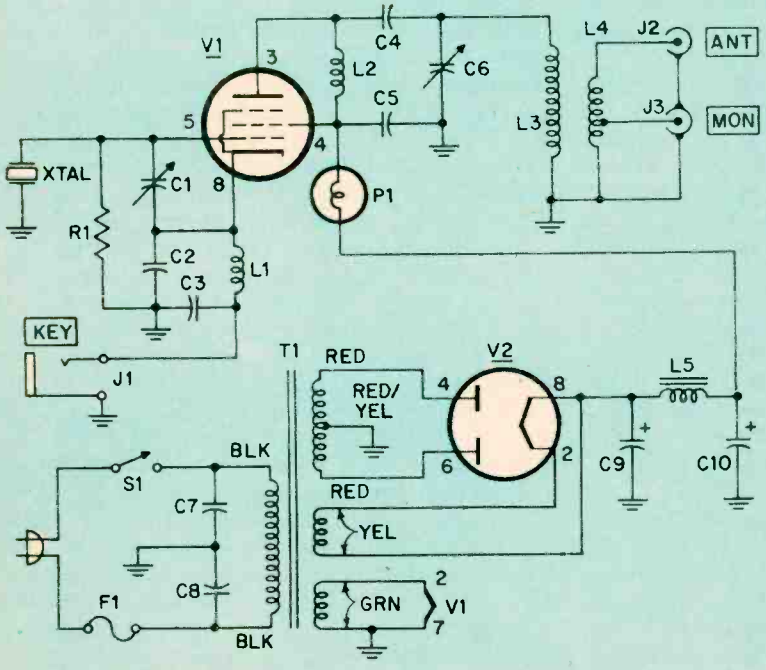
Coil construction. All leads come through bottom of form. Leads marked A through E connect to J2, J3 and ground lug as shown in pictorial at left. We wound L4 in two steps: from ground lug to J3 (E); from J3 (D) to J2 (C).

dries, you're ready for antenna coil L4.

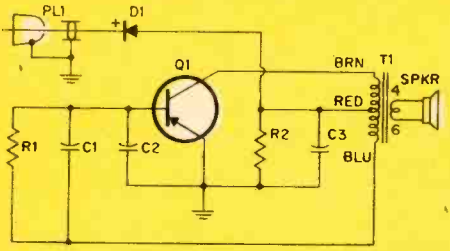
L4's construction and location depend on how you plan to feed the Scrounger to the antenna system. If you use an antenna coupler (see 250-WATT ANTENNA TUNER, Sept. '63 EI), which we recommend, L4 should be five turns of #22 plastic insulated hookup wire wound *adjacent* to L3 as shown in the coil diagram.

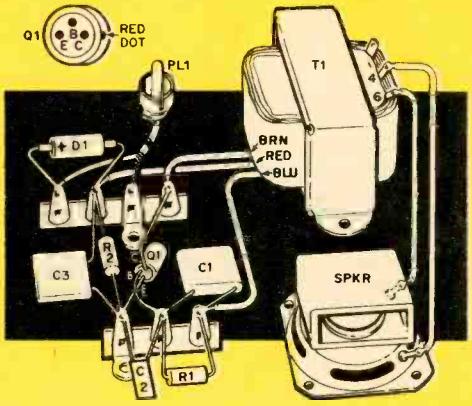
To provide an RF sample for our keying monitor (described on the last page of this story), tap L4 at the second turn from the ground end.

We do not recommend that the Scrounger's



V1 is a combined crystal-controlled oscillator and RF amplifier whose cathode, control grid and screen grid (the oscillator plate) function as the oscillator. Since the screen is at electrical ground it effectively shields the oscillator from the plate circuit and antenna loading effects. We recommend an antenna coupler for long-wire or random-length antennas. A dipole can be connected directly to J2 but you will have to experiment with L4 to obtain maximum loading. For 72-ohm feedlines, L4 should be five to eight turns. For 300-ohm feedlines, L4 should be anywhere from eight to twelve turns. Remember, if you use an antenna coupler, wind L4 adjacent to L3 as shown in the diagram above.





This keying monitor will let you hear your fist. It fits in a 2¼x2¼x4-inch Minibox and is shown next to the Scrounger on the first page of this story. Transmitter must be loaded for monitor to work properly. If tone is garbled, try a .1 or .05 mf capacitor for C3. If tone is shrill, parallel C3 with another .25 mf capacitor.

THE SCROUNGER...

output at J2 be fed into an antenna directly, since the overall efficiency will be low. If you don't have or don't want to build an antenna coupler, close-wind L4 (five turns of #22 plastic-insulated hookup wire) *over* L3, starting at L3's grounded end. L4's ground connection must be the end closer to the center of L3. If the transmitter doesn't load properly, increase the number of L4's turns—anywhere from two to eight more turns may be required. However, if you find you need as many as 12 turns, use a coupler.

P1 is both a pilot light and a tuning indicator so don't change its circuit connection or substitute a different bulb for the one specified. Since P1 is connected in the B+ circuit, make certain both its socket lugs are insulated from ground (some holders use the frame for a ground connection). When the wiring is completed, double-check for a short by measuring the resistance from both socket lugs to ground. The resistance should be several hundred thousand ohms. If you get a reading of only a few ohms, get rid of the short before you turn the power on.

Tune-up. Whether or not you use an antenna coupler, an antenna must be connected during tune-up.

An 80-meter crystal is used for both 80- and 40-meter operation. Plug in the crystal and set C6's plates to full-mesh. Turn on power and allow a minute or so for warmup. P1 lights when the key is closed. Hold the key down, and slowly open C6's plates until P1 dims, indicating plate current dip. The transmitter now is tuned for 80 meters. Continue to open C5's plates and P1 will light up again and then dim a second time. The second dip is C6's tuning for the 40-meter band. If P1 suddenly flashes as you tune C6, it means that C1 is not set correctly—don't worry about this now.

If you use an antenna coupler adjust its controls to increase P1's brilliance and then dip again with C6. Repeat this procedure several times to insure maximum transmitter loading. If you have an 0-100 ma. meter it can be used as a more precise tuning indicator. Plug it into jack J1 and it will key the transmitter and indicate V1's cathode current. Tuned but unloaded, the current should be about 33 ma. (with a B+ of 250V). Loaded, the current is nearly 40 ma.

Another way to tune up the Scrounger is to place a field strength meter near the antenna and then tune for maximum indication. C1 must be adjusted now for best keying. While monitoring the Scrounger's signal in your receiver, adjust C1 for a clean and sharp

[*Continued on page* 118]

KEYING MONITOR PARTS LIST

C1, C3—.25 mf, 15 V or higher, capacitor
C2—.005 mf, 15 V or higher capacitor
D1—1N34 or 1N54 diode
PL1—Phono plug
R1—22,000-ohm, ½-watt resistor
R2—27,000-ohm, ½-watt resistor
SPKR.—1½-inch, 10-ohm speaker (Lafayette SK-61)
T1—Universal output transformer, Lafayette TR-12 (do not substitute).
Misc.—2¼x2¼x4-inch Minibox, terminal strips, RG58/U coaxial cable

THE HAM SHACK

BY ROBERT HERTZBERG W2DJJ

TICKET REFORM . . . With agitation for changes in ham licensing requirements continuing unabated, we'd like to get in our own few watts worth. And what we'd like to suggest is eliminating an utterly mongrel classification — the Technician.

Look at it this way: if a man knows enough to pass the written part of the General test, he certainly has the ability to practice code a bit more and reach the 13-wpm level. Instead of stopping at the ridiculously low 5-wpm standard for the Novice, why shouldn't he go on to the 13-wpm required for the General? After all, the General offers everything the Technician and the Novice do, and more besides. No bones about it, the General is the one ticket to have—the sooner, the better.

Unfunny Fonetics . . . There's not much doubt that the home-brew phonetic alphabets favored by many phone operators are more confusing than clarifying. Matter of fact, using names of cities and countries to spell out words can add to the clamor. Let the QRM be bad, and the receiving op is likely to think he's hearing a station in one of these places.

The FCC already requires the International Morse Code for CW communications. Why shouldn't it likewise specify a single phonetic alphabet—any alphabet—for voice communications? Seems to us such a move would do much to clean up some of the downright silly stuff that can be heard nightly on the phone bands.

Freaky Frequency . . . The unpredictability of short-wave radio has fascinated listeners for more than half a century. We think it will continue to do so, and here's a for instance to prove our point.

Fishing around the 15-meter band for a solid hour, all we could hear was ignition noise from passing trucks. Just as we were about to switch to 20, HC5EJ in Ecuador roared in. He was working someone he called Naga and was asking about the latter's equipment.

Naga also pounded in and gave his call as JA2ACT maritime mobile. With the conversation entirely in English, it took us a while to realize that JA is the prefix for Japan. When HC5EJ faded out, we gave Naga one short call, and back he came, the single, solitary station on the entire band. He is a

[*Continued on page* 114]

OFFICIAL PHOTOGRAPH U.S. NAVY

The U.S. Naval Hospital in St. Albans, N.Y., now has a complete ham shack, courtesy of the Single Sideband Amateur Radio Association. Finding a few extra bucks in its treasury, the SSBARA put the cash to good use by giving the hospital a means of making phone patches between patients and their families. Photo shows Capt. Joseph L. Yon, commanding officer; Lt. Comdr. A. R. Petoletti, hospital PRO; and Harry Dannals, W2TUK, a director of the SSBARA.

DXing the GERMANYS

Still divided as an aftermath of World War II, Deutschland is both heartland and hotspot of a continent. What better fare could a DXer ask for?

By DON CARTER

WHAT WAS ONCE Nazi Germany has been the No. 1 point of East-West confrontation for years. And Germany today also is a pretty controversial topic in DX circles. Does it count as one country, two countries or three? The ARRL, presumably for simplicity's sake, recognizes only one Germany. Most SWL-DX clubs, in contrast, count East and West Germany as separate countries. And no one really seems to know what to do with that city within a country or countries—West Berlin.

For the moment, though, let's be generous. Let's count each of the Germanys as a separate DX country. And now that we have this little problem out of the way, let's see what each has to offer the avid DXer.

West Germany. By far the most easily heard station in all Germany is Deutsche Welle. Official voice of the West German government, DW is an important source of NATO news. Further, DW is an excellent prospect for every novice SWL to cut his teeth on.

As it happens, Deutsche Welle (which translates as Voice of Germany) has three English-language transmissions for North America. There's one at 1010-1050 EST on 11795 kc, another at 2035-2115 EST on 9640 kc and still a third at 2355-0035 EST on both 9575 and 9735 kc. Though all can be picked up throughout the States, the first and third are intended primarily for the West Coast (0710-0750 and 2055-2135 PST).

The Western zone also lays claim to the most important international station operating from Germany—Radio Free Europe. A private station which transmits with Washington's enthusiastic approval, RFE is one of the few Western outlets still extensively jammed in Europe. What's more, RFE often is subject to vicious attack by the various Communist satellite governments. Even bigger proof of its strength lies in the fact that the Soviet block has lodged formal diplomatic protests against RFE!

RFE can be logged on countless frequencies in the United States. One of the best is 11895 kc, where the station transmits Bulgarian before 1300 EST and Romanian after that hour. Some RFE transmissions also are carried by a relay in Portugal, however, so you never can be quite certain whether you have the real RFE or not.

For those DXers who want a somewhat bigger challenge, there is Radio Liberty. Also jammed heavily, this is an anti-Communist, Russian-language outlet operating out of Munich 24 hours a day. Though it transmits on many frequencies, 9660 kc probably is your best bet. Also in Munich is a Voice of America relay which can be heard more or less consistently on 11830 kc at 0900-1100 EST. And if you want to tackle something really difficult, shoot for the 49-meter regional SWBC relays. Both Suddeutscher Rundfunk at Stuttgart on 6030 kc and Radio Bremen on 6190 kc occasionally sneak through QRM before sunset or after midnight.

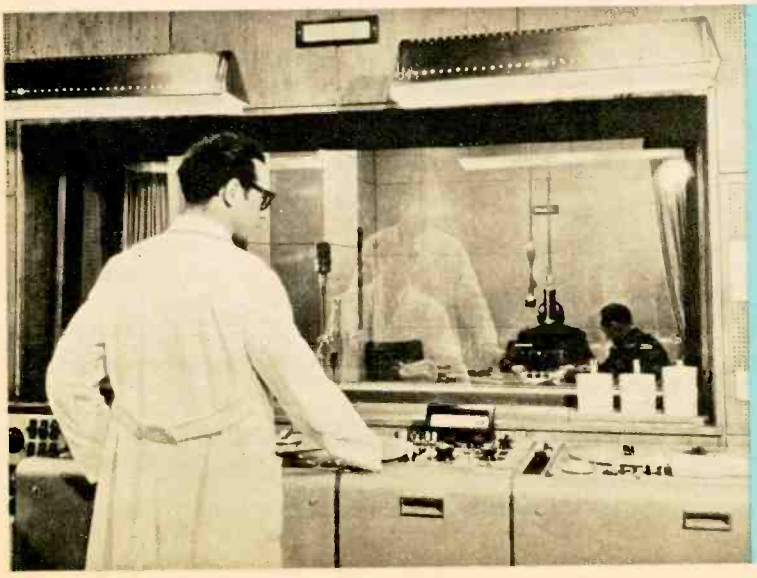
Those who prefer utility DX to the broadcast variety will be happy to learn that many West German international telephone transmitters frequently are received in the U.S. In Frankfurt, for example, there is DFS39 on 18390 kc, DFR59 on 17595 kc, DFP48 on 15483 kc and DFL40 on 11401.2 kc; while in Hamburg, DGK85 transmits on 10850 kc. Reports for all such stations simply can be addressed to Technician in Charge, Radio, Deutsche Bundesposte, at the appropriate location (whatever is announced on the test tape).

East Germany. On the other side of the Curtain, all broadcasting is under the Communist-directed Staatliches Rundfunkkomitee. In addition to its usual propaganda activities, the East German Republic has been known to place transmitters on many West German channels. Further, it even has been accused of providing facilities for various clandestine groups. While some of these tales do not stand up under careful scrutiny (R.Teje Iran on 11697 kc, for example, does not operate from East Germany), other such accounts may be true.

East Germany's official SW arm calls itself Radio Berlin International. RBI pretty well follows the Moscow line with a few special twists—a weekly program on How to Ease Tensions in Germany is one. Though there are transmissions for Eastern North America at 2000 and 2130 EST on 9560 kc and for the Pacific coast at 1945 and 2045 PST on 9730 kc, none of these penetrate QRM very well. However, you might try for the African beam at 1100 on 11795 kc (right after Deutsche Welle signs off). In addition, 15240 kc sometimes is heard at 0830 and 0930 EST when English is beamed to the Far East.

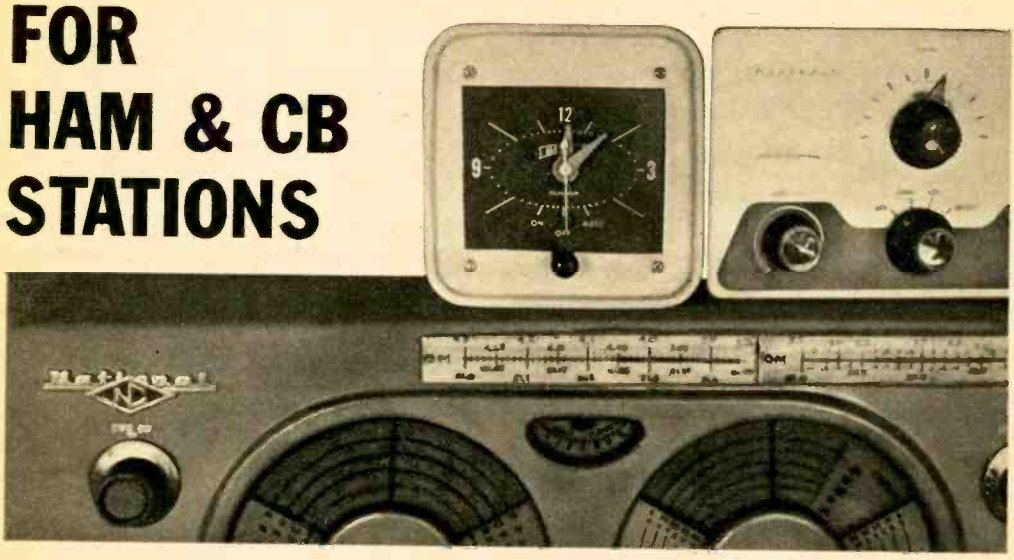
West Berlin. Biggest German DX challenge of all is Berlin—West Berlin, that is, since East Berlin rightfully must be considered an integral part of East Germany. This lonely bastion of democracy has only one SWBC station, RIAS (Radio In American Sector). Operated by the U.S. Information Agency but independent of our Voice of America, RIAS transmits on 6005 kc. And there's the rub: this is smack in Radio Americas territory and there's QRM not only from that Caribbean power but also from those Cuban jammers which accompany it. About the only time North American SWLs can try for RIAS is after R. Americas signs off around 0200 EST.

DXers also might try for the airlift gang—transmissions from aeronautical traffic going to and from the divided city. This can be heard at night on 4689.5 kc, an air-to-ground channel used throughout Europe. You'll naturally have to buck a little static now and then but the channel often is clear of QRM. About the only danger here stems from Latin American broadcasters who just can't seem to keep on frequency for some odd reason or other.



The German Democratic Republic, which is what the puppets across the Iron Curtain call their part of Germany, frequently jams programs from the West. Nonetheless, many stations, including this outlet in Cologne, do get through. And the story from most any camp in the East-West conflict can be yours if you DX the Germanys.

CLOCK CONTROL FOR HAM & CB STATIONS



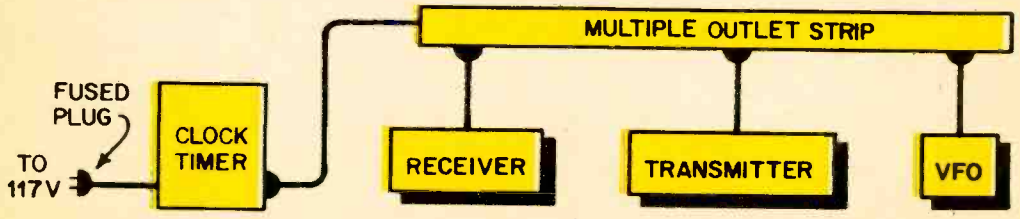
By MANFRED BLACK

EVERYWHERE you look these days the word automation is likely to pop up. There seems to be a machine that can do just about any job better and more reliably than people. There's another side to that story, but for a $5 bill and a few minutes of time, you hams and CBers can add automation to your station. Don't try to beat automation—join it.

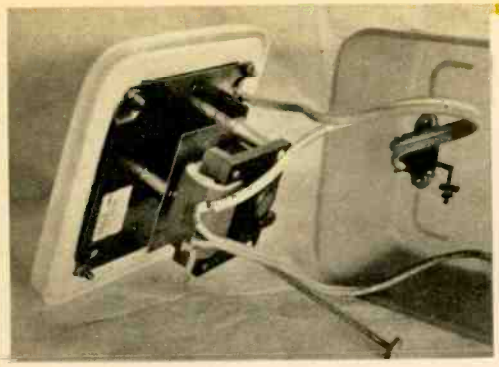
Here's what automation will do for you: 1) prevent unauthorized persons from operating your equipment; 2) warm up your transmitter, receiver, VFO or transceiver *before* you are ready to go on the air; 3) turn off all your equipment after you leave the station; 4) remind you when it's time for a net or some other special event, such as dinner, when you're busy working South Africa. And, to boot, you get accurate time because the heart of this automation program is a clock—a must for a well-equipped station.

The gadget that does the actual work is a switch controlled by the clock, which makes the clock into a clock timer. Clock timers can be purchased from several electronic parts distributors. Our table specifies different types, prices and features. All these clock timers have a built-in 15-amp switch that can be controlled manually or automatically at a preset time. All clock timers we list have a sweep-second hand and some have alarms. One has a 24-hour dial. On some, a sleep switch can be used to shut off your equipment automatically. All but one of the timers, the Olson X-931, come with knobs and a bezel (front-panel protective frame).

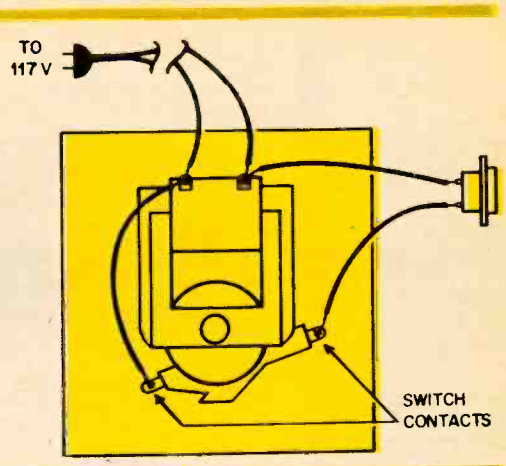
An attractive and inexpensive housing for the clock timer is a plastic food-freezer container. It is made of polyethylene, is unbreakable and is available at supermarkets in



Ham-station installation. Fuses in plug should not be larger than current rating of clock-timer switch.



Rear view of clock timer shows the connections from the switch contacts to the accessory outlet.



several shapes and sizes for about 35¢. Select one large enough for the clock timer you're using. Remove the lid and with a sharp knife cut out a section in the lid large enough for the face of the clock.

Mount an AC chassis receptacle near the rear of the box at one side. Cut a hole in the rear and pull a heavy-duty AC line cord through it. Solder jumper wires (#14 or larger) from the AC outlet to one side of the clock motor and to one of the switch's lugs as shown in the diagram and photo. Then connect another wire from the other lug on the clock motor to the other switch lug. Put the lid on the container and you're in business —almost.

Plug the timer's line cord in a 117-VAC outlet fused for at least 15 amps. The clock should start running regardless of knob positions. Plug one of the multiple outlets we list in the table into the AC receptacle, then plug your equipment in the outlet strip.

When the clock control knob is in the *off* position all the equipment will be off. To turn on the equipment, turn the control knob to *on*. This manually closes the clock-timer's switch. Since all equipment is plugged into the multiple outlet, only someone who knows where that little knob is and what it does will be able to get your gear fired up.

The control knob offers another bonus. It can be used to turn all your equipment off just in case you may have forgotten that one lonesome unit. No more unintentional overnight cooking of equipment.

To prewarm your equipment, set the alarm time and turn the clock-control knob to *auto*. Turn on the equipment you want to drift-stabilize, such as the VFO or receiver. When the preset time arrives, the clock switch will close and the equipment will be readied for you while you're driving home from work or having dinner. Be sure, of course, that all equipment and the main AC line are fused. A fused plug at the end of the clock-timer line cord takes care of this easily.

Some clock timers have a built-in buzzer which can be made to sound at the alarm time by setting another control knob. This feature can be used to remind you that dinner's on if you get too involved at the workbench or in a rag chew.

A 15-amp clock switch will handle 1,650 watts and that's a lot of equipment, unless your transmitter's a really high-power job. Loads that exceed the rating of the clock switch contacts can be controlled by using the clock to energize a separate relay with heavy-duty contacts.

CLOCK TIMERS AND MULTIPLE OUTLETS

Distributor	Stock No.	Price	Features
Olson Electronics	X-931	$2.99	Sleep switch, no alarm
Lafayette Radio	MS-918	4.39	24-hr. dial, no alarm
Lafayette Radio	MS-793	3.95	No alarm
Lafayette Radio	MS-794	5.40	Sleep switch, alarm
Allied Radio	78 B 438	5.98	Sleep switch, alarm
Allied Radio	78 B 499	6.94	Sleep switch, alarm
Radio Shack	61T2503	1.69	8-outlet strip
Lafayette Radio	EL-89	.39	4-way outlet
Lafayette Radio	EL-72	.53	4-outlet Perma-Plug
Lafayette Radio	EL-10	1.47	12-inch-long outlet strip
Lafayette Radio	EL-67	2.29	4-foot-long strip, 3 outlets
Allied Radio	50 N 949	6.25	6 outlets, fused, pilot light

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MICROELECTRONICS —Medium-size ant dwarfs integrated semi-conductor circuit (black square) containing 8 transistors, 12 resistors. Greatly enlarged photo is shown actual size below.

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This photo shows a circuit produced by space age manufacturing techniques. Automation eliminates the many man-hours needed to build conventional circuitry. Each day new developments are out-dating men who can't measure up to more demanding employment requirements.

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BIRDBRAIN LICENSING

UNIVAC IN CHARGE . . . As its flipflops skittered to a halt, the big computer made its choice. David W. Berry of Caratunk, Maine became the first electronically licensed CBer. Part of a new license-processing system procured by the FCC for some $1 million, UNIVAC awarded Berry a call sign that is computer-like in layout. The historic license: KKA-0001. Subsequent call letters spewed out by the machine may not be as exotic, but they'll reach CBers in a matter of days, not months.

Will the birdbrains eventually take over at the FCC? Not likely, though this computer's first act does have a tantalizing twist. Through some uncanny sixth sense, UNIVAC apparently knew Berry needed a new means of communication. Berry, you see, doesn't have a telephone.

Tallow Tip . . . No matter what goes wrong with a CB transceiver, it's rare that coils or transformers go out of alignment. But frequent tuning adjustments, especially on kit-built rigs, can cause iron cores to lose their snug fit. The result is a common malady—sloppy slugs. Car vibration, rough handling and other jigging and jogging detune slop-happy slugs, and performance suffers.

Add a little wax, and loose tuning slugs freeze in position. See text for tips on how it's done.

Both cure and prevention are one in this case. And it's all done with a candle. Light it, then let melted wax drip into the open end of the coil, as shown in our photo. Moments later the slug is locked in place, though it's an easy matter to free it for future adjustment. Better yet, wax won't upset the circuit's electrical characteristics one iota.

Two For One . . . CB radio had a 23-channel band. Want to try for 46? That's just what Mark Products does with its new Sidewinder rig. First commercial single-sideband transceiver to hit the CB market, the SSB-27 is full of surprises. Topping the list is the hefty signal pounded out by the transmitter. With SSB techniques, it has many times the effective power of a conventional rig. Reason: all talk power is squeezed into one sideband, while RF carrier and other sideband are squelched deep inside.

An intriguing idea introduced by the new set is split-channel operation. Hopefully, the company predicts more frequencies, less congestion and, in fact, two channels where one existed before. Is this possible? Can someone be pulling our mike cord?

No flannel-mouthed claim, splitting channels is everyday practice with other radio services. Taxis, police and hams, for example, began it years ago as more stations crowded on their bands. The two-for-one split works for CB, too, thanks to a happy marriage between FCC rules and sideband's technical sophistry.

Sing into the mike of a normal CB rig, and the signal on the air spreads out. If you've got guts and can hit a really high note, the transmitted signal may widen 2 or 3 kilocycles, depending on the tone you wail. But

[*Continued on page* 118]

By JOHN MILDER

AS OUR STORY opens, minds spin, clocks grind and buzzers are all set to sound. Where are we? At a quiz show, no less. One of the contestants is up and the quizmaster has asked him to define high fidelity.

"Uh," he finally stammers, "high fidelity means sound that's pure and undoctored . . . sound that's as close to the real thing as electronics can make it."

The quizmaster nods approval. Our friend beams.

But is he right? Is hi-fi sound a pure and undoctored replica of the real thing? Not quite, you say. And you're right. The hanky-panky, hocus-pocus and general sound doctoring that goes on behind the scene well might be called the greatest scandal in hi-fi.

Commonest old wives' tale in the whole hi-fi business has to do with frequency response. And this same clinker also enters into much of the hanky-panky game in one way or other. The human ear, the story goes, can hear frequencies from something like 20 cps to 20,000 cps.

This being the case, the response of every component from cartridge to speaker ideally should be flat as a pool table all the way from 20 to 20,000 cps. Stretch this response clear across the entire range (as the little characters in Fig. 1 are doing), and you've captured sound-in-the-raw, some would tell us.

But they wouldn't be quite right, either. For one thing, human ears as a rule can't hear sounds as low as 20 cps or as high as 20,000 cps, even if they try. What's more, the human ear exhibits flat response only at extremely high volume levels.

As the little chart in Fig. 2 suggests, a man listening to a hi-fi set at low volume will hear mid-frequencies at around 3,000 cps as nicely as you please. But he'll hear no low or high notes at all unless there's some deliberate hanky-panky performed.

This kind of trickery is so innocent most people never look at it in quite this light, but hanky-panky it is. It ordinarily takes the form of bass and treble controls. Sometimes it's achieved with loudness controls, a special kind of volume control that boosts both

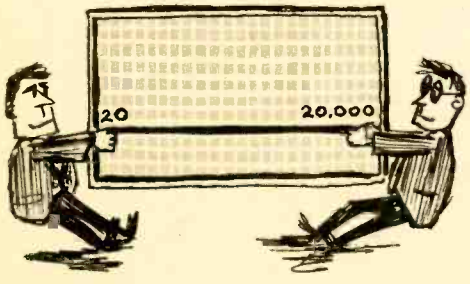


Fig. 1—Absolutely flat response, the sacred cow of hi-fi, is far more theoretical than practical.

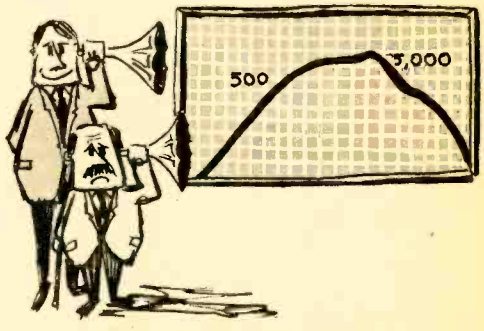


Fig. 2—Ear responds best to mid-frequencies. The louder the sound, the flatter is its response.

low and high frequencies and gives you a sort of upside-down version of the curve in Fig. 2. But regardless of how it's done, both low and high frequencies are made much louder than before and, therefore, are audible to the ear. But they wouldn't have been if some hanky-panky hadn't saved the day.

Other tricks of the hi-fi trade are a trifle more complicated, but they add up to hanky-panky just the same. First bit of hanky-panky we encounter is at a recording studio where master tapes are made. One might suspect that a recording session is a matter of finding

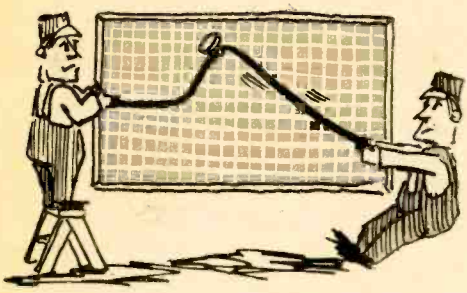


Fig. 3—High frequencies must be boosted when recording on tape to make up for losses involved.

the right microphone positions, adjusting a few controls and letting 'er rip. But it isn't nearly that simple.

Problem is that the recording medium—in this case magnetic tape operating at 15 or maybe 30 ips—won't do well with one of those flat-as-a-pancake, 20-to-20,000-cps signals we were talking about. Feed an undoctored signal into a recording head and the high frequencies disappear quicker than cheese at a mouse christening. What's more, untricked playback of that tape yields sound with no low frequencies.

The solution involves some heavy tinkering with the signal that goes into a recorder and also with the one that comes out. In the U.S., most tape-recorder manufacturers follow recommendations of the National Association of Broadcasters in the kind of tinkering they do. Since most of the high-frequency boost takes place during recording, that flat, 20-to-20,000-cps curve we've been mentioning is distorted to look something like the curve in Fig. 3. And jacking up the low frequencies in playback twists that flat curve into something like the curve in Fig. 4.

Though the actual shapes of the curves

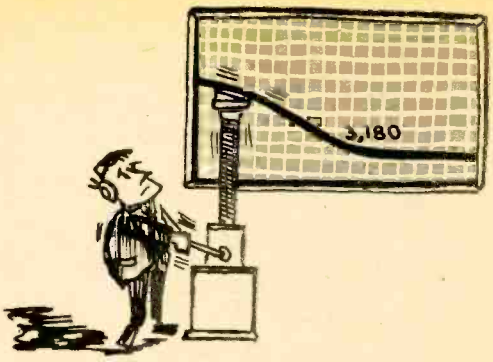


Fig. 4—Getting low frequencies from tapes calls for substantial jacking and boosting on playback.

differ for all but two of the various recording speeds, the aim always is the same. The hanky-panky here simply is an attempt to bend the signal in and out of shape just enough (and in just the right places) to come up with a final curve that looks like the one in Fig. 1. Obviously, the signal that ultimately comes from a master tape might look flatter and sound better if it didn't have to be tricked and twisted in and out of shape, but there's no way to avoid this kind of hanky-panky. It's just something that tape demands.

Once the results of a recording session are safely on tape, the next step usually is to cut a master disc for making LPs. Here, too, the engineers at the controls tamper with the signals, but for different reasons. Unlike tape, a disc gives back pretty much what goes on it in the first place.

Thing is, if the low frequencies were recorded in the same form in which they're shown in Fig. 1—flat all the way to 20 cps—they'd take up so much room on the record

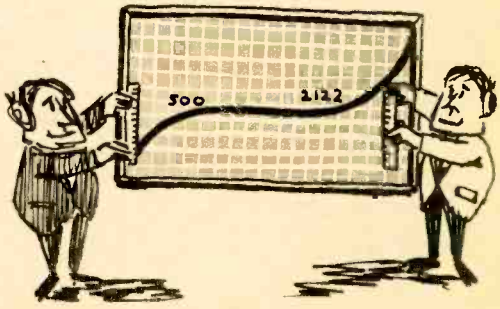


Fig. 5—Low frequencies are cranked down, high frequencies cranked up when cutting an LP record.

you couldn't call it an LP anymore. Further, no cartridge in existence could follow that kind of giant waddle, nor could any record cutter chisel it out to begin with.

The solution is to put less and less sound on the record as you go lower and lower in frequency. Figure 5 shows you the form this kind of hanky-panky takes, and it also reveals something else of interest. Not only are the low frequencies much weaker than they were in Fig. 1; the high frequencies have been made louder at the same time the low frequencies were being toned down.

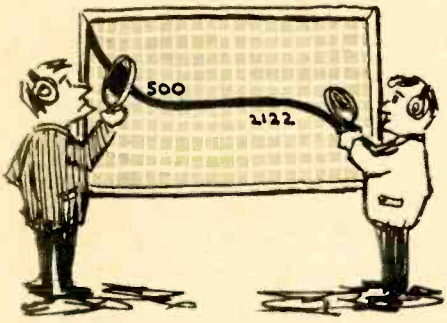


Fig. 6—Pushing down high frequencies when playing records also almost squashes needle scratch.

Boosting the highs in recording means that these same frequencies must be trimmed down in playback. Trimmed down they are, and with them goes much of the needle scratch you'd hear if they weren't. (As shown in Fig. 6, the low frequencies are boosted simultaneously.) In short, hanky-panky as applied to the hi-fi record not only makes that record possible; it also removes most of the scratch and hiss that otherwise would make that record all but unlistenable.

Whether you prefer tapes or records, chances are you often hear your hi-fi indirectly via the signals from radio stations. If they're FM stations, there's some hanky-panky involved there, too, and of a type similar to that used with LP records.

On first thought, one might imagine that FM stations broadcasting records or tapes would do nothing more than correct for the hanky-panky deliberately tossed into both media. This they do, of course, but they also do a little extra twisting that makes a whale of a difference in the way their programs sound.

Though FM beats AM on many counts,

Fig. 7—FM stations transmit wide-band signals, containing far more high than low frequencies.

FM long has relied on some rather simple hanky-panky to make it sound even better. Listen to an AM station over your hi-fi set and you'll hear lots of noise and static right along with a pretty lo-fi signal. Because there's more space in the FM band, FM stations aren't limited to lo-fi signals and can spread themselves out to cover pretty much the full hi-fi range. But they also deliberately jack up the high frequencies before they ever

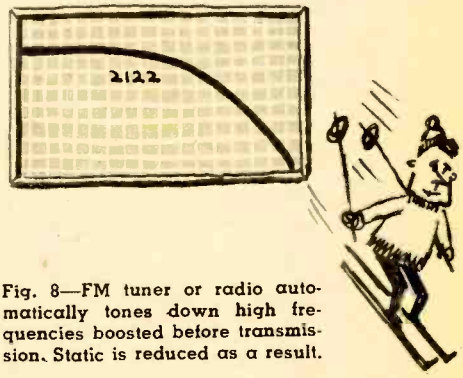


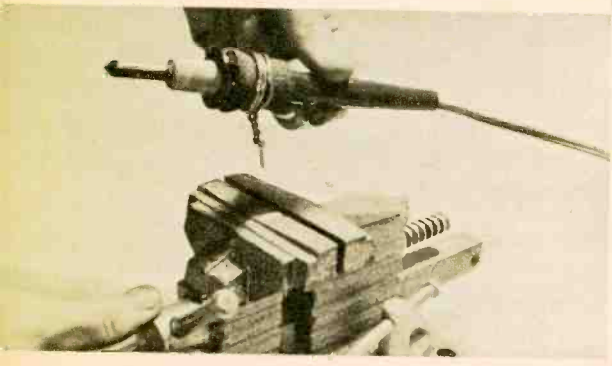
Fig. 8—FM tuner or radio automatically tones down high frequencies boosted before transmission. Static is reduced as a result.

reach the airwaves, in much the same manner that recording companies boost the high frequencies on their records (see Fig. 7).

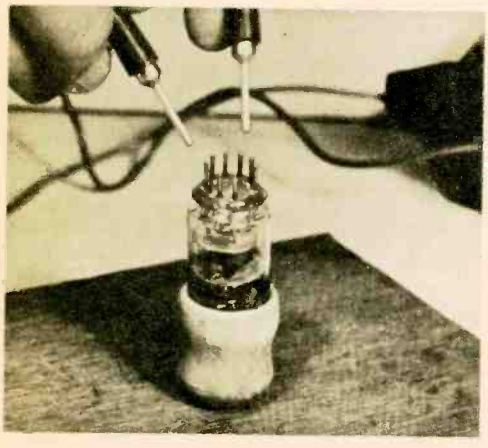
The reasons also are much the same with FM as with LPs. Let your FM tuner or FM radio trim these high frequencies down to size (as shown in Fig. 8), and the overall result is a flat curve much like that shown in Fig. 1. But pruning these high frequencies also dumps most of the noise and static right down the drain. Result is that FM programs come through rich and full, with little or none of the noise and garble that plagues AM.

Try These

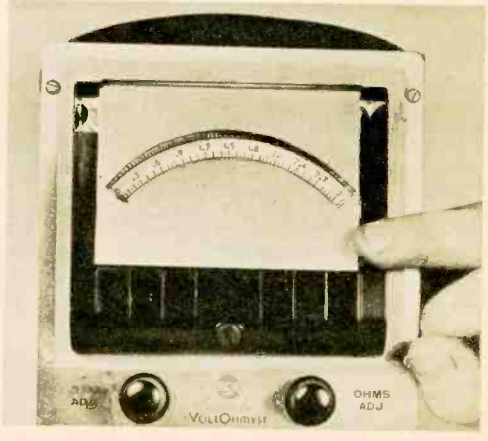
A permanent or temporary shield for a radio or TV tube can be improvised quickly from an aluminum film can. Insert a close-fitting dowel in the can and punch holes in the sides for cooling. For greater heat dissipation, paint the can's inside and outside black. Attach a wire to the can and connect the wire to the chassis.



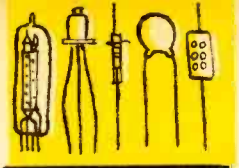
A quick third hand for difficult soldering jobs can be made by twisting a few turns of heavy wire around your iron's handle. Put the wire in a bench vise and you're all set. Your hands are now free to hold the objects to be soldered. Rather than hold the solder between your teeth, tin each lead first and then put a drop or two of solder on the tip of the iron.



Try to check a miniature tube's filament continuity with a test lead in each hand and you'll realize quickly that it takes a bit of juggling. A quick jig to hold the tube can be made by screwing a rubber furniture-leg tip to a block of wood. Push the tube in upside down and you've got it. Different size tips can be fastened to the block for other size miniature tubes.



The many scales on a VOM or a VTVM sometimes can be confusing and also can cause a lot of lost time and possibly incorrect readings. If you use one particular scale more than others, it is a good idea to make a set of masks out of thin cardboard. The masks can be fastened to the meter and removed easily if you use Scotch tape. Glue an envelope to the meter to hold the masks.

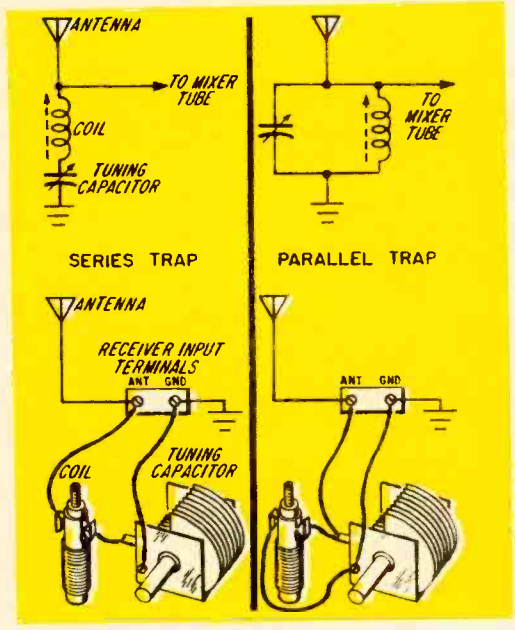


BEGINNERS PAGE

The WONDERFUL WAVE TRAP

WHAT'S a wave trap? A coil and capacitor hooked in series or parallel and connected to a radio's antenna terminal. What does it do? It gets rid of interference near the station you want to listen to.

Take a look at a schematic of the tuning section of a radio (top diagram at the right). This is called a parallel-resonant circuit, or parallel wave trap, depending on where it's used. Let's assume you've tuned the radio to 700 kc. All frequencies *above* 700 kc find an easy path to ground through the variable capacitor. Frequencies *below* 700 kc find an easy path to ground through the coil. But at 700 kc the reactances of both the coil *and* capacitor are equal and opposite to each other. In a parallel-resonant circuit they cancel each other out and the net impedance between antenna and ground is high. This lets the 700 kc signal get right through to the mixer tube in the radio. Put a parallel trap from your antenna terminal to ground and it will help the radio's tuning section reject signals on *both* sides of the one you want to hear.



The circuit at the top, left, is called a series trap. It works the opposite way. To signals *above* the frequency to which the circuit is tuned the coil looks like a high impedance and the capacitor looks like a low impedance. To frequencies *below* which the circuit is tuned the coil looks like a low impedance and the capacitor appears as a high impedance. Since coil and capacitor are in series between antenna and ground, their combined impedance to ground is high at other than the resonant frequency. At the resonant frequency, the reactances of the coil and capacitor are opposite to each other, but since this is a series-resonant circuit their *combined* impedance to ground is *low*. Result is that the signal at the resonant frequency sees an easy path to ground and does not get to the radio.

The parallel trap rejects signals on both sides of the one you want to hear. The series trap reduces the strength of an interfering signal any distance from the one you're tuning.

For broadcast and short-wave receivers (up to 3 mc) you can make a wave trap with a broadcast-type tuning capacitor (maximum capacity about 360 mmf) and a tunable loopstick antenna. A wave trap is not recommended for table radio's with a loop antenna and no antenna terminals. The trap you need depends on your antenna. To find out which is best, tune in a station surrounded by a lot of interference and just try each type for highest rejection.

Turn the slug of the loopstick until it's almost entirely out of the coil, then tune the capacitor for best rejection. Higher-frequency traps for short-wave receivers require a smaller coil. You'll find them listed in electronic parts catalogs; they're described in terms of their frequency ranges.

—*H. B. Morris*

KIT EI REPORT

Stereo FM Receiver

EICO 2536

AT TIMES it makes good sense to buy a complete FM receiver (stereo tuner and amplifier on one chassis) rather than separate components. For one thing, a receiver usually costs less. It also takes up less space and simplifies installation.

Obviously, receivers make sense to a lot of hi-fi fans because a great number of them are now being sold (one report put the figure at more than 50 per cent of the total market).

THE 2536 AT A GLANCE

TUNER (bottom plate off)		Unaligned	Aligned
IHF usable sensitivity	(106 mc)	3.5 μv	2.9 μv
	(90 mc)	2.8 μv	2.8 μv
Total harmonic distortion (mono)		2.25%	1.5%
Total harmonic distortion (stereo, left or right channel)		6%	1.25%
Signal-to-noise ratio (mono)		57db	57db
Frequency response		+1db, 50 cps to 15 kc	
Stereo separation	50 cps	9db	9.5db
	400 cps	18db	27db
	2400 cps	30db	35db
	10,000 cps	9db	9db
Residual 19 kc and 38 kc multiplex components		—34db	—34db

AMPLIFIERS	
Maximum sine-wave power output per channel for 1% total harmonic distortion (both channels working)	16 watts
IM distortion at 16 watts	2%
Frequency response (1-watt power level)	+1db, 20 cps to 35 kc
Construction time	19 hours

If it's approval you want, nearly all hi-fi addicts agree that receivers still represent component equipment and don't indicate a sell-out to the console crowd.

The EICO 2536 receiver is a good example of a complete stereo FM instrument. Its size is approximately 6x16x14 inches and its weight is 25 pounds. The brushed aluminum front panel gives it a handsome appearance. For $154.95 it will give you good stereo sound from all program sources. Assembled, it runs $209.95. The cabinet is extra in either case, metal costing $7.50, wood $19.95.

These are some of the 2536's features: both channels can deliver up to 16 watts of sine-wave power simultaneously. There are separate bass and treble controls for each channel, a dual volume control, a blend control and a balance control. Hold down a spring-loaded front-panel switch and the bar-type tuning eye becomes a stereo indicator. There are inputs for a tape recorder (preamp output), magnetic cartridge and auxiliary program sources such as a TV set or an AM tuner. And there's an output for a tape recorder (unaffected by the volume and tone controls). Speaker outputs are 8 and 16 ohms. Missing are rumble and scratch filters, a loudness control and AC power outlets. A tape monitor switch allows you to monitor while recording on tape through the recorder's playback head.

The 2536 has 20 tubes but don't assume this means construction will be a never-ending job. The front-end and IF strip are supplied assembled and aligned. The stereo adaptor is put together on a printed-circuit board by the builder. The coils are supplied prealigned. All sockets and terminal strips come installed on the main chassis.

The construction manual that came with our kit had a number of errors in it, especially regarding lead lengths. However, having built several kits before, we normally add an inch or two to lead lengths just to be on the safe side. This precaution, as we found later on, saved us a lot of headaches. And whenever a construction step seemed ambiguous we cross-checked with the schematic; this helped, too.

Rear view of 2536. Front-end is at extreme left, multiplex adaptor is at right of it. Preamp tubes have been removed from sockets, IF strip is below them. A metal cover fits over the control panel.

Upon completing the kit we advised EICO of our difficulties and were sent addenda sheets that corrected all the errors we found, a few we hadn't found and included a new dial-stringing and setting procedure. If these addenda sheets are not included in the construction manual in your kit, write to EICO for a set before you start.

Construction is divided roughly into three major steps: front-panel assembly and wiring, mounting of parts on the multiplex-adaptor board and main-chassis wiring. There is lots of space everywhere so you won't have trouble getting all the parts installed. In addition to the manual of construction steps, there is a separate book of large pictorials for each group of steps. The pictorials are clear, easy to follow and there's no need to turn pages back and forth. All parts are packed in bags, which are identified with numbers corresponding to the construction step in which they're used—a real convenience.

Be very careful when wiring the front panel. If a wiring error turns up after the panel has been mounted on the main chassis (and wires and components have been connected in the main chassis) it will be extremely difficult to get into several tight corners to correct things. We completed the 2536 in about 19 hours, but it could take a bit longer. When we turned on power, it worked to our satisfaction and we concluded everything was in order.

There is no home-alignment procedure other than instructions for adjusting the slug of the first IF transformer in the front-end, as well as the hum-balance pots.

Our 2536 was checked out before and after instrument alignment. As you can see from the performance figures in the table, instrument alignment does improve performance, especially distortion.

All the measurements were made with the bottom plate off. We found that when the bottom plate was on sensitivity deteriorated by about 1.5 microvolts and the ratio detector became unbalanced. The difference between EICO's figures and those we obtained after alignment led us to conclude that prealignment of the front-end and IF strip was accurate but did not take into consideration the detuning effect of the bottom plate. Since there were no holes in the bottom plate under the IF, ratio-detector and multiplex-adaptor transformers, we did not align the unit with the bottom plate on. We urge you to put the 2536 up on blocks (for ventilation) and leave the bottom plate off.

We found that the total harmonic distortion of the tuner in the mono FM mode (2.25 per cent unaligned, 1.5 per cent aligned) was higher than EICO's claimed 0.6 per cent. Disconnecting the multiplex adaptor from the tuner section cured this. We then set about determining the cause and found that when the mode switch is in the mono FM position, B+ is removed from the multiplex adaptor (the multiplex-adaptor's tube heaters remain on).

[*Continued on page* 118]

There's a lot of hardware under the chassis but no crowding. Power amplifiers are at the left side, IF strip is in center (vertical), multiplex adaptor is below it. Preamps are at the right, top.

Notes from EI's DX CLUB

WITH this issue, EI's DX Club begins a new department for our SWL and ham readers, offering bits of news, comment, tips & trivia.

Now you can believe it, Virginia. There *are* hams on Swan Island, despite reports to the contrary circulated by R. Americas. And DX Clubber Robert Jacobson, K9ULF, of Chicago has proven it with a red-hot QSL from W3ZQ/KS4. Considering the controversy surrounding this dot on the Caribbean seascape, Bob's card is a top DX trophy.

Bill Wilson of Ottawa, Ont., wants to know whether QSLs used to acquire a Special award from EI's DX Club can be used again later as part of the count toward a General 50 or General 100 award. Answer is yes, but applications must be made separately.

Do Formosa and Red China each count as one country?, asks member D. Dawson of Penny, B.C. Again, the answer is yes. No politics is involved. Just hard facts. We also count N. and S. Korea, N. and S. Vietnam, E. and W. Germany and—if anyone wants to try for it—W. Berlin as separate countries.

R. Tirana is using a new offband channel, 9390 kc, where English can be heard at 1500 and 1630 EST. Rumors say Peking is building a relay base here, and the rumors just might be true.

V. of America at Munich has put a 100-kw short-wave transmitter at the disposal of W. Berlin's RIAS. It operates continuously on 6005 kc and supposedly is synchronized with RIAS' own W. Berlin SW transmitter on the same frequency.

The R. Santa Maria signal we picked up on 120 meters turns out to be a BCB harmonic. Signal has drifted upward some 20 kc since it was first heard and now appears on 2400 kc . . . R. San Pedro has switched to 3212 kc in 90-meter territory but probably won't stay there, either. After all, powerful R. Santo Domingo holds down 3210 kc.

Recent entry on the SW bands is the tiny protectorate of Brunei, which once was slated to become part of Malaysia. Independent R. Brunei first was reported by two Club members out California way, H. L. Chadbourne and William Sparks. Station is heard on 4865 kc until 0930 sign-off. It QSLs promptly and is an excellent bet for West Coast SWLs.

R. Angola is being logged widely on two 40-meter channels at 0600 sign-on. Frequencies are 6025 and 6195 kc. The latter, incidentally, presumably is a new transmitter. It's been doing some frequency hopping and may move again.

We've had reports that there's a station in Yemen broadcasting to Egyptian troops on 6740 kc. Anybody heard it? . . . The Windward Island BC again is toying with 120 meters. Frequency is 2460 kc, but QSL policies seem to depend on the way the chief engineer feels at the moment.

According to European reports, AVROS in Surinam has turned in its license. If true, this country no longer is in the SWBC business. A telephone station now is heard on AVROS' former 19-meter channel (approximately 15460 kc).

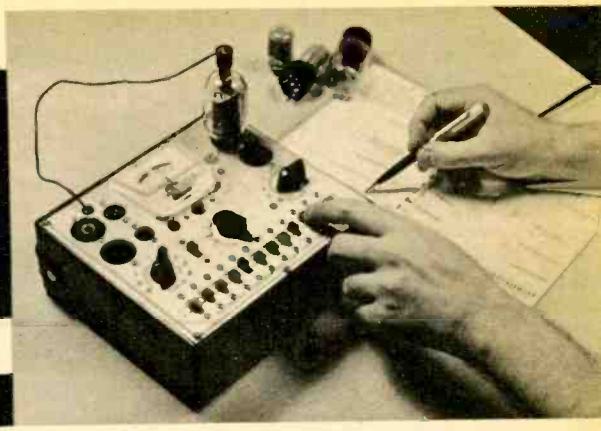
Just to keep things interesting in S. America, there is a two-headed Colombian on 4870 kc. Before midnight, the station relays R. Villavicento; later, it switches over and relays La Voz de Rio Cauca (HJED) at Cali.

Senegal's new transmitter at Dakar suddenly is the hottest medium-wave prospect from Africa in recent DX annals. When conditions are right it can be received on 764 kc just prior to 1900 sign-off and at 0100 sign-on.

KIT EI REPORT

Low-Cost Tube Tester

EMC 213



WHEN do you need to have your own tube tester? In the case of low-cost models, the point where it pays to have a tester at home comes up rather quickly—if you figure your time is worth anything at all.

If something conks out and you happen to have a tester you naturally don't have to pull out all the tubes and haul them down to the drug store or a service shop to find out which ones are bad.

One of the most basic and low-in-cost testers is EMC's Model 213, which runs $18.90 as a kit. It has a plastic case and measures 8⅜ inches wide by 7⅜ deep by about 3½ inches high.

The 213 is relatively easy to wire. The unit we received happened to be short two SPDT switches and some hardware but EMC sent along the needed components with no questions. The wiring instructions are broken down into exactly 112 steps on five mimeographed pages and there are nine easily-read pictorials. It took our builder seven and a half hours to get the tester together.

The wiring around the 14 slide switches and two rotaries is uncomplicated, though it does get a bit dense on some of the tube sockets. Our best suggestion here is for the builder to square off his leads and try to keep them neat to minimize confusion. Much of the wiring is from a lug on one socket to the lug with the same number on another socket. Color-coded wire is provided but there are no instructions as to how to use the coding. Best procedure is to use the same color for connection of lugs with the same number.

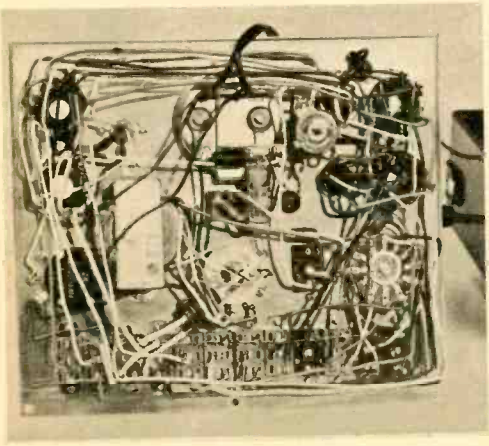
The instructions are quite clear and logical, with one exception. Step No. 46 refers to a red wire from the transformer when the lead actually is orange.

Nearly all entertainment-type tubes can be checked with the 213. It has seven sockets: loctal, octal, 10-pin, 7-pin, Nuvistor, compactron and novar (9-pin).

The 213 is a basic, emission-type tester which tells you in general whether a tube is good or bad. Besides cathode emission, it checks for shorts, leakage between elements and open or intermittent elements.

Since the power transformer is fairly small, we wondered how well it would do with high-current tubes. With the 5U4's 3-amp heater, we found that the voltage dropped to 3.4 volts —still sufficient for you to make a reliable check of its condition.

Summing up, the 213 is modest in cost and construction time and can be a handy instrument; saving you both time and money.



Wiring on underside of top panel is dense around some tube sockets (top); switches are at bottom.

The Dangerous VOM

A gentle lamb to you may be a flame-thrower to diodes and transistors.

By FRED J. WHITEMAN

MOST people think of the VOM as a harmless test instrument capable of checking dozens of things and having nothing more powerful in it than a 1.5-volt battery. So it's surprising to learn that a VOM can turn into a roaring lion if you put the wrong thing in its cage. A diode or transistor, for instance. Use the VOM's ohmmeter ranges to check a semiconductor and you're likely to have fireworks.

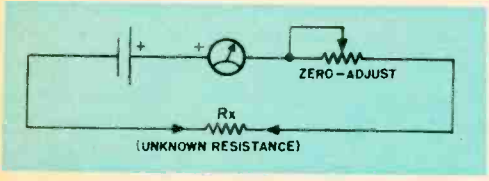


Fig. 1—Series-type ohmmeter circuit is used on high-resistance ranges in many VOM's. Maximum current when probes are shorted is limited by meter resistance and may be no more than 1 ma.

We're going to show you how to determine the current your VOM will put through a semiconductor and which ohmmeter ranges are risky or safe to use for testing them.

The simplest way to measure resistance is with the circuit in Fig. 1. The meter really measures current, but its scale is calibrated in ohms to save you the trouble of performing the simple Ohm's Law calculation $R = E/I$. Trouble with this circuit is that it isn't accurate when the resistance you're measuring is extremely low compared to the meter's resistance. Reason is, the meter's resistance becomes a major part of the circuit. However, this circuit is used on the high-resistance ranges in many VOM's. The current flow when the probes are shorted could be from 50 microamperes to 1 ma, depending on the meter movement. You can't

Fig. 2—Mid-scale resistance of this VOM's ohmmeter scale is 100 ohms. If battery is 1.5 V, when range switch is at R×1 current through shorted probes is 1.5 V divided by 100 ohms, or 15 ma.

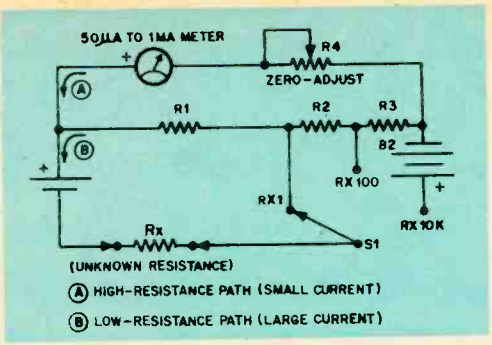


Fig. 3—Low-range ohmmeter circuit. Set S1 to R×1, short probes and meter measures voltage across R1. When R1 equals Rx, voltage across R1 is halved and meter needle deflects half scale.

hurt anything with this current.

It's a VOM's low-resistance ranges that cause trouble. Fig. 3 shows the typical circuit of many VOM's when they used to measure low resistance. Here's how it works. When range switch S1 is set to R×1, the battery at the left causes current to flow through R1 and Rx, the resistor you don't know the value of. Notice that the meter actually is measuring the voltage across R1. When the test probes are shorted together (measuring the forward resistance of a diode or the emitter-base junction of a transistor

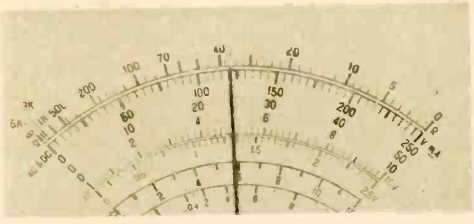


Fig. 4—Mid-scale resistance of this VOM's ohmmeter scale is 35 ohms. If battery is 1.5 volts, when range switch is at R×10 current through shorted probes is 1.5/350, which is about 4.3 ma.

amounts to about the same thing) the meter deflects full scale since the entire battery voltage appears across R1. The current through the probes is simply the battery voltage divided by the resistance of R1.

But how do you find the value of R1 without tearing the meter apart? Simple. When the VOM's range switch is in the R×1 position, R1 is the resistance that's printed smack in the middle of the VOM's ohms scale! (In the meter in Fig. 2 it is 100 ohms, but it could be some other value as you can see in Figs. 4 and 6.)

Doubt us? Okay, let's assume that R1 *is* 100 ohms. Suppose we connect a 100-ohm resistor where we show Rx. This means that the total resistance in series with the battery is 100 ohms (Rx) plus R1, or 200 ohms. Now the current through R1 will be exactly half what it was when the probes were shorted. And the voltage drop across R1 also will be precisely half of what it was when the probes were shorted. Since the meter is meas-

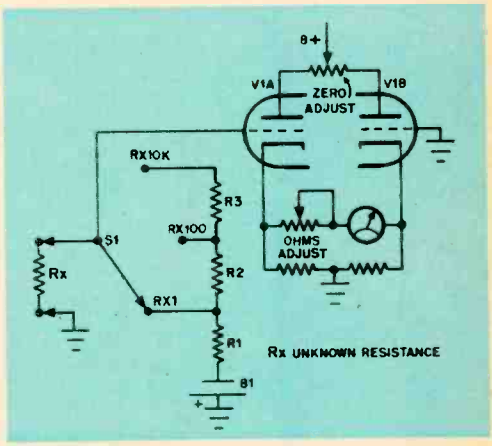


Fig. 5—Ohmmeter circuit of VTVM. When S1 is at R×1 range, current through shorted probes is B1's voltage divded by resistance of R1. When Rx equals R1, half B1's voltage is applied to V1A.

uring the voltage across R1, its needle now goes only halfway up the scale—and that is right under 100 ohms where we said it would be. If the range switch is set to R×10, multiply the center-scale resistance by 10.

Therefore to find the current through the shorted probes, divide the VOM's battery

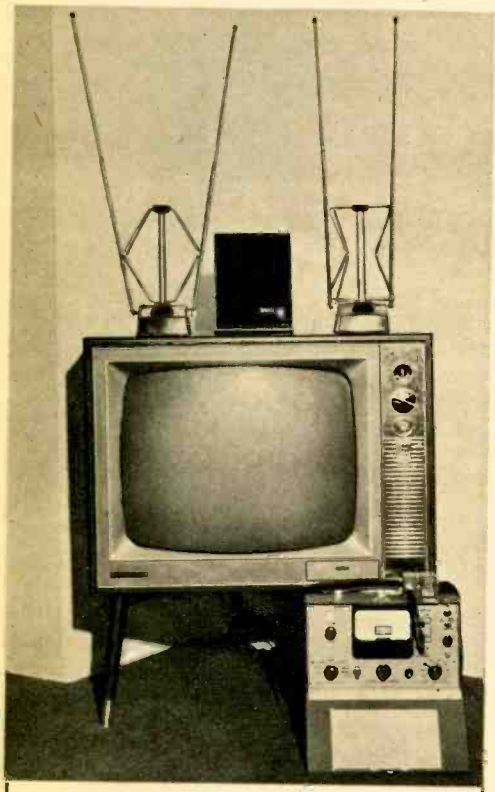
[*Continued on page* 117]

Fig. 6—Mid-scale resistance of VTVM ohmmeter scale is 10 ohms. Since battery is 1.5 volts, when range switch is at R×1 position current through the shorted test probes will be 1.5/10, or 150 ma.

How Good Are The New INDOOR TV ANTENNAS?

EI reports on the Gallo Twin-T and Channel Master Apollo

By HERB FRIEDMAN, W2ZLF



Typical test setup. Channel Master Apollo is at left, Gallo Twin-T in center, Canaveral rabbit-ears reference antenna at right, Jerrold field strength meter on floor. Since no indoor TV antenna possibly can equal the performance of a good outdoor antenna in terms of intercepted signal and picture sharpness (due to minimum multipath ghosting), comparing either the Twin-T or the Apollo against an outdoor antenna would have been useless. For this reason, both products were checked against an indoor antenna that long has been standard in homes across the nation—a pair of extended-length, fully adjustable rabbit ears.

FOR THE LAST ten years or so there's been one sure way to make a fast buck —manufacture an indoor TV antenna. Why? Because practically everyone who must use an indoor antenna is ready at the drop of an eyelid to invest a few dollars in something that promises outdoor-antenna performance. Unfortunately, a large proportion of the so-called computer-designed or space-age antennas were out-and-out duds when stacked up against their claims.

This being the way the cookie has been crumbling, we've become suspicious of any indoor antenna which claims to equal, approach or outperform an outdoor antenna. And when Gallo's Twin-T and Channel Master's Apollo hit the market we decided to give them a going over. Here's what we found.

The Twin-T. Selling for about $10, Gallo's Twin-T is a printed-circuit antenna. An ordinary piece of copper-clad board measuring about 8 x 10 in. is etched so that only a T-shape and an open T-loop remain. The T's are wired to a few coils and a variable capacitor connects everything together. All this is housed in a plastic cabinet which can be hung on the wall, just in case you go in for that sort of thing, or placed on top of the TV set. Since the capacitor shaft passes through the cabinet, you're free to peak the antenna for optimum performance on each station.

The Apollo. Channel Master's Apollo (about $30) basically is an extended (extra-length) rabbit ears—the type with a batch of metal rods in the center and a switch to select different combinations. It differs from the customary rabbit ears in that it has a little transistorized RF amplifier concealed within its base.

The manufacturer makes no wild claims for the Apollo. It's recommended only when an indoor antenna is a must, and at locations

at least ten miles from the nearest station. Reason is that at shorter distances the transistor amplifier might overload and foul up everything.

The Test. To simulate home use, the antennas were tried in several indoor locations. And they were checked both for signal intercept (microvolts delivered to the tuner input) and multipath rejection.

So far as signal intercept is concerned, our chart tells the whole story (measurements are representative of all locations). With the three antennas tuned for maximum picture carrier, the reference rabbit ears consistently outperformed the Twin-T. But the Apollo, on the other hand, just as consistently surpassed both the Twin-T and the rabbit ears.

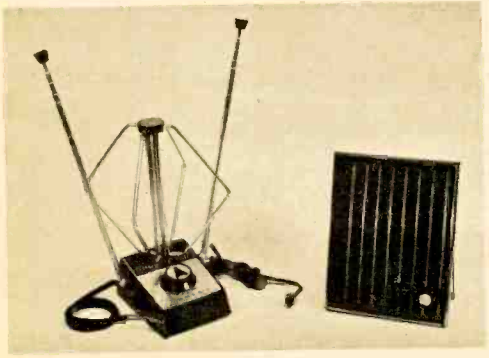
In real figures, the Apollo's gain ranged from 2.5 on channel 7 to 8.6 on channel 4. The low figure on channel 7 results from what apparently is an error in Channel Master's own instructions. When the Apollo's elements are shortened—as recommended—for channels 7 through 13, the gain on channel 7 is notably low. However, lengthening the antenna to the size specified for channels 2 through 6 ups the gain to 5.4. A change in the instruction manual by Channel Master would take care of this problem.

The Apollo has directional characteristics similar to those of a dipole and can be rotated for minimum multipath. The Twin-T, in contrast, is essentially non-directional (this omni-directional sensitivity is played up big in Gallo's promotions). Sadly enough, the fact that the Twin-T can pick up signals from any direction means that multipath ghosting is severe. Matter of fact, it's so bad there are no sharply defined ghosts. The hobgoblins blend into such a complete picture smear that the screen appears to be out of focus.

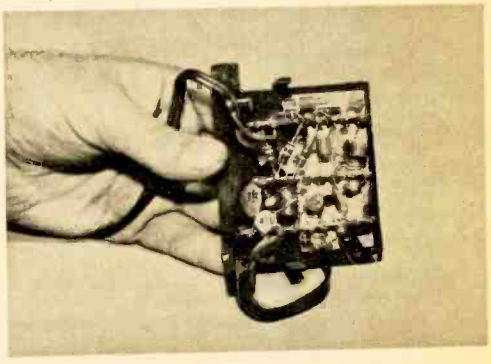
MICROVOLTS DELIVERED TO INPUT			
TV CHANNEL	GALLO	REFERENCE ANTENNA	CHANNEL MASTER
2	196	560	4000
4	32	180	1560
5	480	1240	6000
7	740	750	1960
9	560	1000	5600
11	110	300	2200
13	110	280	2200
FM (mc)			
90	190	58	20
100	76	98	40
106	170	142	76

An interesting plus resulting from the omni-directionality is the Twin-T's superior intercept at FM frequencies. As shown in our table, the Twin-T holds up well on the FM band while the Apollo's sensitivity falls off sharply. For monophonic FM reception, the Twin-T may prove satisfactory at your particular location. But it's useless for stereo FM; multipath distortion is simply unbearable.

Summing up. While the Twin-T is small, attractive and associated with some fantastic claims, it's no match for even ordinary rabbit ears. On the other hand, the Apollo's performance beats that of the rabbit ears and approaches that of an outdoor antenna. In fact, where multipath isn't a problem, it's difficult to tell the difference between a picture delivered by an outdoor antenna and one delivered by the Apollo.

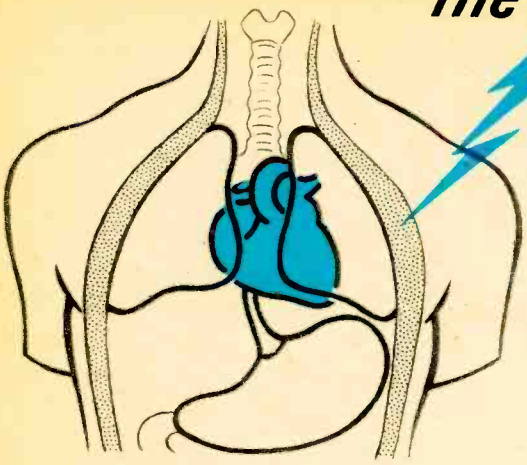


Channel Master's Apollo (left) and Gallo's Twin-T. Apollo has built-in amplifier, Twin-T does not.



Close-up of Apollo's built-in transistor amplifier. Unit works off any standard 117-VAC line.

the shocking facts on ELECTRIC SHOCK



By NORMAN A. CUMMINGS, M.D.

WAY BACK in 1879, a carpenter working on a theater stage in the French city of Lyons gained one of those dubious distinctions you're always hearing about. He managed to interpose himself between the output of a 250-volt Siemens dynamo and ground. Though he died as a result, the workman went down in history as the first victim on record of an electric shock not produced by lightning.

Since that time, of course, the use of electricity has increased by leaps and bounds. And accidental deaths from electric shock also have increased as one of the byproducts of this extended use. In the U.S. alone, accidental electrocution claims some 750 in industry and 150 at home every year. Lightning, meanwhile, takes another 150 lives.

Actually, electricity can damage the body in any one of three ways: by harming the nervous system or heart, by subjecting the body to intense heat or by causing the muscles to contract. The first effect is by far the most important.

The IR of it. When a current enters a body it naturally follows Ohm's Law, just as it does in any circuit. The conductivity of body tissues which have a sizable water content—blood vessels and muscles, for instance—is high. However, your skin is a good insulator and can stop many currents from getting inside.

Grab the leads of an ordinary VOM between thumb and forefinger, one lead in each hand, and you'll read a resistance of anywhere from 200,000 to 500,000 ohms. But wet your fingers first and that reading will drop by 50,000 ohms or more. Grasp the leads with your entire hand and the resistance will become even less.

This last point is important, since it suggests that resistance varies inversely with the area involved. In other words, the greater the surface in contact, the lower the reading on our VOM. A man in a bath with one hand on a bare outlet and much of the rest of him on the grounded tub can have a resistance of less than 500 ohms. And that's quite a drop from the possible half megohm we started out with.

Getting back to our unlucky French carpenter, you'll recall that he received an RMS value of 250 volts through his body. Had his skin resistance been around 500,000 ohms, the current would have been:

$I = E/R = 250/500{,}000 = 0.005$, or 0.5 ma, a safe enough level.

Then how did he die? Well, had he been perspiring and leaned a sweaty palm against a ground, skin resistance might have dropped to 2,000 ohms. The current would have risen to 125 amps and the results would have been fatal.

Offbeat Beats. Though current often kills, there are important factors that may mean the difference between life and death. Naturally, the body must be grounded to complete the circuit or no current can flow. But the path to ground also can be vital. Current entering at one hand and escaping at the elbow of the same arm might give nothing more than a nasty tingle. But let that same current escape from the feet or from the opposite hand and it may pass through the

heart first, killing the victim almost instantly.

Under normal circumstances, the orderly contractions of the heart are set off by rhythmic electrical discharges from a pacemaker located in one of its chambers. But if a large enough current passes through, it can upset the action of the pacemaker.

One of two things happens as a result of such an occurrence. There are rapid contractions—ventricular tachycardia—which are not sufficient to sustain life for long. Or there are weak contractions—ventricular fibrillation—which are too feeble and discoordinated to pump blood at all. In addition, an electric shock can deaden the centers in the brain that control breathing and cause breathing to stop.

Other Dangers. The duration of contact is important too. Generally, the longer the contact the greater the danger. Then too, alternating current is four to five times more harmful than direct current. For one thing, AC tends to cause more muscular contractions. It also stimulates sweating.

The frequency of the AC enters the picture, too, with the lower frequencies being the most dangerous. Unfortunately, 60-cps house current is in the most harmful range; as little as 25 volts at 60 cps can kill. On the other hand, people shocked by diathermy machines, operating at a frequency of a million cps or so, have withstood 40,000 volts without damage.

The heat from electric shock can do damage by burning the skin and deeper tissues (some have had to have limbs amputated due to electric burns following shock). Matter of fact, electric arcing has been known to produce temperatures higher than 14,000 F, which certainly is enough to do more than set clothes afire.

Involuntary muscular contractions also can be set up by the current. Such contractions can cause broken bones or, more importantly, prevent the victim from breaking away from a current source. A man normally can free himself from a current of 9 ma or less; a woman, from 6 ma or less. The reason a high-tension source isn't always fatal is that the victim sometimes is jolted off the wire before much damage is done. A lower voltage may not do this, and he won't be able to let go.

But in almost all cases, it is the current that does the damage. A current of 1 ma can cause tingling of the skin; 100 ma passing from hands through feet can cause ventricular fibrillation and death. Effects in between vary with amperage, other factors being equal.

Nature's Own. Lightning provides a special case of electrocution. Up to a billion volts at 20,000 amperes can shoot along a path a mile long and twenty feet wide, though the so-called bolt from the blue lasts only a fraction of a second. Even if a victim isn't hit directly, he can be caught by secondary flashes from the earth over a hundred feet from the point of contact. Death can result from the current, the heat generated or from the tremendous forces created by the hot compressed air in the vicinity of the flash.

Lifesavers. Though electric shock can be fatal, the right kind of first aid often saves the day. The most important part of treatment is artificial respiration. In one study, about three out of every four who received artificial respiration within three minutes of the shock lived; but of those who got it four minutes or more after the shock, only 14% survived. In another series of cases involving some 700 victims of electric shock, 479—more than half—had stopped breathing. But

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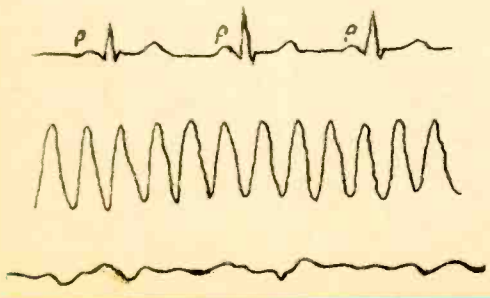


Electrocardiograph of normal heart, showing rhythmic activity of pacemaker (p) and larger response it sets off. Heart averages 65 beats a minute.

Ventricular tachycardia, one of the possible consequences of electric shock, typically results in this tracing. Pacemaker no longer controls rhythm.

Ventricular fibrillation, which can follow exposure to a current of 100 ma, results in random impulses which are too weak to sustain life.

The LISTENER

C. M. STANBURY II

ARGENTINA . . . One of the oldest international broadcasting services in South America anywhere is Argentina's RAE. On the air five days a week, it broadcasts in six languages with antennas beamed to both North America and Europe. The organization's name—RAE—by the way, is pronounced "rye" and stands for Radiodifusion Argentina Al Exterior.

RAE uses one powerful transmitter belonging to the publicly owned Radio Nacional on two frequencies: LRA32 on 9690 kc for North America, and LRA35 on 11,710 kc for Europe. However, since the revolt in the summer of 1962, RAE at various times has used the facilities of a private station. The station is Radio Belgrano and it sports two transmitters—LRI1 on 6090 kc and LRI2 on 11,780 kc. (R. Belgrano, for whatever it's worth, is key outlet for one of Argentina's three major commercial networks; Radio Splendid and Radio El Mundo are the others.)

RAE produces programs in English, Spanish (of course), German, Italian, French and Portuguese. English for Europe is scheduled at 1800 EST, for Eastern North America at 2200 and for Western North America at 0100 EST (2200 PST).

While these transmissions include tourist come ons, talks on art and literature and the like, RAE's news and commentary will be the feature of major interest to most listeners. For by periodically monitoring these, you'll be able to follow official Argentine policy as it twists and turns. However, keep in mind that RAE operates Monday through Friday only.

Meanwhile, for those who like to DX the loose ends, LRI1 and LRI2 are used for both the 2200 and 0100 English sessions. Similarly, with luck, R. Belgrano's own programs (in Spanish) can be received via LRY1 prior to 2100. Then, too, R. El Mundo sometimes cuts through QRM at 2300 S/Off on 9712 kc (LRX2). And to top it off, R. Splendid occasionally sneaks under powerful XEHH on 11,880 kc (LRS) evenings.

Same Time, Same Station. When a truly rare piece of DX is logged, readability often is poor and reception lasts only for a few minutes. The result is a somewhat unconvincing report to the station concerned. But chances are that you'll hear the station again if you tune to the same frequency at the same time the next day. Reception probably will last no longer and copying even may be worse. Just the same, putting these two periods together should give you a reasonably satisfactory report.

Let's take a case history—our own efforts to log the Southern Rhodesia Broadcasting Corp. transmitter at Gwelo (an African railway center). Operating on 120 meters at 2424 kc, this was one of our most wanted targets. (See DXing THE SLIGHTLY SHORT WAVES, March 1964 EI) We first heard the

[*Continued on page* 117]

Argentina airs some six different languages on the short-wave bands from studios in Pacheco near Buenos Aires. Called RAE—short for Radiodifusion Argentina Al Exterior—the SW service welcomes suggestions and requests. In addition, RAE publishes an English-language program guide for listeners in North America. Address letters to RAE, Sarmiento 151, Buenos Aires.

TALK NOW...

LISTEN LATER!

BIGGEST TROUBLE with the telephone is that you can't take it with you. Worse yet, someone always has to be around to answer your phone when it rings or the person calling has just plain wasted his time. Only thing he finds out is that you aren't about—or at least that you aren't answering your phone, either one of which makes for a pretty useless piece of information.

For those who can't afford a full-time secretary or two, a new device called the Phoneminder might be the next best thing. For the Phoneminder is a secretary, albeit an electronic one, that puts in 24 hours a day seven days a week with nary a coffee break. It answers your phone in your own voice, explains you're tied up somewhere or other, then offers to take a message which, it says, will be given to you when you call.

But can the Phoneminder make like a live secretary and actually tell you who called and what they had to say? It sure can. All you have to do is dial your own number, then place a small tone generator —called an Electrokey—to the microphone of the telephone handset. The signal from the Electrokey automatically causes the Phoneminder to play back all the messages it's taken down. This means there's never any need to return to home or office to pick up your phone messages. The Phoneminder gives them to you just as a private secretary would, right over the phone.

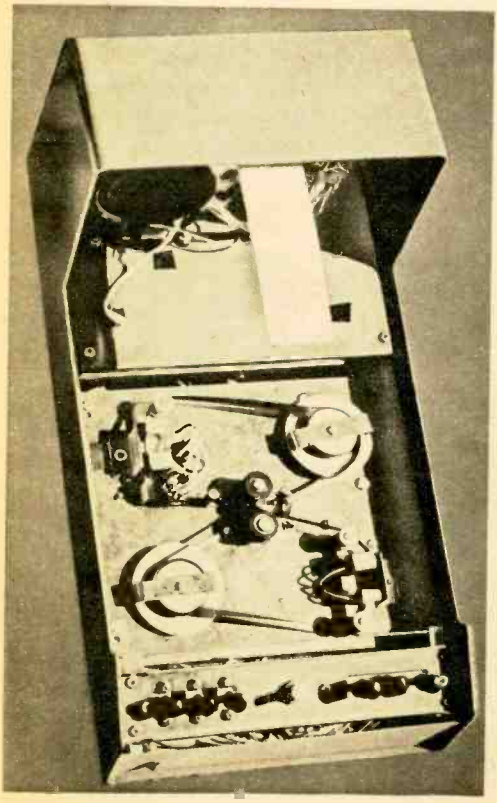
As you've probably figured out by now, the Phoneminder is no simple gadget; it couldn't be and still do all the things it does. But it's no Rube Goldberg concoction, either. As our photos show, it occupies only a little more space on a desk than the telephone itself. Inside, there's a tape recorder, some transducers and a fair selection of switches, both manual and automatic.

Since the telephone companies say nix to any direct connections to their lines or equipment, the Phoneminder naturally was designed to work all on its own. Let the telephone ring, and an induction coil picks up the ringing signal, then feeds it into an

amplifier. Once amplified, this signal activates a solenoid, which lifts the telephone handset clear of the cradle.

Simultaneously, the Phoneminder's tape recorder swings into action and, for the next 18 seconds, the message you have recorded is fed from the Phoneminder's speaker into the mouthpiece of the telephone handset. Your message completed, the Phoneminder automatically adjusts itself to record any incoming message the caller wishes to leave.

Should a tone—which must be of a specific frequency and duration—be received from the Electrokey, the Phoneminder proceeds to play back all messages it has recorded. This done, the Phoneminder reverts to its original mode, ready to answer your phone any hour of the day or night.



Tape mechanism inside Phoneminder plays your message to callers, tapes theirs for later playback.

IEEE Special on Track 64

WITH memories of the fun and confusion of past IEEE shows (where nearly every electronic manufacturer exhibits his wares), we headed up to the New York Coliseum not long ago to see the latest version of the extravaganza, hoping to see something as familiar as an old-fashioned radio tube.

But aisle after aisle of way-out electronic equipment began to get us. Then, finally, we saw an excited crowd of spectators at one booth. Was it a one-transistor TV set?

Nope. It was even better. A set of model trains that a power-supply manufacturer was using to demonstrate his equipment. Judging from the enthusiastic audience, we'd say that computer and space technology often take a back seat when it comes to things that are really close to the heart.—*R.D.F.*

Look Ma, No TVI!

JUDGING from our contacts with the Citizens Band clubs and from the CB papers coming across our desk, there's something new and notable in the way of public or community relations. This particular effort to put the CB shop in order concerns a product you might call an all-purpose TVI cleaner.

The promoters in this case are some well-organized TVI committees. In at least a few localities the concern over keeping good neighbors good has resulted in posters being hung up in public gathering places stating that the local club offers to help with television-interference problems. Specifically, those with Tennessee Valley Indians are asked to contact the TVI committee if the hero of one of those old movies suddenly blurts out, "Break! Break!"

In processing complaints, the TVI committees check the rigs that seem to be causing trouble and suggest proper filtering and grounding techniques. They also suggest that the TV owner call in a serviceman to check the TV tuner.

TVI committees make good sense for CB clubs—and good relations, too. Does your club have one?—*R.A.F.*

who REALLY invented radio?

AUTHORITIES pretty much agree that Edison came up with the first diode. And there's not much doubt that DeForest put in a grid. But exactly who invented radio?

Guglielmo Marconi, says the Encyclopedia Britannica, was " . . . the inventor of a practical system of communicating intelligence without the use of connecting wires . . . " But was he first in the field? Not by a long shot. An American, Nathan B. Stubblefield, said El in its July 1961 issue, well might have been " . . . the true father of radio . . . "

Now another candidate comes over the horizon.

Had it not been for two of America's worst disasters—the Chicago fire of 1871 and the Black Friday financial panic two years earlier—a man named Mahlon Loomis might have gone down as the inventor of radio. For these dark events, along with the traditional fickleness of the U.S. Congress, cost Loomis financial backing. With money behind him, Loomis (the man in our photo above) might have made a major mark in history.

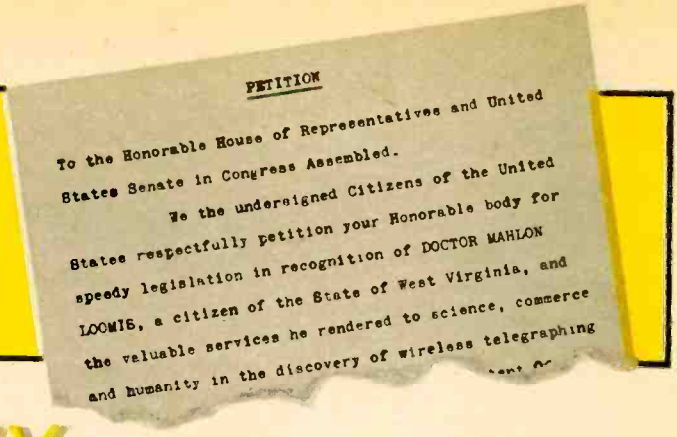
As it stands, Loomis' chief accomplishment is a matter of record. On July 20, 1872, he received his greatest claim to fame. U.S. Letters Patent No. 129,971 and titled Improvement in Telegraphing was awarded for a wireless system Loomis had developed. Though no voice communication was involved, Loomis is credited with sending wireless messages between two mountain peaks in Virginia in October of 1866—29 years before Marconi's experiments, 11 years before Hertz even had pinned down the nature of electromagnetic waves.

Loomis' 1866 experiment as imagined by one artist of the day. Sketch is on file in Patent Office.

Spectators present at that historic first included Senator Samuel C. Pomeroy of Kansas and Representative John A. Bingham of Ohio. Both offered valuable support during later efforts by Loomis to obtain government backing for development of his discovery.

Born in Fulton County, N.Y., on July 21, 1826, Loomis moved as a boy to Virginia. As a young man, he studied dentistry in Ohio, later practiced his profession in various areas before moving to Washington, D.C. In 1854, he patented a process for making false teeth. But even then he must have been more interested in communications than in dentistry. Sure, the tooth business fed him, his wife and

Proof that some citizens believed Loomis deserving of recognition is this undated petition to the U.S. Congress. It was signed by members of the Loomis family and by other interested individuals.



PETITION

To the Honorable House of Representatives and United States Senate in Congress Assembled.

We the undersigned Citizens of the United States respectfully petition your Honorable body for speedy legislation in recognition of DOCTOR MAHLON LOOMIS, a citizen of the State of West Virginia, and the valuable services he rendered to science, commerce and humanity in the discovery of wireless telegraphing

who REALLY invented radio?

his daughter. But wireless was the love of his life.

Fortunately, Loomis himself carefully recorded his ideas and experiments in a collection of notebooks available today in the Library of Congress. In an entry dated February 20, 1864, he wrote:

"I have been for years trying to study out a process by which telegraphic communications may be made across the ocean without any wires, and also from point to point on the earth."

Loomis had a talent for description as well as an easily readable handwriting. He had this to say of the 1866 experiment, first successful wireless aerial communication on record:

"From two mountain peaks of the Blue Ridge in Virginia which are only about two thousand feet above tide water two kites were let up—one from each summit—eighteen or twenty miles apart. These kites had each a small piece of fine copper wire gauze about fifteen inches square attached to their under side and connected also with the wire six hundred feet in length which held the kites when they were up. The day was clear and cool in the month of October with breeze enough to hold the kites firmly at anchor when they were flown. Good connection was made with the ground by laying in a wet place a coil of wire one end of which was secured to the binding post of a galvanometer.

"The equipments and apparatus at both stations were exactly alike. The time pieces of both parties having been set exactly alike, it was arranged that at precisely such an hour and minute the galvanometer at one station should be attached, or be in circuit with the ground and kite wires. At the opposite station the ground wire already being fast to the galvanometer, three separate and deliberate half-minute connections were made with the kite wire and instruments. This deflected, or moved, the needle at the other station with the same vigor and precision as if it had been attached to an ordinary battery.

"After a lapse of five minutes, as previously arranged, the same performance was repeated with the same result until the third time. Then fifteen minutes precisely were allowed to elapse, during which time the instrument at the first station was put in circuit with both wires while the opposite one was detached from its upper wire, thus reversing the arrangements at each station. At the expiration of the fifteen minutes the message or signals came in to the initial station, a perfect duplicate of those sent from it, as by previous arrangement. And although no 'transmitting key' was made use of nor any 'sounder' key to voice the messages, yet they were just as precise and distinct as any that ever sped over a wire."

Thrilled with his success—which he said was "confidently expected"—Mahlon Loomis sought to reach new and greater heights in wireless communication. During the next two years he planned an elaborate project in which he would build and communicate between two wireless stations on peaks in the Rocky Mountains. He also was beginning to talk of sending wireless messages around the earth.

Fortunately, he found ready investors to

support his work, wealthy men anxious to share the financial success they expected him to have. A group of Boston promoters agreed to invest funds in further development of the visionary dentist's discovery. Loomis' future looked bright.

But the Black Friday panic struck on Sept. 24, 1869, and investors found themselves with nothing to invest. Loomis then turned his outstretched hand toward the prosperous Mid-West and its booming trade center, Chicago.

Again, he found businessmen with ready cash. Promised $20,000, he excitedly laid new plans. Then Mrs. O'Leary's cow kicked over a lantern and set the Windy City ablaze, reducing the holdings of Loomis' backers to smoldering rubble. Many of the pioneer radio explorer's hopes also must have gone up in flame.

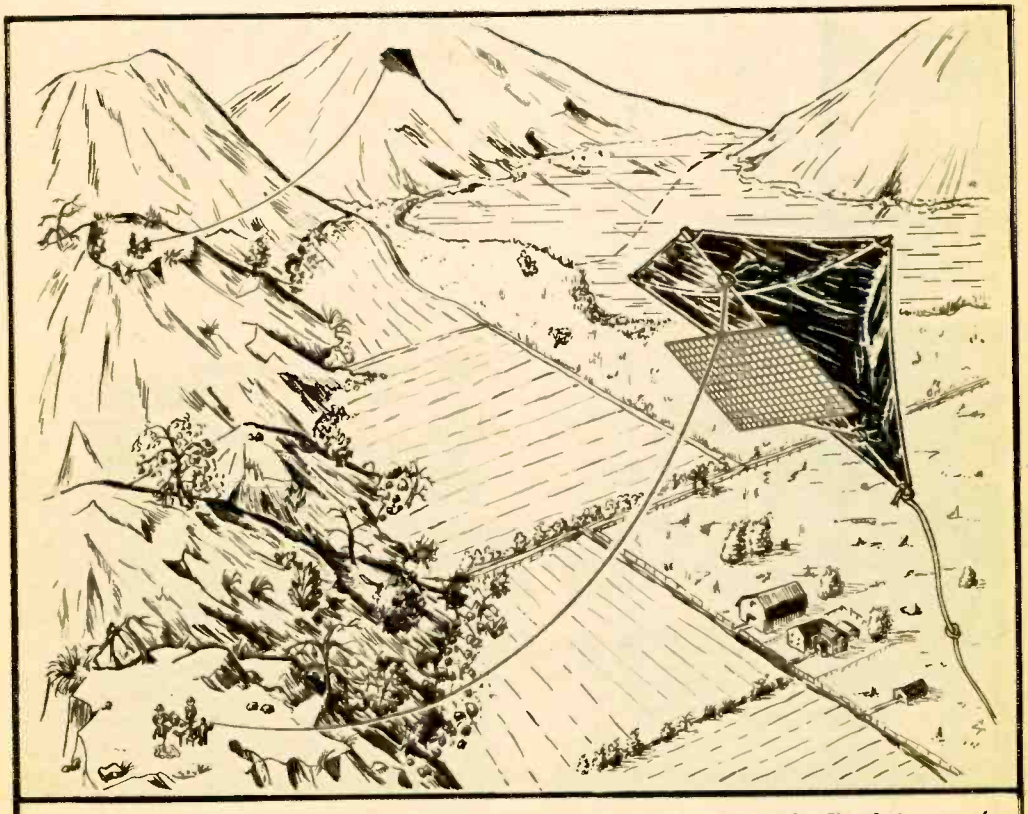
Though Loomis had many supporters, he drew his doubting Thomases, too. Some, in his words, regarded him "as a crank," "a fool," if not some kind of nut. Not everyone had accepted his claims. The New York Journal of Commerce, for example, had this to say on Feb. 5, 1873:

"As we understand the Loomis plan, it is something to this effect—and readers are cautioned not to laugh too boisterously at it, as also not to believe it till demonstrated. . ."

Other newspapers also were highly critical, though many supported him. Patience and persistence, however, are qualities the inventor must have, and Loomis was no exception. Matter of fact, he had so much of both that radio became his all-consuming interest. Dentistry, his profession, took a back seat.

Naturally, his work had attracted attention in Congress. As early as January 1869, Senator Charles Sumner of Massachusetts introduced a bill which would have appropriated $50,000 to support development of the Loomis wireless system. As his other sources failed, Loomis cast a hopeful eye toward the

[*Continued on page* 114]



Artist's concept of world's first transmission and reception of wireless signals. Sketch in one of Loomis' notebooks indicates that the two mountain peaks were located approximately 14 miles apart.

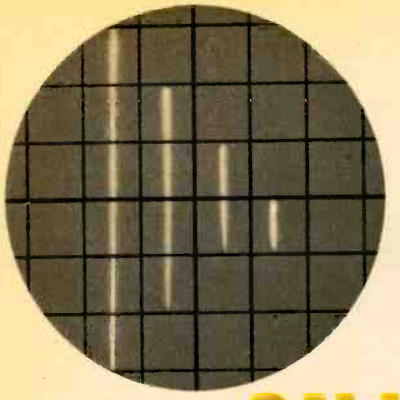
INSTRUCTION BY INDUCTION

Audio amplifier boosts signal from mike, feeds it into loop of wire which surrounds pool completely.

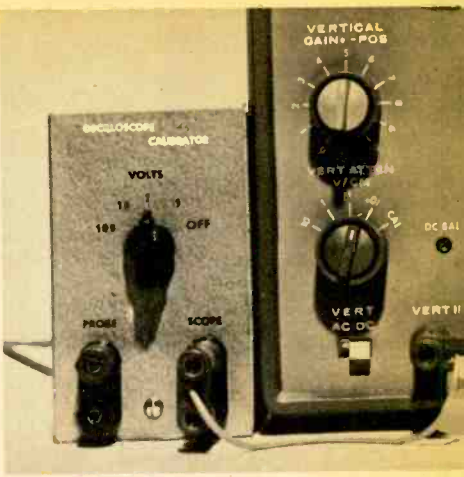
THOUGH THE BRITISH have their share of Johnnys who can't read, there's another part of the learning picture where they're about to shine quite uniquely. Britain's younger set *can* be taught to swim, by George. All it takes is a good coach and some electronic gadgetry developed by a firm called Spembly Ltd.

As you might guess, nothing can replace an instructor when it comes to rescuing the flounderer or spelling out the usual business about kicking, paddling and breathing. But the electronics of this new setup make many of the old-time coaches as dated as the dog crawl.

Heart of the new electronic system is a battery-powered audio amplifier which, instead of driving a speaker, is connected to a coil of wire running around the edge of the pool. Serving as the primary of a huge audio transformer, the coil produces a strong varying magnetic field clear across the pool. You have each swimming student wear a specially constructed, close-fitting headcap complete with earphones, and nobody anywhere in the pool can escape the coach's every command. The headsets operate right in the primary's field, pick up every word that is spoken. Instruction by induction, you might call it.



SIMPLE SCOPE CALIBRATOR



Turn your scope into a peak-to-peak voltmeter with this device.

By AL TOLER

NO thinking hobbyist could conceive of trying to troubleshoot electronic equipment with a VOM that had a blank meter face. Yet using an oscilloscope without precise voltage calibration amounts to about the same thing. In both cases you would know a voltage was present—but you couldn't determine its magnitude. Add a calibrator to your scope and you put those horizontal lines on the CRT to good use. In addition to being able to see what a signal looks like, you now can determine peak-to-peak voltage in a hurry.

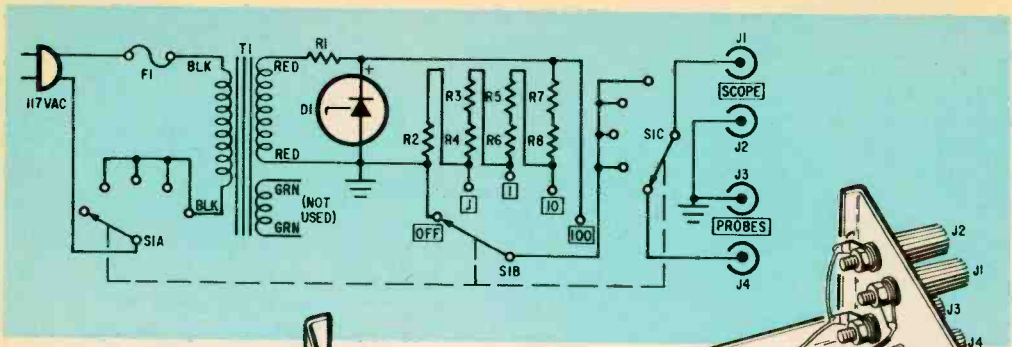
This is how a calibrator is used: first, you set its output to, say, 10 volts, peak-to-peak. Then you turn the scope's horizontal gain all the way down and adjust the vertical gain and position controls until you see a vertical line that is exactly four divisions (or whatever number of divisions you want) high. Now when you display a signal that is four divisions high you'll know its peak-to-peak amplitude is 10 volts.

Set the calibrator to 100 volts, set the scope's vertical gain control so the line is, say, one division high, and you'll know a waveform three divisions high has a peak-to-peak amplitude of 300 volts. You can make each scale division represent any voltage you want. EI's scope calibrator has outputs of 0.1, 1, 10 and 100 peak-to-peak volts. For convenience, we've designed it so it can be left connected to the scope permanently (you connect your test probes to the calibrator). When the calibrator is off the probes are connected automatically to the scope's vertical input. Set the calibrator to 0.1, 1, 10 or 100 volts and its output, rather than the probes, is connected to the scope's vertical input.

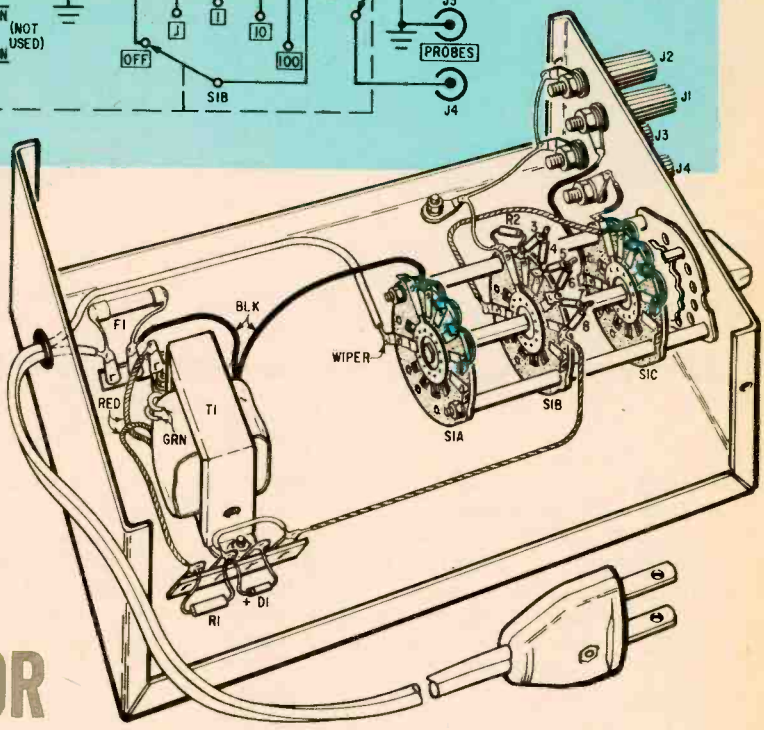
Construction

Our model was built in the main section of a 7x5x3-inch Minibox. Parts layout is designed to keep 60-cycle AC surrounding T1 far away from the output jacks. To cut costs, you can eliminate the automatic switching feature and build only the circuit associated with S1B. S1A could be replaced with an SPST switch, and S1B would be a single-pole, four-position switch. Do not make a substitution for zener diode D1 and take extra care when soldering it in place since it can be damaged by heat. Leave D1's leads as long as possible and be sure to use a heat sink, such as an alligator clip, on each lead when soldering. D1's polarity is unimportant. The calibrator will work regardless of whether D1's cathode is connected to T1's hot lead or ground.

Since the calibrator's output is a complex waveform, its output voltage can be checked only with a VTVM with a peak-to-peak scale. A standard VTVM or a VOM will not indicate output voltage accurately.



Peak-to-peak voltage of T1's 125-volt winding is held to 100 volts by zener diode D1. Output voltages are taken from taps on voltage divider formed by R2-R8. Extra large cabinet was used to keep T1 away from output jacks so 60-cycle AC will not appear at the output. Use specified switch, which has wide spacing between each section.



SIMPLE SCOPE CALIBRATOR

Using the Calibrator

Set S1 to off and connect J1 and J2 to the scope's vertical input. Then set S1 to the 0.1-volt position and adjust the vertical gain control until you see a square wave. Reduce the horizontal gain until you see only a vertical line. At the top and bottom of the line there will be a bright dot. The distance between the dots represents 0.1 volt peak-to-peak. If you adjust the vertical gain control so the line occupies ten divisions, each division will represent 0.01 volt, peak-to-peak. Similarly, if you calibrate with a 1-volt signal, each division will represent 0.1 volt. You can calibrate in any way you want. For example, you can make 5 or 15 divisions represent 1 volt.

When you crank up the horizontal gain control you will notice the waveform is not symmetrical. This is normal and has no effect on calibration. And don't be concerned if the waveform isn't absolutely square. This will not affect accuracy if you follow the calibration procedure we described using a vertical line.

PARTS LIST

D1—Zener diode: 400 mw, 100 V, ±5%. Motorola 1N985B (Allied Radio Industrial Catalog, $3.65 plus postage)
F1—½-A pigtail fuse
J1-J4—Insulated five-way binding posts

Resistors: ½ watt, 5%
R1—30,000 ohms
R2—100 ohms
R3—500 ohms
R4—390 ohms
R5—7,500 ohms
R6—1,500 ohms
R7—75,000 ohms
R8—15,000 ohms

S1—3-pole, 6-position, nonshorting rotary switch. Centralab No. 1421 (Allied Radio Industrial Catalog No. 35 B 135; $3.90 plus postage)
T1—Power transformer: primary, 117 V; secondaries, 125 V @ 15 ma, 6.3 V @ 0.6 A (Allied 61 G 410)

the TRUTH about those Home TV Recorders

By KEN GILMORE

ONE DAY last April a nattily dressed young man named Dick Pell shoved a microphone under my chin, looked me straight in the eye and asked me what I thought of the electronic gizmo in front of us. And while we weren't panelists on a TV show, we were under constant scrutiny. The beady eye of a TV camera watched our every move from the other side of the room.

Our stint on TV didn't set any new rating records. Fact is, only a dozen or so people saw our little performance, and then only on closed-circuit TV. The thing that made the incident noteworthy was the gadget we were talking about—a video recorder that was capturing our every word and action on magnetic tape.

To show the machine's versatility, Pell adjusted the controls and began to record a TV program off the air. Then he rewound the tape and played it back. First our live show and later the replay of the TV program came on the screen clear and sharp.

Though the machine was an impressive performer, the really big news was its price. The video tape recorders TV stations and networks use cost upwards of 11 grand. But Fairchild Camera and Instrument Corp., developer of the machine Pell was showing, predicts it will sell for as little as $300.

Sudden Goldmine? Fairchild isn't the only firm talking about marketing a video tape recorder at TV-set prices. Earlier this year, an English outfit called Telcan demonstrated a similar machine to a New York audience. Cinerama, the U.S. company making arrangements for its manufacture and sale here, says the device will sell for less than $200.

Another group of engineers—called Par Ltd. and operating out of Baltimore—has announced still another home TV recorder. A. Stewart Hegeman, spokesman for the group and the man responsible for designing many tuners and amplifiers now on the market, isn't ready to show his hand at this writing. But best guess is that the machine probably will sell in the same price range as Fairchild's.

And in the Mid-West an engineering group at the Illinois Institute of Technology has de-

Live broadcast from a local TV station as it appeared on the screen of an ordinary TV set.

Playback of tape of same broadcast made on the Fairchild recorder. Note slight loss in definition.

Home TV Recorders

veloped two more prototypes. Each operates on a different principle, and one is scheduled to be demonstrated publicly soon. How soon, no one knows. Group head Marvin Camras won't even estimate its selling price just yet. "I can't indicate any price except to say that it is a low-priced unit of about the same complexity as a home audio machine. The actual cost would be up to the manufacturer," he says.

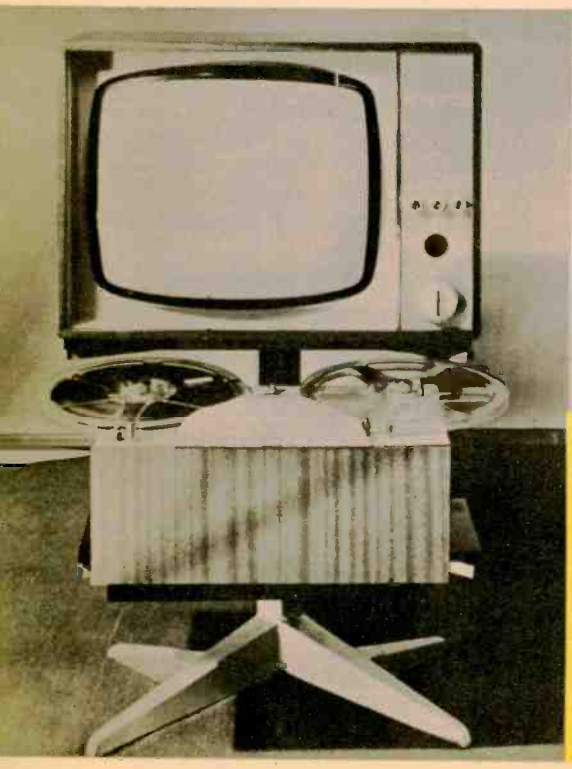
Though the Telcan, Fairchild, Par and IIT are the only machines announced to date, rumors of other low-cost home-TV tapers are rampant. An official of Sony, the giant Japanese electronics firm, explains it this way: "I'm sure every big company has one of these in the back room, but we're not ready to make an announcement about ours yet."

Where are the machines that most everyone's heard about but few have seen? Answer is that many still are on the drawing boards. Truth to tell, the days of home TV taping aren't quite with us yet, despite all the pie-in-the-sky reports that were set off by the Telcan announcement. Here's why.

Tough Task. In order to produce a TV taper to sell in the consumer price range, engineers are going to have to lick a number of mighty sticky problems. Rome, the story goes, went nowhere fast in a day. And engineers aren't going to put together a $150 home TV taper in no time flat, either.

Where music can be recorded with a 15,000-cps bandwidth, television recording requires a bandwidth of at least 2,000,000 or 3,000,000 cps. Problem is, how do you get that kind of response?

Professional TV recorders achieve a megacycles-wide bandwidth in a particularly ingenious manner. Instead of standard, ¼-in. audio-type tape, they use a special tape some 2 in. wide. Furthermore, recording heads on a spinning wheel mounted at right angles to the tape make a series of sweeps across the tape. The tape itself moves forward at only 15 ips, but having the recording heads zoom across the tape as they do makes the effective speed much higher. In fact, it's high



Current flurry in TV tapers began a year or so ago with a British firm called Telcan Ltd. The company announced it was about to produce a TV tape recorder for under $200, later gave a non-too-convincing demonstration of its machine to a New York audience. But unit has yet to appear on the market; photos here were taken by Telcan itself and show two prototype models.

Fairchild's proposed entry into home TV recorder field. Though machine can use standard ¼-in. tape, instrumentation tape works much better. Such tape produces less head wear, keeps heads cleaner.

enough to record all the information in a TV signal.

Though such machines work beautifully, their cost is pure nightmare. Some professional recorders run as high as $65,000. The cheapest portable system costs more than $11,000. Even the tape comes at highway robbery prices. Enough 2-in. tape to record a 15-minute program costs about $70.

Obviously, to make a low-cost home system practical, engineers are going to have to come up with some completely new and far simpler way to do the job. Question is, can they turn the trick?

New Approaches. One improvement they've tried is replacing the revolving heads with stationary heads similar to those on audio recorders. Not only are these heads much, much cheaper, but their use enables engineers to go back to standard ¼-in. tape. Such tape is both less expensive and easier to handle.

But now comes the rub. Tape speed must be stepped up drastically to overcome the woefully limited bandwidth dictated by stationary heads. Professional video tape recorders can run at a leisurely 15 ips because of the advantages their revolving heads offer. But the Telcan and Fairchild machines, for example, whiz along at 120 inches a second. Result is that these recorders gobble up tape as though they were on fast rewind. And tape heads, always subject to wear, are clogged up and polished away just that much faster.

Two more tricks engineers are counting on are better heads and better tapes. And here they definitely are in luck, though neither helps the cost angle one bit. Tape heads today are better than ever, and so are many tapes. But both come at a price, and price is

[*Continued on page* 110]

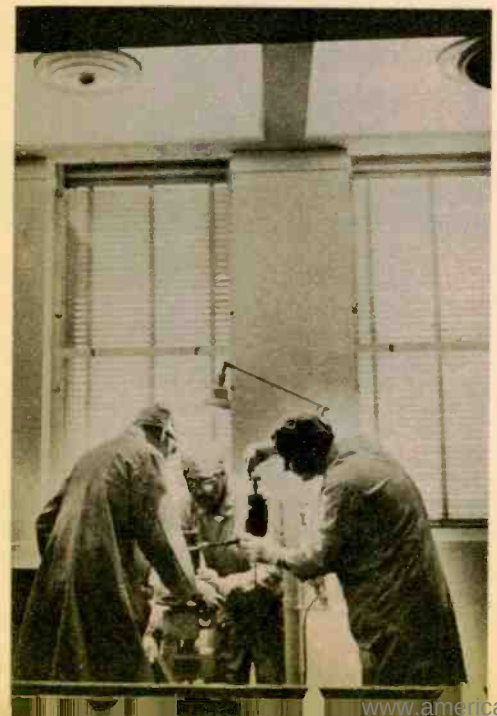
Lab at Par Ltd. looks like most any other, but rig Par's engineers are trying to bring off well may make for a major breakthrough in TV-taper field. Because of its comparatively slow tape speed—30 ips—machine offered a bandwidth of only about 1.5 mc when this photo was taken. But designers Stew Hegeman (left) and Robert D. Morrow hope to extend bandwidth to the 2-mc mark by various circuit and component changes. Judging from picture quality at time this photo was made, their goal seems a reasonable expectation. If so, the Par machine well may be producing a 2-mc picture at a 30-ips tape speed by the time you read this.

PINHEAD *Patients*

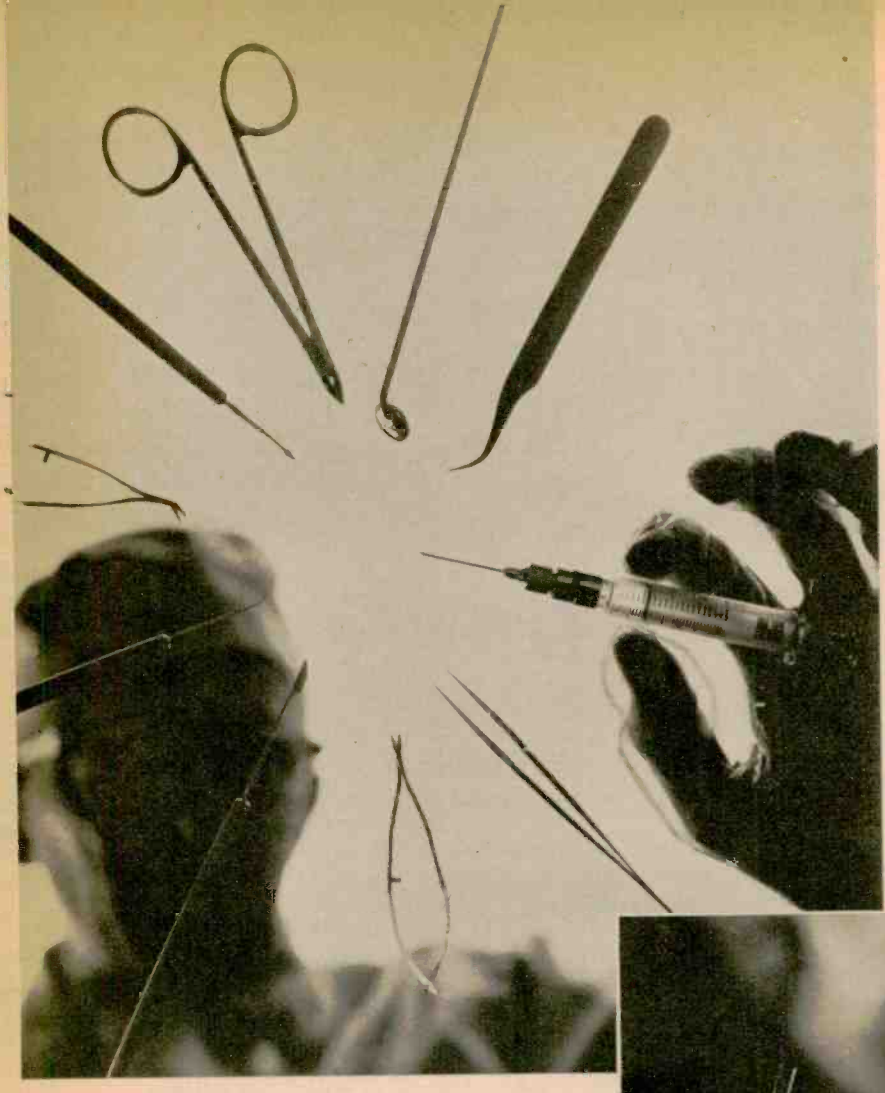
In this strange hospital the little guys getting the knife are smaller than the instruments.

IF YOU venture around a modern research laboratory that is working on miniature electronic components you're likely to think you have stumbled upon some kind of oddball hospital with a slightly mad operating room. Working cautiously around the premises are men wearing surgical gowns and caps and gloves. But where are the patients? Finding them is not so easy because they just may be smaller than the surgical instruments you see being used on them. The so-called patients in most of the labs using surgical procedures are miniaturized solid-state devices made with such narrow tolerances that even a speck of dust can destroy their operation. It is this possibility of dust and dirt, not the threat of germs, that makes the surgeon's garb necessary. Many of the tools used on the components are regular surgical equipment because only these instruments are delicate enough and made with the precision and high-quality materials required. The men shown here are at work in the Westinghouse Research Laboratories in Pittsburgh. Most of the "operations" we picture are concerned with high-speed computer components.

"Give him another shot, Doc. He's still breathing." Garbed like surgeons, three researchers operate on an electron tube.



Curved hypodermic needle that would give any hypochondriac the creeps is used to apply glue coupling tiny ionic switches.



Preparing for delicate operation on inanimate patient, a researcher lays out his medical equipment, including a laryngeal mirror, some dissecting scissors and other assorted devices.

Surgical-type preparation is given to small sliver of ceramic material that contains ten solid-state diodes. Scissors are kind used in eye operations; note the filmy surgical gloves.

Using a miniature scalpel, a scientist trims the gaps in an ionic switch. Device becomes a conductor if sufficient voltage is applied to enable it to ionize gas in its envelope.

Wireless

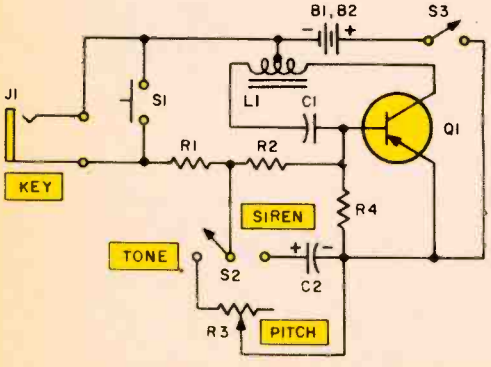
Now you can learn code the right way:

By FRED MAYNARD

TIME seems to drag when you're learning code for that ham ticket. And on those days when you're copying while your friend sends it's a real grind. Finally, the day arrives when you feel confident that 35 wpm would be duck soup. (Matter of fact you are up to 13 wpm, and that's without mistakes.)

Friend feels he can take a night off so you tune the 80-meter band for a change in pace —and then it hits the fan. Impossible to copy, you shout. Must be a foreigner sending 200 wpm. Your best efforts draw a complete blank.

Reason for your sudden collapse is that the code you were brought up on was clean as a whistle. You didn't count on or get used to a lot of noise and strong interference from other operators. And what a difference that makes!



When S2 is in tone position, tone's pitch is determined by setting of R3. When S2 is in siren position, tone frequency rises like that of a siren. Circuit is called a squegging oscillator.

Actually, one of the best ways to learn to copy code is to listen to it through plenty of noise from the day you start. The QRM doesn't have to be that heavy all at once, but it should increase in intensity a little bit each day. And how do you do this with an ordinary code-practice oscillator? You can't, but plug your key into our Wireless CPO and your friend will be able to send code to you through a standard broadcast radio. The radio doesn't need a BFO, either, because the Wireless CPO transmits a modulated tone. Its transmission range is limited and there's no chance of your jamming a neighbor's radio. The device operates on license-free frequencies as a low-power transmitter and a license is not required.

Just tune the radio to a point on the dial where there's a weak station, or perhaps several stations clustered together. Move the CPO closer to or away from the radio to raise or lower the level of the code with respect to background interference and you're ready to learn to copy the right way.

PARTS LIST

B1, B2—8.4 volt mercury battery (Eveready E146 or equiv.)
C1—.02 mf. 75 V or higher ceramic disc capacitor
C2—100 mf, 25 V electrolytic capacitor
J1—Phone jack
L1—80 turns #26 enameled wire wound on 7½-inch-long, ¼-inch dia. ferrite rod (Lafayette MS-331 or equiv.)
Q1—2N398 transistor
R1, R2—47,000 ohm, ½ watt resistor
R3—100,000 ohm, linear-taper potentiometer
R4—100,000 ohm, ½ watt resistor
S1—Single-pole push-button switch
S2—SPDT slide switch
S3—SPST toggle switch

CPO

with QRM mixed with the dits & dahs.

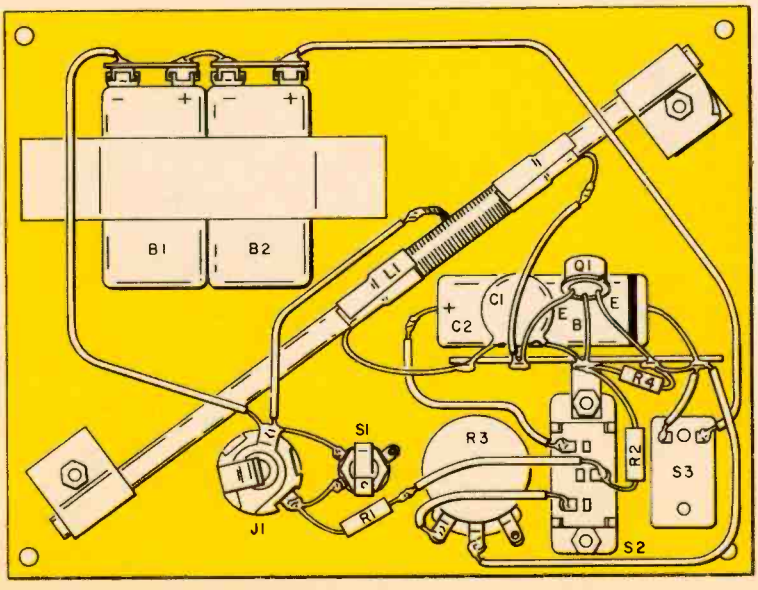
Matter of fact, when you're just beginning to read code it's a good idea to keep the CPO close to the radio—for a while, at least. It'll be easy to copy at first but as time passes you should raise the level of the QRM to decrease readability. It'll take a lot of concentration but when you can copy 15 to 20 wpm through QRM, you can be sure you've got the required 13 wpm cold, come hell or high water.

Notice that word *siren* on the schematic? Just flip S2 to that position and when you press your key or push button S1 the CPO will transmit a siren tone through the radio. As a joke, you can have fun with a friend by giving him a siren wail when he's listening to some favorite program. In a serious application, you can connect the CPO to a switch on a window. If someone tries to break into the house, the siren tone will blare out of a radio in a nearby room to alert you.

In order to increase the CPO's range sufficiently for this application, it will be necessary to add an antenna wire. We'll talk more about this later.

Construction

If, after looking at the schematic, you wonder why we built the CPO in such a large box it is because of the long ferrite rod on which coil L1 is wound. (A long rod is necessary for transmission range.) And the only



We mounted all components on 6½x5-inch cover of bakelite box (don't use a metal box). In order for specified loopstick to fit in 6¾x-5¼x2¼-inch box, it must be cut to 7 inches and mounted diagonally. Q1 can be soldered directly to terminal strip, but be sure to heat-sink leads. S1 can be omitted if you use an external key. And if you don't need siren tone, connect R3 to junction of R1, R2; omit C2, S2.

plastic box in which a 7-inch-long ferrite rod would fit was the size we used. Even this didn't solve the problem since a standard 7¼-inch rod was just a bit too long to be mounted diagonally.

Don't try to break off a quarter-inch of the rod with a pair of wire cutters or you may split the rod where you least expect it. Best way is to cut off the end with a fine-tooth hacksaw blade.

Next thing to do is wind coil L1, which is made with 80 turns of #26 enameled wire. Start winding about two inches from one end. Wind the turns close together with no overlap. Secure the beginning of the coil with a piece of tape. At the 40th turn, pull out a loop, twist it two or three times and wind 40 more turns in the same direction. The loop is the center tap. Put another piece of tape over the last winding to keep it from unraveling.

Mount all other parts on the back of the box's cover as shown in our pictorial and photo. Above all, don't build the CPO in a metal box. The reason is obvious—no signal will get out unless, of course, you mount the coil on the outside.

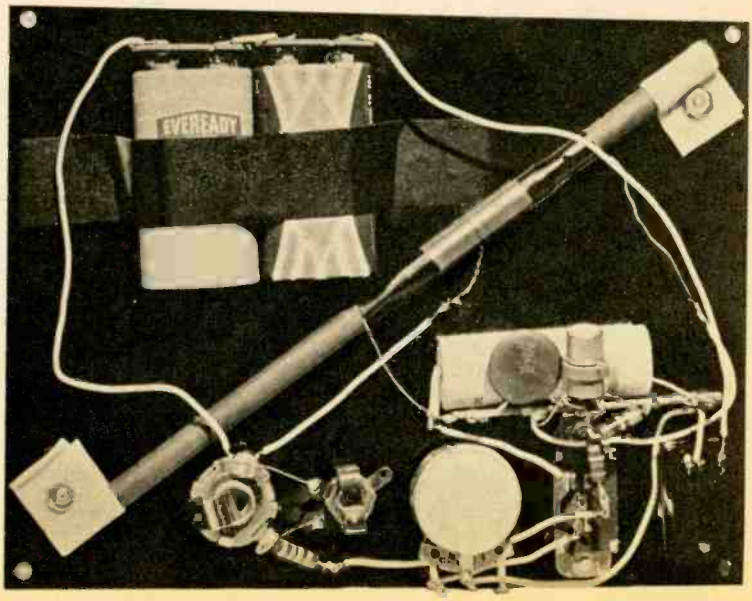
The parts arrangement is not critical. Our model was built in a 6¾ x 5¼ x 2¼ Bakelite box which you can see on the first page of this story. The loopstick coil and batteries can be held in place with brackets or tape.

Adjustments

While you should use the components specified in the Parts List, the operation of the circuit depends mainly on the characteristics of the loopstick, the transistor and the battery voltage. If the pitch range doesn't suit you, here are a few changes you can make: to get the siren tone to reach a higher pitch, reduce the size of C1. For a lower pitch, increase the size of C1. If you want the siren tone to die more slowly, increase the size of C2.

What's the Wireless CPO's range? It depends on several things. To use the CPO to transmit code through a *clear* spot on the dial where there's no QRM, you should be able to pick up its signal with a sensitive radio about 40 feet away. But that's outdoors and with the CPO's and radio's antennas oriented parallel to each other. Indoors, where there's a lot of metal around (steel building frame, wire lath in walls, metal desks and filing cabinets), the range will be somewhat less.

And one good way of increasing the range is to connect an antenna wire to the collector lead of the transistor. But don't use the Wireless CPO to practice code at the beach, where there may be transistor radios close by. If you do you may interfere with reception and that's against the law and will get you into trouble.



Rear view of our model. Best way to cut ¼ inch off end of loopstick is with a fine-tooth hacksaw. The ferrite is brittle and could break where you don't expect it to if you use a large pair of wire cutters. Use the mercury batteries we specify, rather than ordinary small 9-volt transistor-radio batteries, for longer life.

ALL-BAND SWL ANTENNA

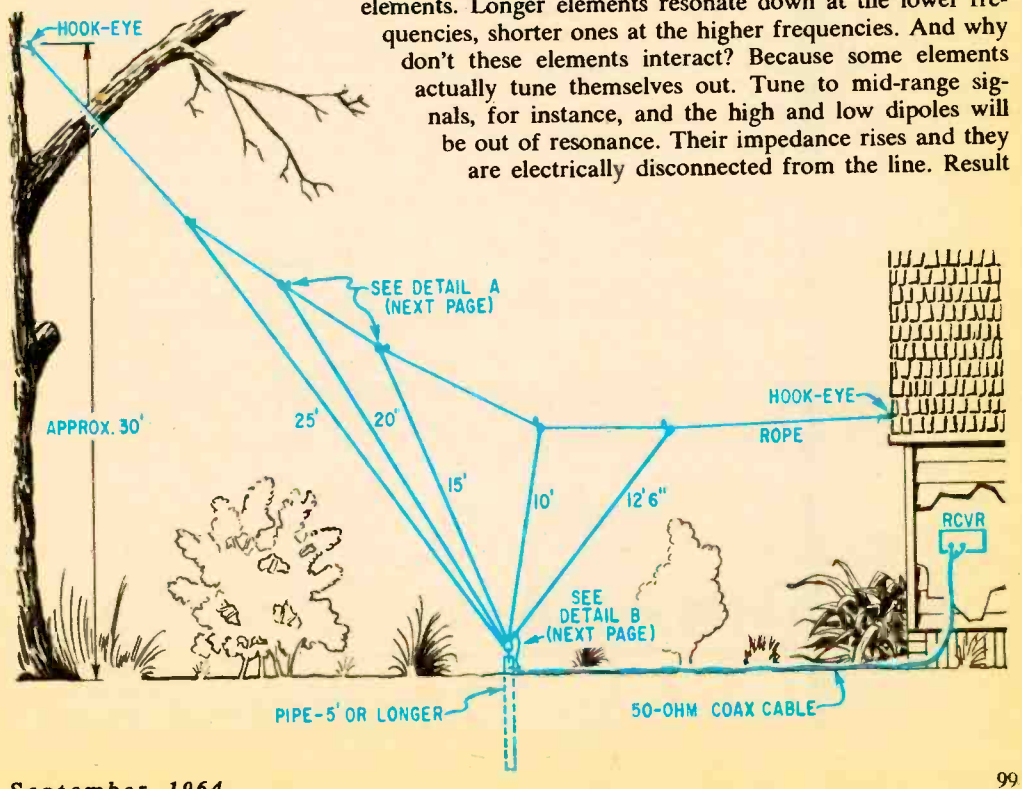
By DAVID WALKER

MOST SHORT-WAVE antennas are straight out of the book. Reason is that a short-wave listener needs an antenna recipe of some sort, and it's in a book that he finds one. Thing is, those bookish antennas largely are all chocolate or all vanilla. There's nothing in between.

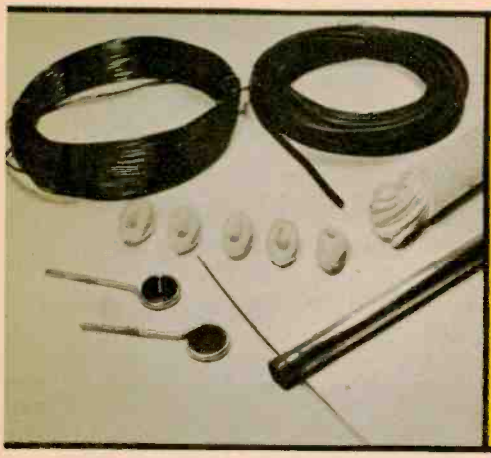
To put it another way, the SWL usually is given only two antenna choices: a long-wire for general coverage or a half-wave dipole cut for a specific band. And that's where the all chocolate or all vanilla comes in. Since that single wire is resonant only at certain spots on the SW bands, it obviously is a compromise. So, too, is the dipole, which must be cut for a specific frequency. To roam across a large span of frequencies and have good pickup everywhere there's only one answer. And that's an all-band antenna, specifically designed to pull in every frequency on the SW bands.

EI's all-bander overcomes the disadvantages of both the single wire and the dipole. It actually is equivalent to five separate tuned dipoles, though it doesn't require anything approaching the effort, expense or space. Better yet, it differs from both the single wire and the dipole in that it'll pick up DX from the four corners of the globe with equal facility.

EI's all-bander is designed to respond where it counts—in the important 6-to-18-mc segment of the spectrum where nearly all international short-wave stations are to be found. Secret of its outstanding performance is five different-length elements. Longer elements resonate down at the lower frequencies, shorter ones at the higher frequencies. And why don't these elements interact? Because some elements actually tune themselves out. Tune to mid-range signals, for instance, and the high and low dipoles will be out of resonance. Their impedance rises and they are electrically disconnected from the line. Result



SWL ANTENNA



MATERIALS

100 feet of #12 copper antenna wire
RG58/U coaxial cable
Six 2-hole egg-type strain insulators
Approximately 60 feet of heavy rope
Five feet of ½-inch diameter (or larger) copper pipe
Two screw-type TV standoff insulators

Photo at near right shows how antenna-support rope is held to house by screw-type TV antenna insulator from which plastic insert has been removed. Pull rope taut but before tying it, check that each element does not sag. Photo at far right was taken from house and shows dip and rise of author's support rope.

is that the all-bander is matched properly to its coaxial feedline over its entire frequency range.

Our bill of materials lists all the parts you'll need. It's a mere handful and won't cost over five bucks. Approximately 100 feet of copper wire is called for and this figure is relatively easy to pin down. The coax, in contrast, is cut to length after installation and naturally depends on the distance to your shack. Note that one end of a pipe is drilled to receive a short lengh of wire. The hank of line or rope is the kind used for clothes lines or for stringing a Venetian blind, though any type of strong braided rope will do.

Before starting work, study the pictorial on the first page with your house and lot in mind. Only one arrangement is shown, but you're not restricted to it except for certain dimensions. Note that the antenna consists of five wire elements which fan out from a copper pipe driven into the ground. The top support is a length of rope which both supports and spaces the wires. One end of the rope must be attached to a support approximately 30 feet off the ground. Easiest support is a tree, assuming one's handy. Simply drive a screw-in TV standoff (the hook-eye in the diagram on the first page) into the tree and tie one end of the rope to it. Anchor the other end of the rope to the side of the house in similar fashion. Height at the house should be at least ten feet.

The second important dimension is the distance between the house and tree; it should be at least 40 feet.

If rope height at either end is inadequate, long elements might slant excessively, causing the antenna to exhibit some directionality and to favor signals in the direction of the

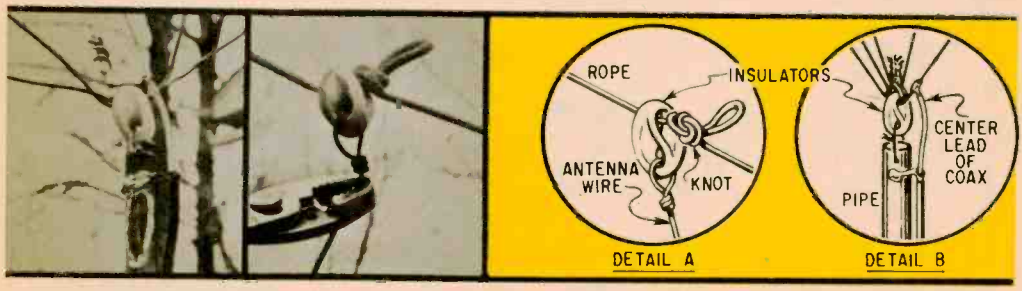
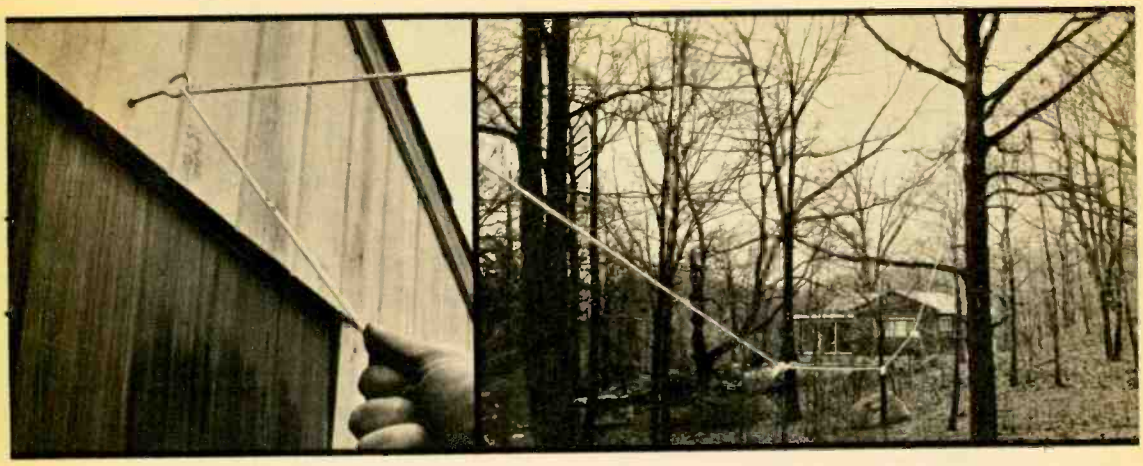


Photo at far left and diagram at far right show how all elements and coaxial cable are joined at pipe. Use a heavy-duty iron to be sure coax braid is well soldered to pipe. Photo at right and diagram at left show method of tying rope after the correct position has been established for each element's insulator.



slant. Some slant is acceptable, but be careful. Dimensions are not given for spacing between elements since it is only important that there be three or more feet between them where they attach to the rope.

With these points in mind, antenna layout can be jockeyed around to suit your lot and available supports. It's perfectly acceptable to mount the rope between two high supports. Shorter elements could be extended with additional lengths of rope. The way to do it is to connect the wire to an insulator, then tie a piece of rope to the other side of the insulator and run it to the main support rope, fixing it there so it doesn't slide.

After you've sketched a rough layout, drive the pipe into the ground to a depth of five feet or more. Attach one insulator to it with a short length of wire through two holes in the pipe. Thread the ends of the five antenna elements through the top hole of the insulator, twist the wires together and solder them. Solder the coax shield to the pipe and the inner coax conductor to the joined elements. The coax may be buried a few inches below ground between antenna base and house.

Next, attach five insulators to the other ends of the elements as shown in the photo and diagram. Through the other insulator hole, slip and knot the rope. To determine the final position of each element, have someone raise and lower the antenna at the house, as shown in the photo. Pull the rope taut to raise the antenna. A drooping element means the high support may not be high enough or the element is not at the right angle. An element that doesn't allow the entire antenna to be raised full height must be lengthened with a piece of rope connected to it with an insulator.

Connect the coax cable to the SW receiver as you would a doublet or dipole antenna. On two-terminal sets, connect the coax shield to ground (G) and the center lead to the antenna (A) terminal. Sets with two separate antenna terminals ordinarily come with a small link that can be connected between ground and one antenna terminal. Tie the center coax lead to the other antenna terminal and connect the shield to ground.

The antenna should pull in plenty of long-haul stations. It will be resonant at their frequencies, for one thing, and the vertical elements will favor skip signals which have traveled thousands of miles and arrive at a low radiation angle.

Rocky soil that does not have much moisture will not provide a good ground—which is essential for this antenna. If your soil is of that type, add several long lengths of bare copper wire to the pipe and lay them out like spokes of a wheel. Dig furrows several inches into the ground and bury the wires in them.

Fire up the receiver and roam the bands for a while. You'll be surprised at how much reception has improved and at how many new stations you pick up that weren't around before.

Junk the Car-- Save the Radio!

By LEN BUCKWALTER

Car radios beat AC/DC's and can be operated at home with these supplies.

WE HEARD about a man who couldn't part with his aging car because he was so enamored with the console-like tone of its radio. Far fetched? Not when you consider the important features car radios have.

Most have a tuned RF stage. This gives them sensitivity and selectivity—important when they're used in far-off places where signals may be weak, of equal strength and close together on the dial. They are solidly built to take a lot of vibration and bouncing around. And many car radios have a push-pull output stage that delivers high power to a large speaker in order to override the ambient noise level in the car. How many five-tube AC/DC radios can boast these features?

Think twice then before you rush out to buy that small table set for the den. A good second-hand car radio can be picked up at an auto junkyard for $10 or less. Build one of our inexpensive power supplies to operate the rig on house current and you'll enjoy the best AM sound you've heard in a long while.

One supply takes care of old 6-volt vibrator sets. The other, which furnishes up to 4 amps, handles most 12-volt radios. There are two 12-volt radios that, because of their high current consumption, can't be powered by the 12-volt supply. One is the relatively rare 12-volt vibrator set. The other is a 6- or 12-volt radio with a signal-seeking tuner, a motor-driven accessory that sweeps the dial to find stations.

Six-Volt Supply

Six-volt vibrator radios are the easiest to power. All it takes is 6 volts AC, which was formerly produced by the vibrator. Thus, the supply is merely a husky filament transformer which steps house current down to 6 VAC. Only a simply modification to the radio is required and it takes just a few minutes. A picture of the supply and its schematic are shown at the right.

If your filament transformer has a center-tapped secondary, clip the lead and tape its end to prevent a short. Remove the vibrator

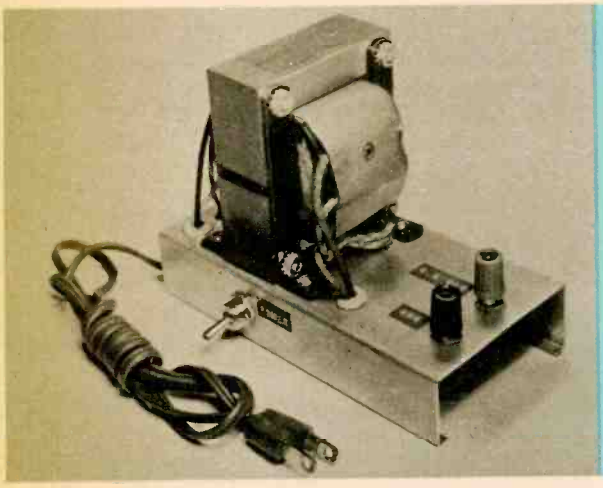
from the radio and connect *either* one of the small holes in its socket to ground. A convenient way to do this is to cut off one small pin from the vibrator, solder a wire to it, then connect the wire to the chassis. Or remove the radio from its metal cabinet and connect a wire from either small socket hole to ground.

Connect the radio's hot power lead to J1 and run another wire from its metal cover or chassis to J2. (Use No. 18 wire or lamp cord.) If there are two hot leads coming out of the radio, connect both to J1. Turn on the radio and leave it on. Power is now controlled by S1 on the supply.

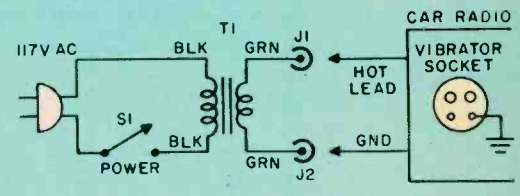
Connect a short length of wire to the radio's antenna jack and adjust the antenna trimmer capacitor for loudest sound on a weak station on the upper half of the dial.

binding posts J1 and J2 from shorting to the cabinet.

Filter capacitor C1 should be mounted with the fiber plate supplied with it. Mount C1 in this sequence: first, fasten C1 to the fiber plate by putting its tabs through the plate and twisting them. Second, solder two leads to C1's lugs—a light-colored wire to the inner or hot lug, a dark wire to either of the can's tabs. Third install two one-inch screws up through the bottom of the case and secure them with nuts. Fourth, put two additional nuts on the screws to serve as small platforms upon which the fiber plate will be mounted. Then adjust the platform nuts so there's plenty of clearance between the lugs and the bottom of the cabinet. Lastly, secure the plate on top of the screws. Connect the light wire to fuse F1



Six-volt power supply consists of only a filament transformer, toggle switch and insulated binding posts mounted on a 6⅛x3x1¼-in. metal chassis.



Six-volt power supply schematic. Ground either of the small holes in the radio's vibrator socket.

SIX-VOLT SUPPLY PARTS LIST

J1, J2—Insulated five-way binding post
S1—SPST toggle switch
T1—Filament transformer: primary, 117 VAC; secondary, 6.3 V @ 10 A. (Allied 61 G 418 or equiv.)
Misc.—Line cord, 6⅛x3x1¼-inch chassis (Bud CB-1628)

12-Volt Supply

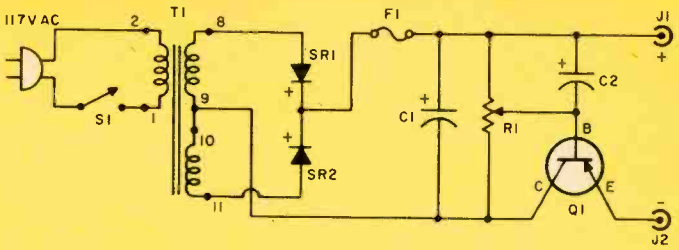
The 12-volt supply provides up to 4 amps of filtered DC for 12-volt radios. It contains a transistor regulator that permits you to vary the output voltage to compensate for the different power drain of tube and all-transistor jobs.

The most important thing to remember during construction is that there must be no electrical connections to the metal case. Great care must be taken to keep the transistor, diodes, the metal can of capacitor C1 and

and connect the lead from the can to Q1's collector (a solder lug).

Diodes SR1 and SR2 are insulated from the cabinet with special mounting kits mentioned in the Parts List. The detail drawing shows how they're mounted. It's important to drill burr-free holes to prevent shorts. Binding posts J1 and J2 and the two screws that hold Q1 must be fitted with two fiber insulating washers—one flat, the other a shoulder type. The case of transistor Q1 must be insulated from the metal cabinet with a mica washer and socket. We used a Motorola MK-15 mounting kit, which is mentioned in the Parts List.

Connect the 12-volt radio to the appropri-



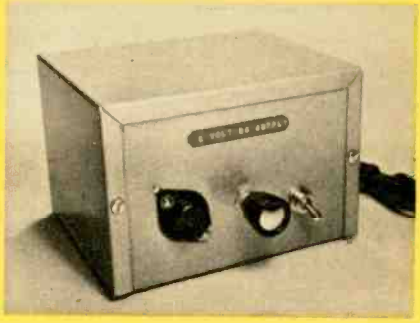
Twelve-volt supply schematic. Output of full-wave rectifier is filtered by C1. R1 is used to adjust supply's output voltage. Capacitance of C2 is multiplied by beta of Q1 to give additional filtering.

Junk the Car-- Save the Radio!

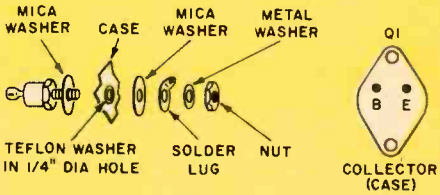
ate binding posts and turn voltage-control potentiometer R1 full counterclockwise. With the power switches on the radio and the supply on, rotate R1 until a voltmeter connected to the binding posts indicates 12 VDC *after* the radio has warmed up. There'll be a hum in the speaker, but this will last just a few seconds during warmup. Once the 12-volt setting is found for your radio, remove R1's knob.

Twelve-volt car radios can be operated between 12 and 14.5 volts, but 12 volts is recommended. If an especially large radio is used, the increased current drain at a higher voltage may introduce hum. Any transistor radio which requires less than 12 volts can be powered by the supply. Just use a voltmeter to find the setting of R1 that produces the correct output.

Inside of 12-volt supply. Note how C1 is mounted with its fiber mounting plate and long machine screws. Cabinet serves as heat sink for diodes.



Completed 12-volt supply. Case (collector) of Q1 must be insulated from box with special mounting kit. Use an ohmmeter to check for short between the case and box.

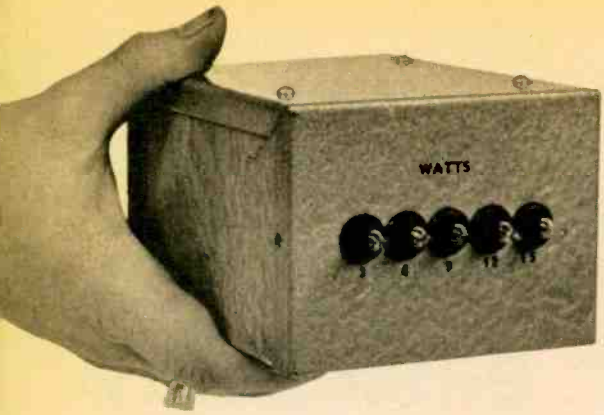


MOUNTING DETAIL, SR1, SR2.

Mounting details for SR1, SR2. Washers (supplied in mounting kit) must be used to insulate diodes' case from the metal cabinet.

TWELVE-VOLT SUPPLY PARTS LIST

C1—1,000-mf, 50-V can-type electrolytic capacitor (Sprague TVL-1338 or equiv.)
C2—1,000-mf, 15-V tubular electrolytic capacitor
F1—4 A type 3AG fuse and holder
J1, J2—Insulated five-way binding post
Q1—PNP power transistor; 2N176 or equiv. (Lafayette Stock No. SP-277)
R1—1,000-ohm, wirebound, pot
S1—SPST toggle switch
SR1, SR2—Silicon diode: 12 A, 200 PIV, 7/16-inch hex-nut stud type (Lafayette SP-267 or equiv.)
T1—Selenium-rectifier transformer: primary, 117 VAC; secondary, 12-29.8-V @ 4A. Stancor RT-202
Misc.—6x5x4-inch Minibox, Mounting kit for 7/16-inch hex-base diode (Lafayette SP-272), transistor mounting kit (Motorola and Allied Nos. MK-15), flat and shoulder washers.



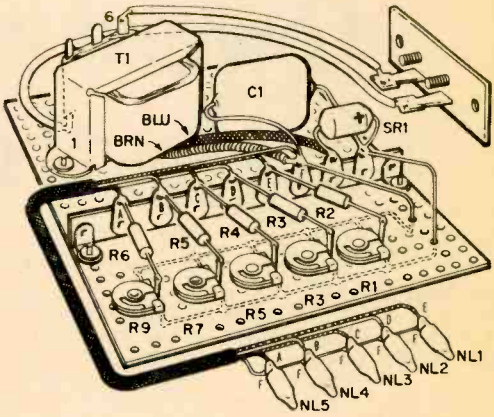
World's Simplest Audio Wattmeter

THAT last music passage may have sounded like 40 watts, but we'll bet the $6 price of this wattmeter it wasn't even close to that power level. Don't believe it? Then connect our wattmeter to your amplifier's speaker terminals. In a twinkle of the wattmeter's neon lamps you'll know what the approximate power is.

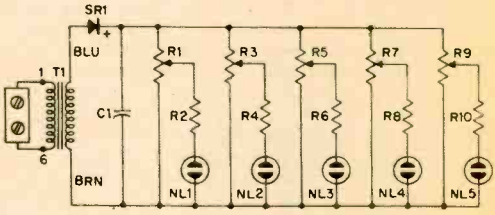
The circuit couldn't be simpler. The amplifier's output is stepped up by a reverse-connected output transformer, rectified and then filtered. The DC is then applied through pots to a bank of neon lamps each of which can be set up to light at a specific power level. For example, you can set R9 so NL5 lights at 3 watts. The other pots can be set so their associated neon lamps light in steps up to about 15 watts. We show T1 connected for an 8-ohm amplifier output. If your speaker is connected to the 4- or 16-ohm output, don't worry about it. Wattmeter operation will still be the same. The pictorial and caption have construction details. Connections between the neon lamps and terminal strip are identified with letters A—F.

To calibrate the wattmeter you'll need a 12.6-volt filament transformer, a 100-ohm pot and an AC voltmeter. First thing to do is use the formula $E=\sqrt{W \times Z}$ to determine the voltage at the amplifier's 8-ohm output terminals when the output is, say, 3 watts. E is the voltage you want to determine, W is power in watts (3) and Z is the amplifier's output impedance (8 ohms). Plug 8 and 3 into the formula and you get about 5 volts.

Connect the AC voltmeter to the input terminals of the wattmeter and set the 100-ohm pot until you get 5 volts. Now adjust R9 until NL5 just lights. If you want NL1 to light at the 15-watt level, set the 100-ohm pot so the input voltage is 11 volts, then adjust R1 until NL1 just lights.—*Bob Gaulin*



Mount parts on 3⅝x3½-inch perforated board. Mount board on standoffs so wiring on its underside doesn't touch inside of 3x4x5-inch Minibox.



Amplifier output is stepped up by T1 (reverse-connected) and rectified and filtered by SR1. C1. R1, R3, R5, R7, R9 set level at which neons light.

PARTS LIST

C1—.25-mf, 400-V tubular capacitor
NL1-NL5—NE-51 neon lamp
R1, R3, R5, R7, R9—500,000-ohm miniature potentiometer (Lafayette VC-61)
R2, R4, R6, R8, R10—100,000-ohm, ½-watt, 10% resistor
SR1—Silicon diode: 100 ma, 400 PIV or higher (Lafayette SP-196 or equiv.)
T1—Universal output transformer, 4 watts (Lafayette TR-12 or equiv.)

Hi-Fi Today

Continued from page 37

to you. And since you won't find these records listed in the Schwann Catalog as yet, you'd best check with your local dealer to see what's available.

From Czechoslovakia comes news of an antistatic vinyl material for making LPs. This could mean that dirty records are going to be a thing of the past, but I doubt it. Fact is, I have a hunch the Czechs simply have discovered one of the processes already in use here.

But whatever's happening on the other side of the Vinyl Curtain, there still is room for more and better record-cleaning gadgets. True, the Dust Bug, Preener, Hush Brush and Dustate all are good products. Even so, the perfect record cleaner — particularly for stereo record grooves—isn't yet with us.

Hi-fi is cramming in the crowds at the World's Fair, which fact scarcely surprises us older soaks. Manufacturers exhibiting at the Fair include Acoustic Research, Dyna, KLH, Scott and Shure, among others. And the Institute of High Fidelity has a separate exhibit designed to explain component hi-fi to the uninitiated.

To my mind, the most interesting audio goings-on at the Fair are the live-vs-recorded concerts held periodically at the AR exhibit. These affairs give you a chance to check the state of the audio art. And they also serve to remind you that live music, not electronic sound, is what hi-fi gear is meant to be judged by.

To end up where we started—on the subject of records, I see that Command Records has come up with something called Dimension 3 stereo. Command says their new technique gives more depth to the sound by filling in the center channel. Now a phantom middle channel may be a worthwhile development, but the boys at Command's ad agency are giving us to believe that you actually will hear a third speaker in your living room.

C'mon now, fellas. I don't particularly want the sensation of any speakers in my living room. Just the same, there may be something to that phantom-channel idea. Why not give it a listen and judge for yourself? —

Budget Battery Charger

Continued from page 43

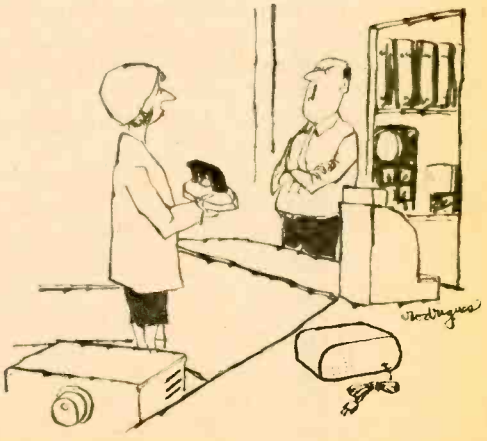
waste of time and effort.

A half-charged 6-volt battery will start charging at over 1 amp. Current will drop gradually to about 0.6 amp at full charge. This is not a quick-charge unit, but neither does it require careful timing and watching. Plan on charging at least overnight. The maximum length of time required to charge a completely discharged battery is about 48 hours. Charging current will drop automatically as the battery terminal voltage approaches the charger output voltage.

When a battery is badly discharged, it may draw a high current, causing the circuit breaker to open. This can be remedied by putting a 6- or 8-foot length of #18 wire in series with one clip and its corresponding battery terminal. This will reduce the current until the battery is partially charged, at which time the wire can be removed.

A full charge is indicated by gentle bubbling in each cell—like a glass of flat soda. Loosen the battery caps during charging to release gas, and don't charge in an enclosed area. Also, don't light a match to look into the cells.

The charger can be used to power a 9-volt transistor radio by setting S1 to 6 volts. The slight hum can be eliminated by installing C1 across the output terminals. This also will boost the output at this low drain to slightly over 9 volts.—*Fred Blechman, K6UGT* —



"Madam, I'm an electronics expert. Would you ask Einstein to add up your grocery bill?"

Tools

Continued from page 46

has had much of a chance to overheat.

After you obtain an iron you can think about buying a *soldering gun,* since there's no getting around the fact that for some jobs a gun's just great. Buy a high-wattage gun (200 or 250 watts). This way you'll have the necessary oomph when you need it and you always can fall back on the pencil for light work.

For homebrew projects, you'll need metal-working tools. Heading this list is an automatic *center punch.* Why automatic? Well, strike a standard punch with a hammer and you'll likely cave in an aluminum chassis. On the other hand, you simply press down on an automatic punch, thereby cocking a spring. When the spring fires, the point is driven into the chassis with no cave in. This dandy item is made by General Hardware.

You'll need an *electric drill* and we suggest a three-eighths rather than a quarter-inch model. If you get the lighter job you'll have to use necked-down drills for holes larger than ¼ in. And this is anything but good. Matter of fact, if you think you'll be drilling many large-size holes, purchase a slow- or medium-speed drill. They cut much cleaner holes of the larger variety.

And treat yourself to a full set of wire-gauge drills, plus ¼, 9/32, 5/16, 25/64 and ½ inch sizes. These will equip you for virtually every screw and mounting stud used in electronics.

You're going to punch tube sockets, so don't forget *chassis punches.* Stick with the Greenlee punches and pick up ⅝, ¾, 1 and 1⅛ inch sizes. A 1¼-in. also can be useful and 1½-in. is perfect for those low-cost miniature meters.

If you think you will be cutting odd-shape rectangles, the Adel *metal nibbling tool* should be on your list. This handy device will cut any shape hole in a standard-gauge chassis or panel.

For those large round holes—a 3½-in. speaker or meter opening, say—a left- and a right-hand *aviation snip* are the no-strain tools. They're also a lot safer than a circle cutter in an electric drill. In fact, for any large rounded opening you can't beat aviation snips. Kraeuter makes good ones, and you may as well pick up a pair of regular *tin snips* while you're at it.

While the above are basic tools for any electronics shop worthy of the name, there are some special items you might like to add. A combination *T-square,* a metal *tape rule,* a box of black *grease pencils* and a *scriber* all are useful for chassis layouts. A *hack saw* or, better yet, a low-cost *saber saw* is handy for heavy metal cutting. An *electrician's knife,* a set of *Allen wrenches,* a set of *open-end wrenches* to match your socket wrenches and a *screw-holding screwdriver* also are mighty nice to have around.

And, finally, while it really isn't an electronics item, a *bench grinder* can be an important asset. Not only does it keep your drills sharp and screwdrivers flat-faced, it's great for putting a point on grease pencils (ahem).

Once you start collecting tools for your shop, you'll find many we haven't mentioned. But we've tried to cover only the heavy-use items; things like *holding tweezers, heat sinks, jeweler's screwdrivers* and *hole saws* you'll accumulate as you go along.

Total up the cost of the tools we've mentioned and you'll likely be shocked. But then you don't have to get them all at once. It'll be quite good enough to add them one at a time. Just remember, though, that with rare exception it's less expensive when you buy the best in each case. Pick up a cheap something or other and you'll likely be buying another before you know it. And that kind of business is false economy, pure and simple.

Home TV Recorders

Continued from page 93

precisely what every would-be manufacturer in the field wants to keep as low as possible.

Perhaps the most important breakthrough that might make low-cost TV tape recorders possible lies in improved electronic circuitry. Here, most companies aren't talking. Wayne Johnson, designer of the Fairchild machine, says he uses information theory—a highly sophisticated branch of electronics—to get more information on each inch of tape. But he doesn't say what the technique is.

One group that has put its cards on the table is the one at the Illinois Institute of Technology. According to Marvin Camras,

[*Continued on page* 112]

New 1964 Heathkit® All-Channel Color TV

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(Includes chassis, all tubes, VHF & UHF tuners, mask, mounting kit, & special speaker) cabinet optional $49.00

Everyone Agrees It Outperforms Any Other, Is Easy To Build, & Saves Up To $400!

Here's What The Experts Say! Popular Electronics, May issue: "The GR-53A is not a skimpy receiver in which corners have been cut to keep costs down and still provide color TV. Instead, the GR-53A (on a comparison shopping basis) has the same color and sound fidelity, flexibility, and ease of handling as those manufactured receivers which sell for over $600."

Radio-TV Experimenter, June issue: "The repair cost savings during the Heath Color TV set's life compared to commercial units may be more than $200."

Popular Mechanics, February issue: "Mounted, pre-aligned critical circuits enable beginners to assemble. Picture quality is topnotch."

Science & Mechanics, April issue: "Built-in servicing circuits such as a dot generator are valuable aids in getting the set operating for the first time & eliminating expensive service calls & bills when realignment or part replacement is needed later on."

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CL-185R

Home TV Recorders

Continued from page 110

the tape-recording authority heading the group, IIT hopes to get across-the-tape recording—the kind used in professional machines—without use of rotating heads.

How? Well, IIT thinks it can use a recording head that puts a series of several hundred microscopic single-turn coils across the tape. An electron beam, similar to the one in a cathode-ray tube, would energize each one in turn, in effect sweeping across the tape.

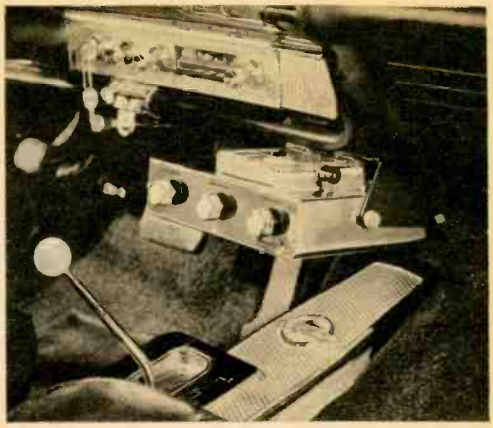
Old Movies. With all these many problems to solve, you may wonder how the machines announced so far actually perform. Answer is not bad, though much may remain to be done. Expressed in terms of bandwidth, the Fairchild machine produces a 2-mc picture at 120 ips.

Though the Par Ltd. machine hasn't been shown in public at this writing, its developers claim it produces a 3.5- to 4-mc picture at half the Fairchild speed: 60 ips. The average high-quality live picture you see on a well-adjusted TV set is not much better than this. At 30 ips, Par's engineers already have achieved a slightly-less-than-2-mc picture; this would look about the same way an old movie does on TV. And they expect a full 2-mc response at 30 ips.

Discs Again? While engineers may be on the verge of solving the technical problems, price still is rearing its head. Price in this case relates chiefly to the tape, which preferably should be the finest available. But the best also is the most expensive. And no matter what quality tape is used, the high speeds required with stationary heads means an entire reel spins though in less time than you thought possible.

One hope for a real price breakthrough in this area lies in a different recording medium: a magnetic disc. Idea is to use magnetic tape, for long recordings, discs for short ones. The tape-record would be coated with magnetic oxide, have an extremely narrow spiral track recorded on it. Already mentioned by the Par Ltd. group, such a disc should be relatively inexpensive, possibly sell for even less than a dollar.

But tape or disc, one thing's for certain. Home TV recorders, once only a distant dream, are *almost* with us. Tomorrow, they just might be here.



STEREO ON WHEELS

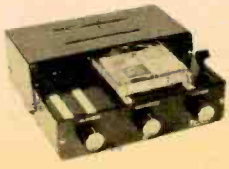
THE MUSIC you want when you want it never could be said of the car radio. It's always been catch-as-catch-can when you're on wheels, with two advertisements blasting from the speaker for every car you meet on the road. But those days well may be over. For this is the age of 4-track stereo tape, and what better place to put it than in the family flivver?

Though it measures a mere 4 x 10 x 10 in., the Muntz Stereo-Pak is a complete tape-cartridge player. And in that term *tape cartridge* lies the key to why the Stereo-Pak is great for cars, boats and most anything else on the move. Each cartridge plays up to two hours automatically; you never thread, wind or rewind.

The Stereo-Pak can be mounted most anywhere, though under the dash is a good spot as in our photo above. Four 5-in.-square speakers tucked away in the bottom part of your car's front doors set the air to moving, while any 12-volt electrical system (positive or negative ground) can handle the unit's modest power requirements.

Muntz Stereo-Pak Inc., 16032 Arminta St., Van Nuys, Calif. 91401 is the manufacturer; $99.50 is the price for cartridge player and speakers, fully installed and ready to rip.

—Jerry Lynn



Fully transistorized, the Stereo-Pak draws about 500 ma and plays continuously. Its cartridges contain 4-track stereo tapes moving at 3¾ ips.

This New Heathkit® FM Stereo Tuner At $49.95...

Plus ... This Heathkit® 16-Watt Stereo Amp At $39.95...

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Start With The New Heathkit AJ-13 Stereo Tuner! First you'll like the ease with which it operates ... just three controls—On/Off-FM-Stereo Selector ... a Tuning Control ... and AFC On-Off switch. What could be simpler?

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Who Really Invented Radio?

Continued from page 85

Capitol. But two years after its introduction, the appropriation bill still was tied up in committee.

Representative Bingham then introduced a new bill in the House, one which would incorporate the Loomis Aerial Telegraph Company with the right to sell up to $2 million in stock. That bill finally was approved in January 1873, after Loomis had patented his system.

But the incorporation measure lacked an appropriation. Loomis still had to sell stock in his new firm to gain critically needed financial support and this never is easy. At that time the country had not recovered from the jolt of Black Friday. And the few investors that could be found wanted something more secure than promises of wireless communication—an idea which brought chuckles among even some of the well-informed.

Loomis died at his brother's home in Terra Alta, W. Va., in 1886, impoverished and disheartened. He believed that history had passed him by and that others some day would get the credit which rightfully was his. He had spent the last 20 years of his life in unsuccessful attempts to gain financial support. Never was he given the chance to develop radio (or wireless, if you prefer) to a practical commercial level. George Loomis, his brother, attributed to him this death-bed statement: "I shall never see it (radio) perfected, but it will be, and others will have the honor of the discovery."

In recent years, however, there has been renewed interest in the work of Loomis. Foremost among his champions is Dr. Otis B. Young, director of atomic and capacitor research at Southern Illinois University. At the 1963 meeting of the Illinois State Academy of Science, Dr. Young reported on the work of Mahlon Loomis. And he went on to claim that the little-known dentist deserves more credit than anyone else for inventing radio.

Reaction to Dr. Young's report has varied, but most of those contacting the SIU scientist simply have asked for more information about Loomis. There was a significant international response, too. Perhaps the most notable letter from afar was that of R.W. Bell, historian for the Marconi Co. Ltd. in Chelmsford, Essex, England. Significantly, this firm was founded by Marconi himself in 1897.

"A fact which is perhaps often overlooked," Bell wrote, "is that Marconi never claimed to have invented radio and always readily acknowledged the use he had made, in evolving his wireless system (his first experiments took place in 1895), of knowledge already acquired, and theories already formulated, by others."

Has history done Loomis great injustice? Dr. Young, among others, believes it has. He contends that Loomis was ahead of his time, that society was not ready to accept his accomplishments. Had it not been for Black Friday, the great Chicago fire and the reluctance of Congress, Dr. Young says, the star-crossed Loomis would have received the financial support he needed. With it, he likely would have developed radio to an extent that credit could not be denied him.

How much credit does Mahlon Loomis really deserve? Perhaps his place in history was best nailed down in his own time by one of his supporters. Said Senator Sumner, in presenting the Loomis appropriation bill to Congress, "It is certainly (either) a great case of moonshine, or it marks a great epoch in the progress of invention."

—Robert G. Hays

Ham Shack

Continued from page 55

ship's officer, and his vessel at the time was out of the Panama Canal and headed for Louisiana. Wish we could talk Japanese a tenth as well as he talks English!

Signs Of The Times . . . One of these days we intend to have a large sign made up for the wall of our shack. It will read something like this, and it will save us a lot of repeat performances.

NOTICE TO INTERESTED VISITORS

1. No one has the slightest notion as to why radio amateurs are called hams. They just are.

2. Hams never broadcast. When they communicate, they are said to be working each other.

3. Hams do not transmit messages for pay. That's the job of Western Union, RCA Communications, etc.

4. Yes, this equipment not only looks expensive, it is.

5. No, neither one of us is on Candid Camera.

A MESSAGE TO ELECTRONIC BUFFS—

DON'T JOIN THE ARMY UNLESS

unless you want to build a career in Electronics. The sky's the limit in this field, if you have the right training. The Army is the place to get that training. And the Army will keep you trained as you move up to positions of increasing responsibility.

unless you want your future to be automation-proof. No matter how far automation goes, men with electronics training will still be in demand in tomorrow's Army.

unless you want premium pay for doing work that you'll enjoy. As you advance in grade and increase your skill, you can earn from $50-100 extra per month in proficiency pay.

unless you want travel... adventure...and responsibility. Army electronics specialists are stationed in many countries throughout the Free World. Doing work that is exciting, stimulating, and vital to everyone's safety.

unless you care enough about your Country to serve it.

If that sounds like just what the doctor ordered, talk to your Army Recruiter soon. And ask him about Army electronics training.

If you're good enough to get in...a proud future can be yours in the new action

Army

Shocking Facts on Electric Shock

Continued from page 79

323 of those—more than 77%—were saved by artificial respiration. Most recovered in 20 minutes, but some victims took as long as four hours to start breathing on their own again.

What to do if someone suffers a severe shock?

First, remove him from contact with the current. Cut off the current if at all possible. If not, insulate yourself from the victim with rubber gloves, several thick layers of dry clothing or a heavy wad of newspapers. In any case, don't get yourself shocked from the same source.

Second, if the victim has stopped breathing, give artificial respiration immediately. And keep it up, even if he doesn't come around. If help is available, have someone see if his heart is beating; if not, closed heart massage can be attempted. (Artificial respiration and even closed chest massage methods should be familiar to those working in areas where first aid may be needed. They are relatively simple and can be taught by the Red Cross or your doctor.)

Third, get a doctor. Though it's not common, a person can feel well after the shock but suffer some side effects weeks or even months later. A physician is trained to be on the lookout for hemmorhages, eye damage, burns, personality changes and other possible effects of electric shock.

Most important of all for you, avoid getting shocked. If there's an electric storm, get inside the house and shut the windows. If you're caught outside in the country, stay in your car with windows closed or get into a cave, under a *large* clump of trees or in a ditch. Keep away from hilltops, lone trees, river banks, ground rises, poles of any sort and wire fences.

In your workshop, see that appliances and electronic gadgets are insulated properly. Know your equipment well and wear dry shoes (and even rubber gloves, if necessary) when puttering around hot chassis or other open circuits. And always provide a direct path to ground for any antennas you happen to have around.

Remember, both the fun and use of electronics is in controlling electricity. Don't let it get out of control. But if it does, know what to do.

The Dangerous VOM

Continued from page 75

voltage by the mid-scale resistance of the range you're using. (Don't assume every VOM has only one 1.5-volt battery; some have two.) The important thing to remember is that the lowest ohmmeter scale is most dangerous.

One popular VOM has a center-scale resistance of 4.4 ohms. It has one 1.5-volt battery, which means that when the range switch is in the R×1 position, the shorted-probe current will be 340 ma—much too much for many diodes.

VTVM's also can cause trouble. Study the circuit in Fig. 5 and you'll see that the shorted-probe current is determined the same way that it was for the VOM. You divide the battery voltage by the center-scale resistance of the range used.

After checking out your meter, why not put a label on the back of it with the short-circuit current for each range. Consult that label, abide by it, and you can't go wrong.

The Listener

Continued from page 80

station at 2305 EST way back on March 2. Though we battled valiantly to hold it, the absolute end came with a complete fadeout at 2320.

Box score: four very general items without a clincher like sponsor or announcer's name. Strategy: tune in same time, same station the following day. Outcome: though a king-sized buzz engulfed the band, we gave it a try nonetheless. Naturally, we more or less flipped when S.R.B.C. at Gwelo did cut through the QRN for some seven minutes.

In the end we wound up with plenty of program data, though reception never was better than lousy. Plain lucky we were, since there are times when you tune back the next day and come up with absolutely nothing. Just the same, this trick always is worth a try. Thing is, it's best to be prepared for the worst and never count on even having a chance at a second round. After all, you never know when that second chance will be exactly like lady luck—the old girl who continually says maybe but who really means either yes or no.

Calibrated Bandspread for CB

Continued from page 30

corresponds to CB channel 23. Similarly, plug in other crystals to calibrate the bandspread dial for all CB channels. Make another adjustment to C11 while receiving a station in the middle of the Citizens Band—channels 9 through 12.

To listen to CB after the receiver has been used to tune other bands, merely set the receiver's main-tuning pointer to the point jotted down previously. Zero on the bandspread dial again will correspond to channel 1. After tuning in a CB station, peak the signal with C1. Any station that sounds strong but distorted probably is overloading the SW receiver. This is cured through reducing the gain by backing off R1.

Troubleshooting. If wiring is correct but the preamp doesn't work, the problem may be caused by small differences in wiring layout which may have affected the tuned circuits. If adjustment of C1 does not help matters, try reducing the number of turns on L2. To do this solder a short piece of bare wire to one end of L2 and wedge it between successive turns, shorting out one turn at a time. Adjust C1 throughout its range during each trial until the preamp works.

The same technique should be used for coil L4 if the oscillator fails to operate. Coil L3 is adjusted the same way.

CB Corner

Continued from page 64

this is the width of just one sideband. Conventional rigs create two identical sidebands, and a 2-kc tone doubles out to 4 kc in transmission.

Just how much bandwidth you can occupy is stated in FCC rules; they allow an 8-kc spread (4 kc above and below the carrier). Say a word like "sassafras" and those "s" sounds may hit close to 4 kc, then fatten out nearly to the 8-kc limit.

Now run a single-sideband rig onto the channel. Since it rams everything into one sideband, a gaping hole some 4-kc wide exists on the channel. Another sideband station can slide into that unused pocket and jabber away with no interference. Result: two SSB rigs can share, say Channel 7, at the same time.

Such split-channel operation requires that one transmitter be on upper sideband, the other on lower. Happily, the new Mark rig provides a sideband selector switch to give the operator a choice. Equipped with five transmit crystals, the rig therefore can work ten of the split-level channels.

This kind of wizardry comes at a price, of course. The SSB-27 hits you for just under $300 and contains circuits considerably more complex than usual gear. Some 17 tubes, nine diodes, crystals inside ovens and special filters make the unit an elaborate (yet surprisingly compact) package. But with it, the CBer enters the other-world of SSB—replete with socko signals and twice as many channels.

The Scrounger

Continued from page 54

tone, not a wheep-wheep. It's best to use your receiver, rather than the keying monitor, for C1's adjustment. And speaking of the keying monitor, since it was designed specifically for the Scrounger, don't try to use it with another transmitter.

If you don't want to use an antenna coupler, a simple 80-meter dipole (that can be plugged directly into J2) can be made by connecting two 62½-ft. long pieces of wire from each side of a glass insulator to two supports (use insulators at each end). The feedline to the transmitter from the center insulator should be 72-ohm twinlead.

Stereo FM Receiver

Continued from page 71

This causes diode action in the multiplex adaptor's input tube, which loaded down the ratio detector (to which the multiplex adaptor is always connected). This was the cause of the high distortion. EICO has prepared an addenda sheet modifying the circuit to keep the B+ on when the mode switch is in the mono FM mode. We suggest you obtain a copy of this correction sheet before starting your kit, or to modify earlier models. After these changes were incorporated in our unit, performance improved significantly and the 2536 met or exceeded the claimed specs. Performance of the amplifier section of the 2536 is quite good and essentially the same as EICO claims. Specs appear in the table.

With all corrections incorporated, you'll find the 2536 a good performer.

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