

ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED

NOVEMBER • 354

Build:

Monitor Meter for CB or Hams

Portable Radio Signal Booster

Wireless Telephone Extension

New Type Proximity Detector

SWL Weather-Wave Converter

Miniature Slave Photoflash



**ADD DOUBLE CONVERSION
TO YOUR CB TRANSCEIVER**



Dig that Crazy Music!

Upgrading Your License

How to Choose an FM Antenna

New SWL Award for Beginners

How to Publish a Good CB Club Paper

What to Do When Your TV Goes

Next Best Thing to Being a Ham

All About Power Transformers

Exclusive!

**BUILD YOUR OWN LOW-COST
ULTRASONIC CLEANER**

Prepare Now For The Higher Rewards The Electronics Age Offers You

There is an immediate and growing need for trained technicians in Industrial-Military Electronics, Radio-TV Servicing and Communications. Better than average jobs with high pay, interesting work, bright futures await you in the fast growing industry of the 1960's. Join thousands of NRI graduates now benefiting from career opportunities in this Electronic Age.

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NRI "learn by practice" training is the time-proved way to higher earnings and advancement. Except for FCC License course, all NRI courses include—at no extra cost—special training equipment to give shop and laboratory experience in your own home. Equipment is yours to keep. Makes NRI training come to life in an easy-to-grasp, interesting manner.

JOB COUNSELORS RECOMMEND

Today, a career in any branch of Electronics offers unlimited opportunity. Job Counselors advise, "For an interesting career, get into Electronics." The National Association of Manufacturers says: "There is no more interesting and challenging occupation in American industry."

NRI can provide the training—right in your own home and in your spare time. No need to go away to school. There are no special requirements of previous Electronic experience, or education in particular subjects. Mail postage-free card now. Read about Electronics opportunities, about NRI courses, about NRI trial plan.

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National Radio Institute,
Washington 16, D. C.



Industrial ELECTRONICS

The NRI course in Electronics—Principles, Practices, Maintenance prepares you for a career as an Electronic Technician in industry, business, government, the military. Computers, telemetry, automation, missiles, rockets all employ the same basic Electronic principles . . . and that is what this NRI course stresses with illustrated lessons, special training equipment.



Commercial FCC LICENSE

You must have an FCC License if you want to operate or service transmitting equipment used in TV and Radio Broadcasting, aviation, marine, microwave, facsimile or mobile communications. Even a service Technician needs an FCC License today to work on C-Band Radio equipment. From Simple Circuits to Broadcast Operation, this new NRI course trains you quickly to take Government exams.



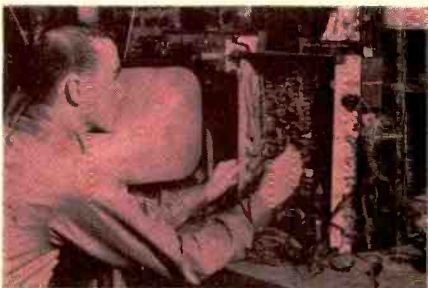
TV-Radio COMMUNICATIONS

In NRI's Communications course you get *actual experience* as NRI trains you for your choice of Communications fields. Commercial methods and techniques of Radio-TV Broadcasting; teletype; facsimile; microwave; radar; mobile and marine radio; navigation devices; multiplexing are some of the subjects covered. You work with special training equipment.



Radio and TV SERVICING

NRI's time-tested course in Servicing not only trains you to fix radios, TV sets, hi-fi, etc., but also shows you how to earn spare-time money starting soon after enrolling. Fast growth in number of sets means money-making opportunities for you in your own spare-time or full-time business, or working for someone else. Special training equipment at no extra cost. Mail postcard.



WHERE YOU TRAIN IS AS IMPORTANT AS YOUR DECISION TO TRAIN



NRI is America's oldest, largest home-study Electronics, Radio-Television school. NRI teaches *only* by home-study. The interests and efforts of our carefully-selected staff are devoted exclusively to this method of training. For nearly 50 years NRI has maintained the confidence and respect of students, graduates, and the Electronics Industry for constantly providing the best possible home-study training, at a cost most anyone can afford. For the complete NRI story, mail the postage-free card at the left. This could be the most profitable move you ever made.

For Nearly 50 Years NRI Has Been The Leader In Training At Home For Electronics, TV-Radio



J. E. Smith,
Founder—1914.

It takes a growing industry to give qualified men the best opportunity to advance and prosper. That's why so many men are deciding on a career in Electronics. But, even more important is *where* you get your training, and *how* the school of your choice teaches Electronics . . . how it trains and encourages men to reach their goals and realize their ambitions. It takes a growing

school—with years of specialized experience behind it—to do that for you.

This is a fast changing world, and a school offering Electronics courses must keep pace. The NRI staff of more than 150 is on the job every minute to see that course material is up-to-date . . . to see that you get all the help and advice you need . . . to assist you in job placement when you're ready, even to help you earn your way while you train. In short, whatever branch of Electronics you select, NRI is well qualified to help you grow in your new career . . . in usefulness, in prestige, in monetary gain.

NRI's Outstanding Staff Is Directed By These Men

DIRECTOR OF EDUCATION, William F. Dunn, supervises lesson preparation, training equipment development, consultation services, lesson grading. He heads a full staff of instructors and advisors.



SUPERVISOR OF TRAINING, J. B. Straughn, is particularly concerned with NRI home-training equipment and its integration into course subject matter.

CHIEF TECHNICAL EDITOR, James P. Tate, Jr., heads a staff whose concern is the careful writing, editing and illustrating of lesson texts, keeping lessons up-to-date.



DIRECTOR OF PUBLICATIONS, Oliver Read, was formerly editor and publisher of Electronics World magazine; publisher Popular Electronics and Hi-Fi Stereo Review magazines.

ELECTRONICS ILLUSTRATED

November 1962

A Fawcett Publication

Vol. 5, No. 6

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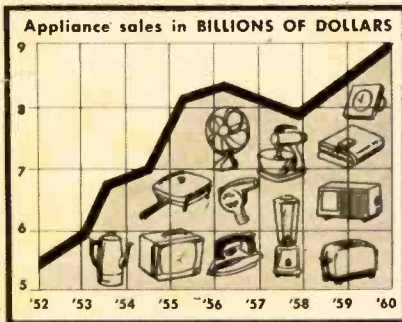
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Record-Shattering Boom in Electrical Appliances Opens Up Exciting Profit Chances for Men Who Can Repair Them

OVER FOUR HUNDRED MILLION electrical appliances are in use right now in American homes—and are increasing at the rate of 76 MILLION a year! No wonder that men who know how to service them properly are making \$3 to \$5 an hour—in spare time or full time. FREE BOOK tells how you can quickly and easily get into this profitable field.



(Above) Based on chart in Electrical Merchandising Week Magazine.

Just look at how dependent American homes have become on electric appliances!

Here are some of today's common appliances, and the number of U.S. homes containing each.

Air Conditioners (Room).....	6,500,000
Bed Coverings.....	10,800,000
Clocks.....	40,268,000
Coffee Makers (automatic).....	27,000,000
Freezers.....	11,200,000
Frypan Skillets.....	20,600,000
Heaters, Portable (Elec.).....	14,415,000
Heating Pads.....	19,925,000
Hotplates.....	12,105,000
Irons (Standard).....	44,850,000
Steam Irons.....	28,200,000
Mixers.....	27,000,000
Ranges.....	17,200,000
Refrigerators.....	49,605,000
Sandwich-Waffle Comb.....	17,615,000
Shavers.....	34,500,000
Toasters.....	40,195,000
Vacuum Cleaners.....	36,700,000
Washers.....	47,100,000

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with this
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TESTER**
— Yours at No
Extra Charge



Course includes all parts to assemble a portable, sturdy Appliance Tester. Use it to locate faulty cords, short circuits, poor connections, etc. in a jiffy; find defects in house wiring; measure electricity used by appliances; many other uses. Helps you earn while you learn.

THE "ELECTRICAL APPLIANCE BOOM" is in full swing. For example, annual sales of coffee makers have zoomed in the last decade from 900,000 to 4,750,000. Room air conditioners have gone from 200,000 a year to 1,800,000 a year. In just the last five years Americans have bought 26 million electric fans, 9 million electric heaters, 5 million deep-fat fryers!

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.

We Tell You Everything You Need to Know

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

You can handle this work anywhere—in a corner of your basement or garage, even on your kitchen table. And you can earn \$3 to \$5 an hour—get back the cost of the course before you finish it. No technical experience, or



higher education necessary. We tell you and show you everything you need to know, in plain English and clear pictures. And the training costs you less than 20¢ a day!

FREE BOOK and Sample Lesson

Our 24-page Free Book tells about America's "Electrical Appliance Boom"—how we train you to "cash in" on it. Free Sample Lesson shows how simple and clearly illustrated our instruction is—how it can quickly prepare you for a profitable future. Mail coupon, letter, or postcard to: *National Radio Institute, Dept. KM2, Washington 16, D.C.* (No obligation—and no salesman will call on you.)



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Dept. KM2, Washington 16, D.C.

Please send me Free Book about your Electrical Appliance Repair Course and a free Sample Lesson. I am particularly interested in:

Spare Time Earnings Business of My Own Better Job

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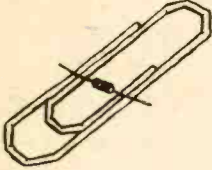
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Write to: Letters Editor, Electronics Illustrated,

67 West 44th St., New York 36, N. Y.

● The Latest



Last fall you printed my letter about my company's transistor, the 2N $\frac{1}{2}$, which was half as big as an ant (FEEDBACK, November '61 EI). Now I want to report on another product, a resistor that makes a pencil look like Mount Everest. Our ads show one lying on a paper clip. We haven't sold many resistors but the paper clips are going like mad. Anybody want to buy a million?

Sid Prescott
Ultra Electronics
& Paper Clip Co.
Houston, Tex.

We always heard Texans thought BIG, Sid.

● Speakers & Such

I have just completed the Duoflex speaker system (July '62 EI) and have compared it not only with a popular multi-speaker system I built, but also with a second system having a 12-inch woofer and compression tweeter.

I was so pleased with the Duoflex that I like it better than either of the other two. It's remarkable. I used the speakers you specified and did not add the tweeter. The sound is hard to believe; it's so natural, and all the tones are present from the lows through the highs. I'm surprised it could sound so good and cost so little. I have less than \$15 invested in it.

Benjamin D. Morgan, Jr.
Denver, Colo.

I have read your article on multiple speaker systems (March '62 EI) and, frankly, I can't agree with you on any detail in regard to your appraisal of

multiple speaker systems.

I built a 28-speaker job that was written up in an audio magazine and I am well pleased with the sound . . . It cost me less than \$100 for speakers, cabinet and all.

O. C. Hoggren
Chicago, Ill.

We certainly wouldn't argue with you about how your speaker sounds to your ears, but we do have some objective data on its resonant peaks and poor frequency response since we built the same model. Our point was that you could get better sound for less money.

● Sparks

Your article on the CRADLE OF U. S. WIRELESS (July '62 EI) shows you should have looked a bit deeper. You confuse spark radiotelegraphy with continuous-wave radiotelegraphy (in saying Marconi used CW). To anyone who remembers the hot battles between proponents of the two systems, such a mistake seems unbelievable.

Carl C. Drumeller, W5EHC
Oklahoma City, Okla.

We missed the big battle, Carl, but we should have known better, anyway.

● More About Clubs



A change has been made since your article ALL ABOUT RADIO CLUBS
[Continued on page 6]



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projects
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**HOME
LABORATORY**

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these units to
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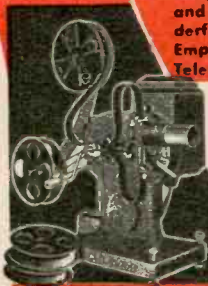


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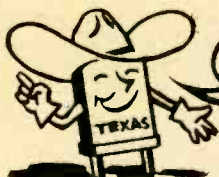
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Matched crystal sets for ALL CB units (Specify equipment make and model numbers) **\$5.90 per set**

CRYSTALS IN HC6/U HOLDERS

SEALED OVERTONE .486 pin spacing — .050 diameter — .005% tolerance
15 to 30 MC **\$3.85 ea.**
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Pin diameter .093 Pin diameter .125

CR1A/AR holders FT-171 holders
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Amateur, Novice, Technician Band Crystals

.01% Tolerance **\$1.50 ea.** — 80 meters (3701-3749 KC)
40 meters (7152-7198 KC), 15 meters (7034-7082 KC), 6 meters (8335-8660 KC) within 1 KC
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Pin spacing 1/2" Pin diameter .093

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FEEDBACK

continued from page 4

(July '62 EI). Anyone may now become a full member of the Canadian DX Club.

Alan Leith, DX Editor
Sydney, N. S.

CADEX's Associate Memberships (for non-Canadians) have been abolished and all members have voting rights. However, the four-man Executive Council remains a Canadian-only affair to insure the Canadian outlook.

John Harvey
Lewiston, N. Y.

Your article on radio clubs left a distorted view of activities, I'm afraid, by indicating the only real value in a club was the mimeographed bulletin. To me, the most important aspect is the personal contact. From 40 to 60 DXers get together for National Radio Club conventions. Obviously, the club means more to its members than just a bulletin.

John Callarman
Pampa, Tex.

● The Question



I wish to know whether it is possible to produce alpha particles by using some simple apparatus composed of tubes. If it is, please give me the name of the equipment.

William Maksymink
Montreal, Que.

You don't have to build anything to get alpha particles, Bill. They are emitted naturally by such radioactive elements as uranium and radium. The only question here is in knowing whether what you're getting really is alpha particles. Alpha detectors are pretty elaborate and expensive.

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What you do about your future is up to you. Do nothing and stay at your present job at the same old pay. Or earn an I.C.S. diploma in your spare time for security, promotions, more pay! Your first step is to mark the course that interests you in the coupon below, and mail it to us.

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Small investment now means big gains later

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The security of your present job—or the success in finding the new job you've always wanted—is in your hands. Move ahead with I.C.S. training while others stay behind on the routine, small-pay jobs. Remember, your first step to security and success is to mail this coupon. Take a few minutes and do it now. Putting it off will put you further behind in the race for higher pay and real job security.

Clip coupon here—and take your first big step to real success! I.C.S., Scranton 15, Penna.

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- Interior Decorating
- Magazine Illustrating
- Show Card & Sign
- Painting
- Sketching and Painting

AUTOMOTIVE

- Auto Body Rebuilding
- Auto Electric Technician
- Automobile Mechanic
- Engine (Gas & Diesel)
- Engine Tune-Up

- Transmission Specialist

AVIATION

- Aero Engineering
- Aircraft Drafting
- Aircraft Mechanic

BUSINESS

- Accounting
- Cost Accounting
- Public Accounting
- Bus. Administration
- Executive Training
- Marketing
- Personnel-Labor Relations
- Programming for Digital Computers
- Purchasing Agent
- Real Estate
- Salesmanship
- Sales Mgmt.
- Small Business Mgmt.
- Traffic Mgmt.

CHEMICAL

- Analytical Chemistry
- Chem. Engineering
- General Chemistry

- Lab. Technician
- Nuclear Energy
- Plastics
- Pulp, Paper

CIVIL ENGINEERING

- Civil Engineering
- Construction Engrg.
- Highway Engineering
- Reading Structural Blueprints
- Sanitary Engineering
- Structural Engineering
- Surveying & Mapping

DRAFTING

- Architectural
- Electrical and Electronic
- Mechanical
- Sheet Metal
- ELECTRICAL
- Elec. Appliance Servicing
- Electrical Engineering
- Elec. Eng. Technician
- Elec. Motor Repairman
- Industrial Electronic Technician

- Industrial Telemetering
- Instrument Technician
- Practical Electrician
- Practical Lineman

ELECTRONICS

- Automation
- Basic Electronics
- Electronic Computers
- Electronics Technician
- Hi-Fi Stereo and Sound Systems
- Industrial Electronics
- Ultrasonics

ENGINEERING (Professional)

- Chemical
- Civil
- Electrical
- Mechanical

ENGLISH and WRITING

- Better Business Writing
- Introductory Technical Writing
- Short Story Writing

Practical English

HIGH SCHOOL (Diploma)

- High School General
- High School Math
- High School Secretarial
- High School Vocational
- College Preparatory

MECHANICAL and SHOP

- Gas and Electric Welding
- Industrial Engineering
- Industrial Instrumentation
- Machine Design
- Machine Shop Practice
- Mechanical Engineering
- Reading Shop Blueprints
- Tool Design
- Toolmaking
- Safety Engineering

SECRETARIAL

- Clerk-Typist
- Professional Secretary

- Shorthand
- Stenographic
- Typist

STEAM and DIESEL POWER

- Boiler Inspector
- Power Plant Engineering
- Stationary Diesel Engineering
- Steam Engineering

SUPERVISION

- Foremanship—Suprv'n
- Foreman—Lab. Rel'n's

TV, RADIO

- Radio and TV Servicing
- Radio-Telephone License
- TV Technician
- Practical Radio-TV Engineering

MISCELLANEOUS

- Railroad
- Textile
- Other (please specify)

Name _____ Age _____ Sex _____

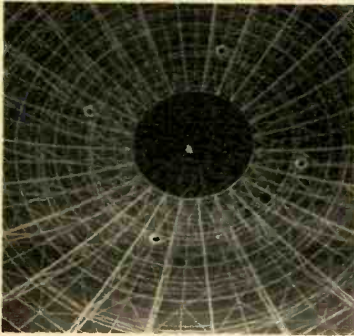
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City _____ Zone _____ State _____

Occupation _____ Working Hours _____

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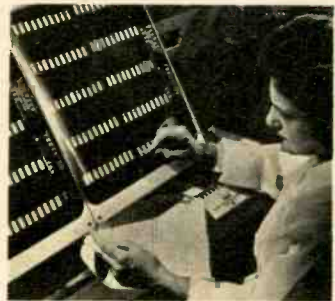
...electronics in the news



What Is It? . . . You might guess our photo shows a sand sifter or circus net . . . or a parabolic reflector for an antenna, which is what it is. The 84-foot dish was built by Goodyear Aircraft for the Air Force's ballistic missile early warning radar system, and will be installed with two other antennas at Fylingdales Moor, England. A 140-foot diameter radome will protect each reflector against high winds and bad weather. If you look closely at the center square you may be able to see two engineers making final terminal connections. The project is under the aegis of the Radio Corporation of America.

An Ounce of Prevention . . . It's unfortunate but true that not a few U. S. space shots have never quite made it because of minor component breakdowns. The Bell System, when working on its experimental communications satellite, Telstar, took no chances. Component suppliers were given stiff specs and double- and triple-checking was required.

Our photo shows a technician at Union Carbide, one of the suppliers, examining a *second* group of X-ray pictures of some tantalum capacitors for the satellite. A separate record was kept on each capacitor.



Conductive Paint . . . A comparatively new product making things easier for the manufacturer is conductive silver-filled paint that is useful on printed circuit boards for hookup changes, new connections or shorting out components. The paint carries the number 3030, is put out by Joseph Waldman & Sons, Irvington, N. J., and is composed of silver, a solvent and a thermoplastic base. It can be brushed on (as in our photo), dipped or silk-screened. Errors can be wiped off before the paint dries to a hard film. The low-resistance paint is especially valuable where high soldering temperatures can damage components. It also can be used as a soldering base on non-solderable surfaces.

Goodbye, Miss Young . . . It won't be the same without you, but the wheels of progress may have done you in. RCA engineers under Dr. Harry F. Olson (shown in photo) have demonstrated an electronic voice translator that can take spoken English or French and type out the words as they are dictated. It also can do its own translating, making English come out as French, German or Spanish. Or French becomes English, German or Spanish. Lastly, the apparatus will reproduce either of two foreign tongues in sound. The smiling girl is Miss Ann Young, a secretary who is watching her secretarial job go down the drain. So why is she so happy?



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AIRLINES NEED MEN

Who pays this kind of money to beginners? You'd be surprised at how many fine openings there are for Coyne trained men—in small towns and big cities everywhere all year 'round. For example, the airlines are always on the lookout for men who can fill jobs as radio mechanics, aircraft electricians and electronic systems technicians, to mention only a few. From a good starting salary, a trained man can quickly boost his income to \$8,000 a year. And that is by no means the limit.



THE MISSILE INDUSTRY

Another field where employers are clamoring for trained men is the missile industry—an industry growing so fast as to be almost unbelievable. Here there is a constantly increasing need for trained men. Every day these companies are hiring electronic technicians, laboratory technicians, electronic assembly inspectors and field service engineers. A field service engineer with minimum experience can easily demand and get \$8,000 a year—plus extra compensation in the form of living expenses and incentive pay.

COMPUTERS—Data Processing
A tremendous field. Men with basic electronic training are welcomed by manufacturers to receive further training—while on salary in—the operation and maintenance of their specialized equipment. Opportunities unlimited. No ceiling on salaries.

TV and RADIO Manufacturers
Perhaps the biggest opportunities of all are to be found with the large electronic manufacturers. With these giants, job opportunities are practically without limit.

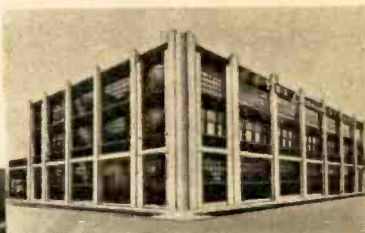


And the same thing can be said of salaries. These radio and TV manufacturers are expanding into new fields and are growing at an unheard of rate. Any man with ability and ambition can grow with them, earn promotion after promotion. With these promotions come frequent pay raises as he continues to step from one important job to one still more important.

OR, YOUR OWN BUSINESS

Hundreds of graduates have gone to work for former graduates, servicing TVs and Radios, Air Conditioners, Refrigerators, other household appliances—then, after learning business methods have branched out and started their own shops. Others have started their own shops immediately upon graduating. Profits as independent business men, after taxes and other business expenses, are as high as \$10,000 to \$20,000 a year.

These are not dreams. They are realities. But don't try to break into Electronics "on your own." You can save years of struggle and disappointment by first getting the necessary training at the great shop-laboratories of the Coyne School in Chicago.



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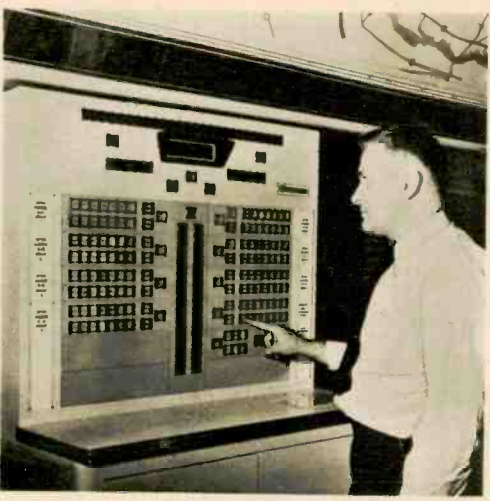
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...electronics in the news

Long-Distance Signs . . . Microwave radio now makes it possible to change the messages on warning signs along the 131-mile New Jersey Turnpike from a central control point.

The signs can be made to read Drive Slow, Snow, Ice, Fog or Accident Ahead just by pressing a few buttons. State

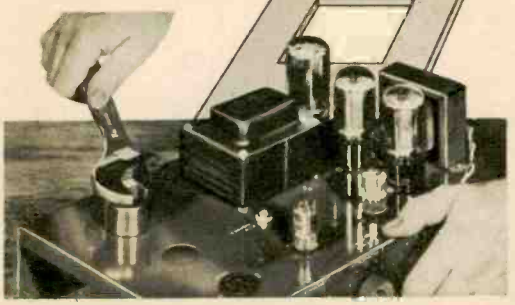


troopers used to have to turn a switch at each sign.

Equipment at headquarters in New Brunswick consists of a control console (see top photo), coder cabinet and data recorder that keeps track of which signs read what and when. Buttons on the

[Continued on page 12]

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The Grantham Communications Electronics Course prepares you for a **FIRST CLASS** F. C. C. license, and it does this by **TEACHING** you electronics. Each point is covered simply and in detail, with emphasis on making the subject easy to understand. The organization of the subject matter is such that you progress, step-by-step, to your specific objective—a first class F. C. C. license.

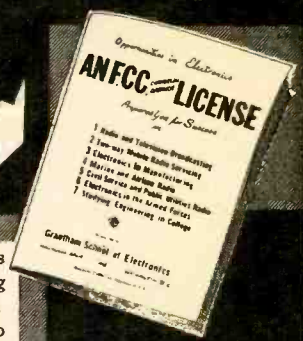
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Edward R. Barber, 907 S. Winnifred, Tacoma, Wash.	1st 20
M. A. Dill, Jr., 20 Cherry St., Gardiner, Maine	1st 12
Bernhard G. Fokken, Route 2, Canby, Minn.	1st 12
Kenneth F. Foltz, Broad St., Middletown, Md.	1st 12
James C. Greer, Mound City, Kansas	1st 12
Thomas J. Hoof, 216 S. Franklin St., Allentown, Pa.	1st 22
Clyde C. Morse, 7505 Sharronlee Dr., Mentor, Ohio	1st 12
Louis W. Pavek, 838 Page St., Berkeley 10, Calif.	1st 16
Wayne Winsauer, 2009 B St., Bellingham, Wash.	1st 12

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28-5

...electronics in the news

console turn on (and off) all signs, groups of signs or individual signs via tones. For example, when the dispatcher wants signs one, two and three to warn motorists of ice, he pushes the button for that group and another marked *ice* (see bottom photo on page 10).

Five 60-watt repeaters link headquarters with the road's 67 signs. The tone signals are picked up by the repeater nearest the target sign and re-transmitted to a receiver in the sign structure. A decoder closes contacts, providing voltage to light up the neon letters. Motorola installed the system.

Biko-Graphical Sketch . . . Magnified electrocardiogram lines on the face of a new astronaut-monitoring machine tell the story of the bike rider's reactions to his labors in this composite photo from Republic Aviation's Environment Laboratory. The biomedical monitoring system includes a back-pack radio



transmitter worn by the astronaut. It telemeters 15 channels of body-function information to a monitoring screen (or recorder) and also has a two-way voice channel.

Achtung! . . . With a few hundred bucks to buy a Hughes Aircraft Electrocular headset, anyone can make like Erich von Stroheim, Hollywood's longtime Prussian general. In our photo Dr. A. V. Stern, who developed the system for Hughes, succeeds very well in carrying off the part. Electrocular is an elision of electronic-optical, the two fields that are joined in the Hughes apparatus. Electrocular is a viewing device which permits a pilot, astronaut, control-tower operator, etc., to do his normal duties while



watching a display of data on the monacle. The data can be anything displayable on a miniature cathode-ray tube contained in the case over Dr. Stern's ear. The CRT image goes through a mirror and hits the eyepiece, a dichroic filter which reflects colors of certain wavelengths. Colors of other wavelengths reflected by his surroundings can be seen by the wearer at the same time because they go through the monacle as if it were plate glass. The set has earphones and can include a mike.

ITEM . . . The Russians have turned radio astronomy into **television astronomy** with a two-channel TV apparatus that makes it possible to see two images of a star or other celestial body on separate screens at the same time. The TV pickups are fed by twin 18-inch reflecting telescopes. From what the Russians say, the pickup tubes are sensitive to some non-visual wavelengths, as well as to the visible light spectrum.

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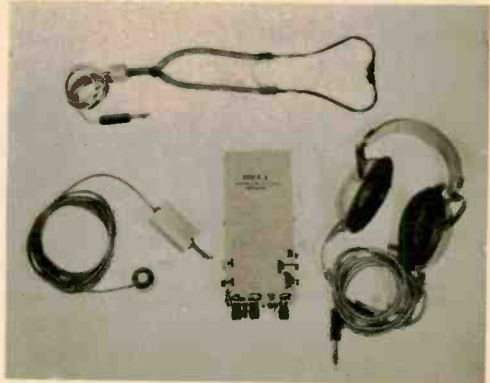
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...electronics in the news

Hearty Sound . . . Diagnosis has come a long way since a doctor had to put his ear to a patient's chest to listen to his heartbeat. The stethoscope brought the heartbeat to the doctor's ears, amplified it and eliminated much unwanted stray noise.

The newest development in the field, by Bell Aerosystems, is an ultra-sensitive instrument that enables the physi-



cian to hear only selected portions of the cardiac cycle, eliminating all the rest. Sound signals from the stethoscope can be fed to earphones, to a speaker for group analysis, to an oscilloscope for visual examination or to a recorder that makes an electrocardiogram (or to all at once). The pickup microphone is on the left in our photo.

Transistor Notes . . . Some bright chap at Raytheon figured it would be cute to show the company's tiny new hearing-



aid transistors as notes on a bar of music. Our photo indicates how the high brass reacted to his idea. Maybe he was right.

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

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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.

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You begin by wiring 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, and learn theory, practice testing and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

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

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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.

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- TESTER INSTRUCTION MANUAL
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- 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 fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Stalitis, 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 at 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, fine, the trouble, if there is any, to be found."

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Model #10A: 10 Circuits \$14.95

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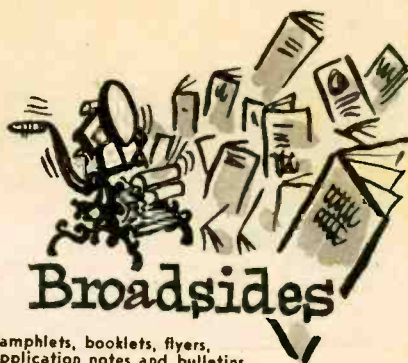
TRANSVISION Electronics, Inc., Grey Oaks Ave., Yonkers, N.Y.

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Broadsides

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

If you complain about how fast the light bulbs blow in your house, take time out to read General Electric's **How Long Should a Light Bulb Last?** It explains the manufacturer's dilemma: longer bulb life vs. brighter light. Write GE's Dept. WR-62 in Nela Park, Cleveland, Ohio, for a free copy.

Portable Power Handbook is a well illustrated text on dry batteries that covers everything from Volta's first battery to fuel cells. The booklet is free for classroom use if requests are written on school letterhead. Write to Union Carbide Consumer Products Co., 270 Park Ave., New York, N. Y.

Krylon's latest catalog of aerosol products lists items that clean, coat, lubricate and finish with push-button ease. Included are cleaners for tuners, switches, relays, pots and electric motors. For a free copy, write Krylon, Inc., Morristown, Pa.

Atoms for Space is the title of a 28½-minute **free loan film** on atomic batteries that is offered by the Atomic Energy Commission, Washington, D. C. The 16mm film describes the Commission's SNAP program for converting nuclear energy into electrical power for operation in space.

Epoxy "solders" and conductive silver-filled paints, which are finding many applications in electronics, are described in a free bulletin by Joseph Waldman, 137 Coit St., Irvington, N. J.

Hams and SWLers have special interest in the sixth **DX Log Issue** of GE's Ham News. Among other things, the booklet carries an official countries list and describes the principal DX operating awards now available. Copies may be obtained (20¢) from GE Ham News, Box 1009, Owensboro, Ky.

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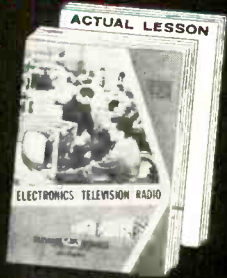
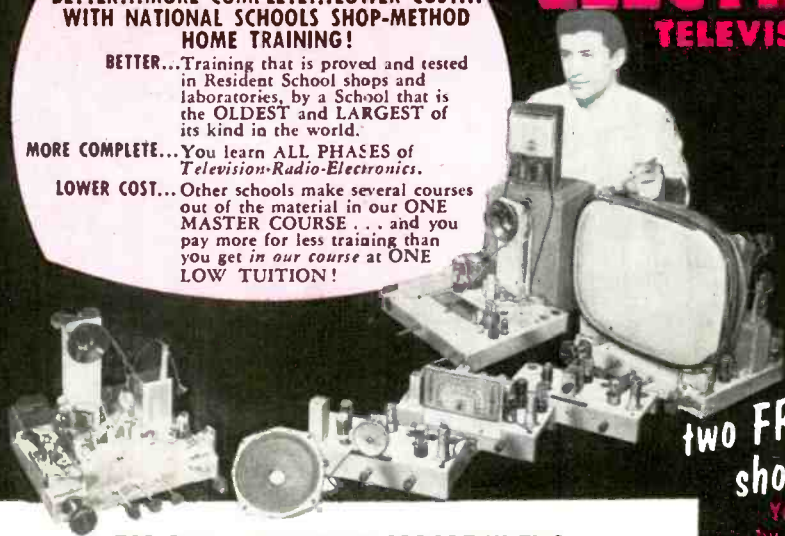
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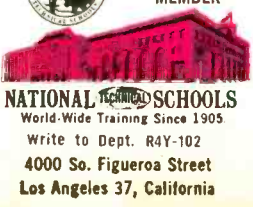
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Edgar Wesatze



Thanks to N.T.S. I have a business of my own right in my home. I am still in the

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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.

Alvin Spera

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PHASE 6 RADAR AND MICROWAVES
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PHASE 3 ELECTRONICS
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PHASE 7 AUTOMATION & COMPUTERS
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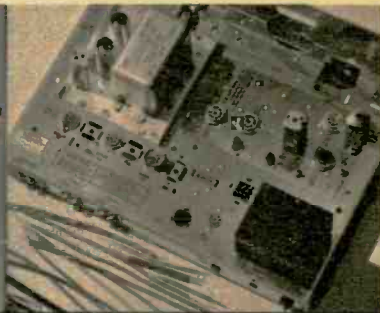
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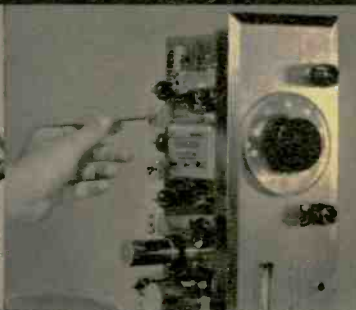
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*Audio — February 1961, Pages 54-56

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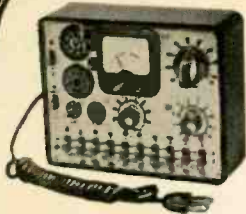
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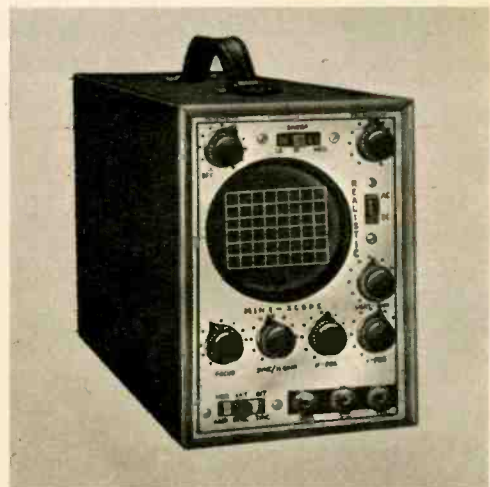
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Electronic Marketplace

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plifier. DC sensitivity is 1 volt peak-to-peak per inch; AC is 25 milli-volts per inch.

The portable scope has a silicon-diode power supply and a shielded transformer to prevent trace distortion. The price is about \$45. Radio Shack Corp., Boston 17, Mass.

Sonic Servant . . . Ultrasonic remote control, the technique that gave TV viewers armchair channel selection, is now providing push-button directional tuning for TV antennas, also of the armchair variety.

The rig, Model AK-122, consists of a hand-held transmitter (see photo) and a receiver, which is shown being used as the base of the manual rotor control

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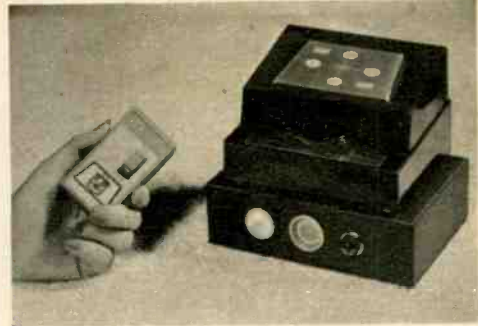
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Marketplace

unit. The remote-control job is designed to work with the manufacturer's own CDR manual antenna rotors.

A push of a button on the transmitter sends an ultrasonic tone signal to the



receiver that then operates the rotor control, which turns the mast-mounted rotor. The sonic transmitter can be up to 30 feet from the receiver. About \$55. Cornell-Dubilier Electronics, Fuquay Springs, N. C.

A Can for Your Gallon . . . A gallon in ham parlance is the full legal power allowance of 1 kilowatt, so it's appropriate that Heathkit's up-to-a-kilowatt Cantenna transmitter dummy load is housed in a gallon can. The can is filled with oil to keep the resistive element



(shown at right) cool. Substituting for a regular antenna during transmitter servicing, the shielded dummy keeps signals off the air and prevents TVI, QRM and assorted gremlins. The 50-ohm load is useful up to 300 megacycles for testing commercial, Citizens

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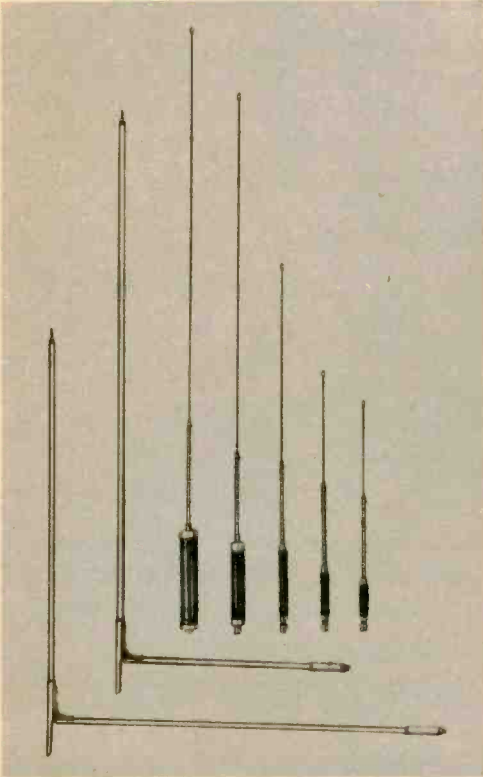
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EI-42

Marketplace

Band, ham or marine equipment. About \$10. Heath Co., Benton Harbor, Mich.

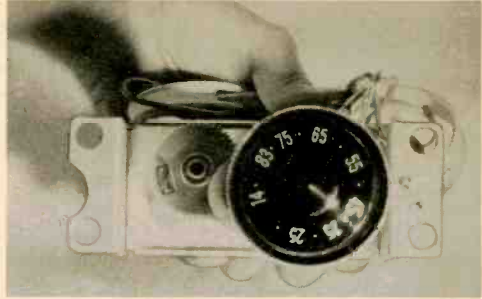
Half Mast . . . Two ingenious new fold-over antenna masts simplify the job of changing resonators during mobile operation on the ham bands (10 through 80 meters) and save whips from collisions with tree limbs, garage over-



heads, etc. One 54-inch mast folds 15 inches above the base for rear deck or fender mounting and the other folds 27 inches up for bumper mounts. Power rating of the antennas is 75 watts AM, 150 watts SSB. New-Tronics Division, Cleveland 13, Ohio.

UHF TV . . . The television industry, doing a forced march into UHF, is about to burst forth with a rash of adaptors to make its new VHF sets legal by enabling them to pick up UHF channels 14 through 83. One of the first such

adaptors has been announced by Admiral for its 23-inch 1963 models. The unit has a built-in antenna and plug-in connectors for solderless installation and costs \$30. Adaptors probably will have a short market life, being pushed



aside soon by true all-channel receivers. But the market for converters to enable older VHF sets to pick up UHF stations, is due for a renaissance.

Are They or Aren't They? . . . Only her interior decorator knows for sure . . . that her lamps are not really lamps at all. They're satellite speakers that radiate sound in a 360-degree circle. Each unit has a six-inch PM midrange



speaker facing upward with a coupled horn tweeter and diffusion cone above it. The speaker's base is solid wood, available in a variety of finishes. Hidden inside is a treble level control. The price is about \$50 each. Electrohome of Canada, Kitchener, Ont.

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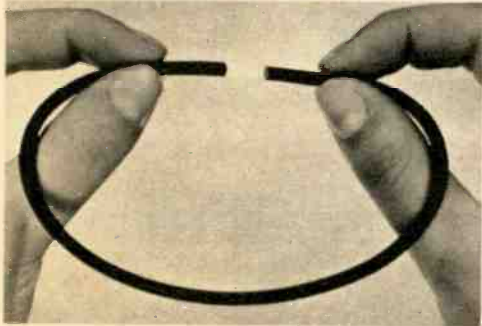
Name

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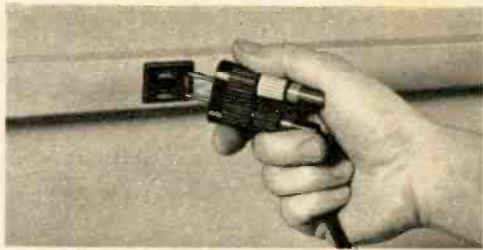
Instant Belts . . . Drive belts usually come in stock sizes to fit special kinds of gear. If your tape recorder or movie projector becomes obsolete (and it will) you're bound to have trouble finding a replacement belt. The new do-it-yourself remedy is buying a Makabelt kit, which has lengths of rubber in popular



belt diameters. Then you cut off the right amount of rubber, thread it around the pulleys (without disassembling your equipment) and fuse the

ends with a chemical. Each kit contains enough rubber and adhesive to make eight average-size belts. About \$3. Techni Parts Corp., W. Hempstead, N. Y.

Jiffy Plug . . . When your experimental rigs lack cords and plugs, you're always looking for a quick way to make temporary AC line hook-ups (or plugging in the bare wires). Superior's Dual Adapter neatly connects banana plugs,



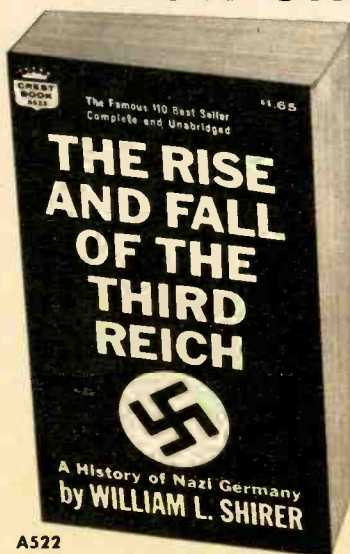
clip leads, spade lugs and hookup wires to the outlet, and does it safely. The Adapter, rated at 15 amps, has color-coded thumb nuts on its binding posts. The price is \$1.50. Superior Electric Co., Bristol, Conn.

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Marketplace

Lay Those Pliers Down . . . You don't need 'em if you have GE's handy gadget that straightens tube pins with speed and ease. The flat, plastic pin straightener has hole configurations that fit five receiving tube types with 7



to 12 pins. It measures a slight 1/4-inch thick by 2 1/2 inches across, but it hardly can get lost on your workbench—the color is bright orange. Price: 60¢. General Electric Co., Chicago 41, Ill.

30-50/145-175 . . . If you're up on your bands, you know those frequencies include public service channels. Two new AM/FM receivers permitting you to eavesdrop on these police, fire, Civil Defense and utility stations have been



introduced by Lafayette. Both are ten-tube superhets with three IF stages and squelch. The HE-51 (in our photo) covers 30-50 mc, has a crystal-controlled channel plus manual tuning; the HE-52, covering 145-175 mc, has manual tuning only. Both list at \$52.50. Lafayette Radio, Syosett, N. Y.

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UPGRADING YOUR LICENSE

How much do you have to know to get a commercial ticket? How about code? Here are the answers.

By Robert Hertzberg, W2DJJ

YOU'VE seen what the ads say: "Get your First Class Commercial FCC License in 12 weeks!" "An FCC license or your money back!"

But just what is involved in getting one of those prized commercial tickets? How many kinds are there?

Strictly speaking, *all* operator tickets other than amateur are classed as commercial by the Federal Communications Commission. Citizens Band tickets are *station* licenses.

Commercial tickets come in seven varieties and are divided into two types: *licenses* and *permits*. The types are much alike but permits do not carry as many privileges as do licenses.



To thousands of two-way radio users and servicemen, the most prized ticket has become the Second Class Radiotelephone License. The reason: Citizens Band (Part 19) regulations say that only holders of first- or second-class commercial licenses can adjust frequency-determining elements in CB transceivers.

A Second Class Radiotelegraph license also is qualified to do such CB service work, but that ticket requires code. So it comes down to the fact that the second-phone license is the easiest-to-get qualifier. Serious CBers want the ticket because it permits them to tune their transceivers legally. To the serviceman, being able to do the full range of work on CB rigs means a stack of service dollars.

No permit holder can do this type of CB servicing legally, and neither can amateur licensees, although their own equipment is likely to be far more complicated than most Citizens Band transceivers.

Our chart shows the various types of commercial tickets and the requirements. Applicants normally must be

U.S. citizens. The restricted phone permit is a mail-order item but to obtain the others you must appear in person before an FCC engineer.

If you don't know the location of the nearest FCC office, look in your phone book, ask at the post office or write to the FCC's headquarters (Washington 25, D. C.).

Probably the best reference you can obtain if you decide to go for a commercial ticket is Study Guide and Reference Manual for Commercial Radio Operator Examinations, which costs 75 cents from the Government Printing Office, Washington 25, D.C.

The written examinations are split into six Elements. The type of license determines which Elements you take and the total number. All questions are multiple choice.

When there is a code requirement, you are required to pass this test before going on to the written exams.

How hard is it to get a commercial ticket? If you're really interested, and willing to learn theory and practice code, you'll have no trouble in bringing home the prize.

COMMERCIAL RADIO OPERATOR LICENSES				
TYPE OF LICENSE	AGE MINIMUM	CODE REQUIREMENT	WRITTEN TEST	TERM OF LICENSE
Restricted Radiotelephone Permit*	14 years	None	None; obtained by declaration (FCC Form 753)	Permanent
Third Class Radiotelephone Permit	None	None	Elements 1, 2	5 years Renewable
Second Class Radiotelephone License	None	None	Elements 1, 2, 3	5 years Renewable
First Class Radiotelephone License	None	None	Elements 1, 2, 3, 4	5 years Renewable
Third Class Radiotelegraph Permit	None	16 code groups per minute	Elements 1, 2, 5	5 years Renewable
Second Class Radiotelegraph License	None	16 code groups per minute	Elements 1, 2, 5, 6	5 years Renewable
First Class Radiotelegraph License	21 years; one year experience	20 code groups, 25 plain words per minute	Elements 1, 2, 5, 6	5 years Renewable

*Intended mainly for private boats, planes, etc.

EXAMINATION ELEMENTS

1. Basic law, 20 questions.	4. Advanced radiotelephone, 50 questions.
2. Basic operating practice, 50 questions.	5. Radiotelegraph operating practice, 50 questions.
3. Basic radiotelephone, 100 questions.	6. Advanced radiotelegraph, 100 questions.



THE LISTENER

SWL-DX NOTES

BY C. M. STANBURY II

AURORA 7 . . . Our lead item last time had to do with DXing space capsules, and we'll start there again. Space DX is by far the hottest news in the field today.

For 45 gripping minutes—1230 to 1315 EST—one day last May, DXing was something more than an enjoyable game. Scott Carpenter had come down from orbit in Aurora 7 and had disappeared. Was he alive? Had the capsule survived re-entry?

"Cape Cap Comm calling Aurora 7." It was the network station at Cape Canaveral. There was no answer. It called again. And again the channel (15016 kc) was silent. The minutes ticked by.

Finally, at 1254, Cape Cap Comm came on with, "I read you very weak, Aurora 7." I couldn't pull in the capsule's signal, but it didn't matter. Those seven words told me he was down and safe.

Later, when a rescue plane got close to the capsule, Aurora 7's UHF beacon could be heard.

It was a day few DXers who found the 15016-kc channel will forget.

Our last column listed some channels that bear watching during space shoots: 15016, 13826, 13215.5 and 11228 kc.

Now you can add two more: 10615 and 7580 kc. Those are channels used

by transmitters at Greenbelt, Md., and they permit you to follow our space explorations first hand, without delay or editing. They transmit, for the benefit of Mercury Control and tracking stations around the world, every message that goes over the Goddard network. While not true DX, Greenbelt at least tells you what's going on. The signals are single-sideband. If you don't have an SSB rig, you can make them intelligible by using your variable BFO control (see TUNING SSB WITH BFO, September '62 EI).

Country Counting (Cont'd.) . . . A DXer's prestige depends on the number of countries he has verified. If he has 50 on short wave he's considered competent. On the broadcast band, 15 will qualify you. But, as we mused a couple of columns ago, what is a country?

Any self-governing state certainly is a country. But what else? Administration is one criterion. Thus, Puerto Rico, which is a partially independent commonwealth, counts as a country separate from the U.S. Hong Kong is distinct from England and other colonies.

But you become a little confused when you get to Portuguese possessions. Lisbon considers such far-flung lands as
[Continued on page 119]

Floating broadcaster is Holland's SS Veronica, which transmits from the North Sea on 1563 kc.

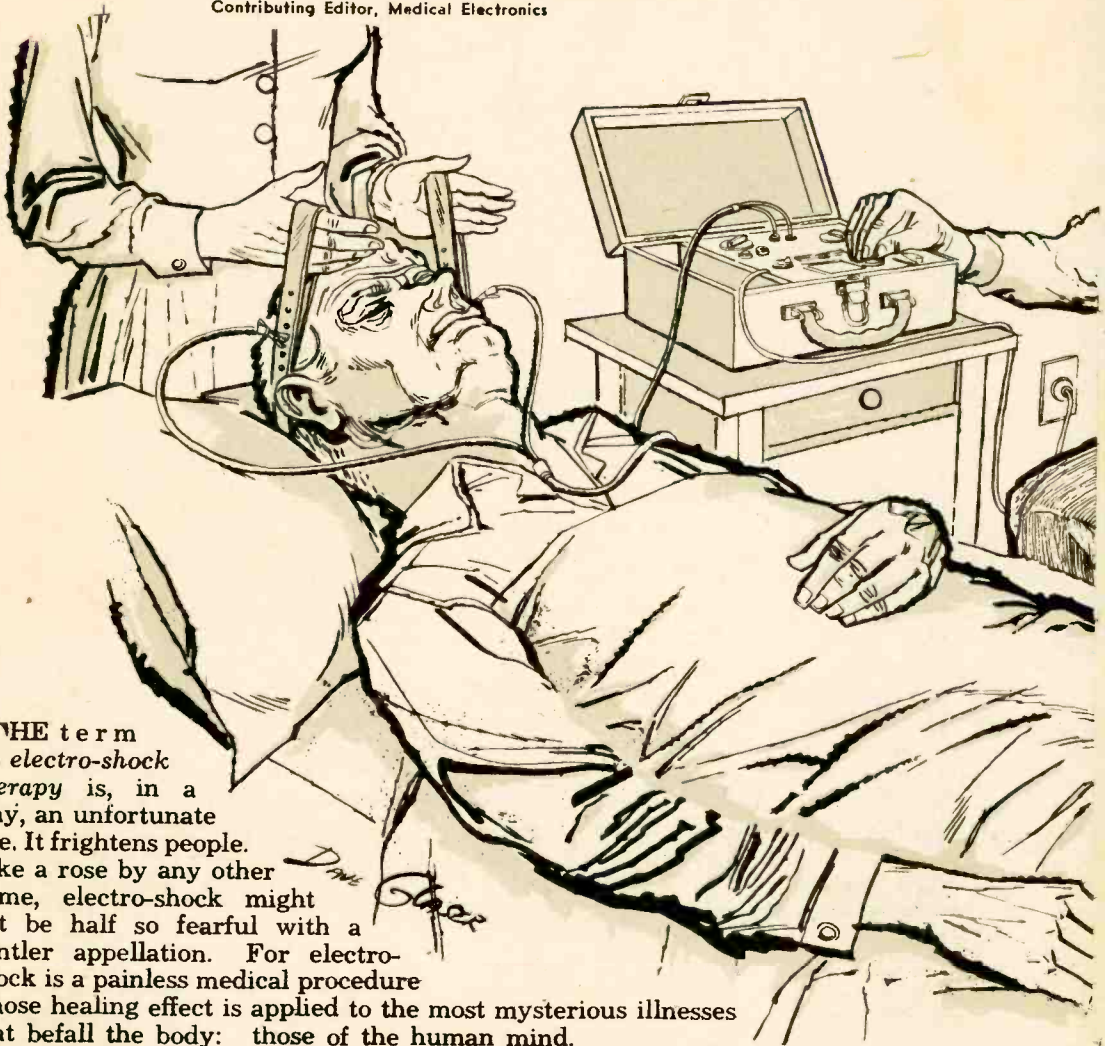
CSB-81 at Santa Maria, Azores, is rare catch but is lumped with Portugal in country count.



the truth about **ELECTRO-SHOCK**

By Richard A. Markoff, M.D.

Contributing Editor, Medical Electronics



THE term *electro-shock therapy* is, in a way, an unfortunate one. It frightens people. Like a rose by any other name, electro-shock might not be half so fearful with a gentler appellation. For electro-shock is a painless medical procedure whose healing effect is applied to the most mysterious illnesses that befall the body: those of the human mind.

Most of those who shudder at the thought of electro-shock therapy have never seen it given. Let's visualize a treatment. A patient lies on a couch. The doctor makes an injection into a vein in the arm. The nurse holds a pair of round metal electrodes against the patient's head as the doctor presses a button on the electroshock machine, a radio-size apparatus with leads going to the electrodes.

The patient stiffens slightly, quivers and relaxes. He has been unconscious ever since the button was pressed, and now he falls into a deep sleep. He may sleep as long as two hours, or as short as 20 minutes. When he awakens he will have a feeling of being wonderfully refreshed.

That's all there is to electro-shock. No pain. No fearsome procedure. It's a controlled and highly effective treatment that makes use of an electric current applied to the brain.

The electro-shock story goes back to 1934, when Dr. Meduna of Budapest's Royal State Mental Hospital observed that patients who suffered from the supposedly incurable mental disease, schizophrenia, improved if they, by chance, developed epilepsy. So he started inducing convulsions as in epilepsy with drugs that, unfortunately, were dangerous. Then, four years later two Italians, Drs. Cerletti and Bini, developed a method of producing convulsions by applying electricity directly to the patient's head. This was electro-shock.

Convulsions had been observed in accidental shocks, but shock was thought too dangerous for use in treating humans. Indeed, electric current can be dangerous if applied to the whole body because it may arrest heart action. Electro-shock is safe because the electricity is applied only to the *head*; the heart is not involved.

Although 60-cycle alternating sinusoidal current, controlled by a *convulsive* machine, is used most often, direct currents in varying pulse patterns are available from *stimulator* type machines. The most important recent development has been muscle-relaxant drugs, which are injected before electricity is applied. They reduce convulsive movements nearly to the vanishing point, preventing fractures, which once were a danger.

Three distinct reactions occur when electricity is applied in this way. First comes a tonic contraction of the muscles (a single contraction) and unconsciousness; next, a relaxation and, finally, clonic contractions (waves of twitching) called convulsions (known, too, as a seizure). Such convulsions are extremely violent without relaxant drugs.

Just why convulsions aid a person suffering from mental illness still is not known, but there is no question as to results. Electro-shock therapy is used to treat several types of mental illness but is most effective against depressions. As few as six treatments sometimes restores a deeply dejected, suicidal patient almost to normal. It is effective also in many cases of schizophrenia, the too-common mental illness, and can lead to dramatic improvement.

Some scientists believe the electro-shock-produced convulsions alter the bio-chemical functioning of the brain. Others call attention to the transient losses of memory which occur, holding that the treatment achieves its effects by interrupting pre-occupations—vicious circles of thought and fantasy which promote mental disorder.

It is not the electricity itself that causes the beneficial convulsions. These involuntary phenomena are set off by some still-unknown mechanism in the brain—a kind of biological switch. The switch in anyone's brain can be tripped, bringing on convulsions. In epileptics, it is simply too easily tripped. Electricity trips it artificially.

The amount of electricity used varies widely. In some patients more is required than in others. There are more than half a dozen electro-shock machines with both AC and pulsed DC outputs. Our photo shows a modern model produced by Medcraft. Some types have the volt- [Continued on page 116]



PRIZE SHACKS

WIN \$20! In each issue EI publishes photographs of three Prize Shacks—Citizens Band, short-wave listening and amateur radio rooms or corners that have an attractive and efficient-looking layout. To the owner of each Prize Shack we pay \$20. We invite you to send us a picture of your CB, SWL or ham shack, along with a list of your equipment. We prefer 8x10-inch glossy prints. Pack your picture well to prevent damage in the mail. Unused photos are returned. The address: EI Prize Shacks, 67 W. 44th St., New York 36, N. Y.



CB

Proprietor of our Prize CB Shack is John Rossilli, 2A5174, who is a cameraman for WNBC-TV in New York. His transceiver is an ECI Courier, and he uses a 3-element beam and has an SWR bridge. His equipment is used in his after-hours job of making commercial CB installations. John's home is in Brooklyn, N. Y.

Sven Elfving listens to the world of radio from far-off Ornskoldsvik, Sweden, which is on the east coast not far from the Arctic Circle. He has 300 countries verified. Sven, who is 23 years old, has a Hallicrafters receiver and he records signals on tape.

SWL



HAM

Off-pictured ham shack of Larry LeKashman, W9IOP, in South Bend has RME 6900 and Collins 75A4 receivers plus preselector, 100-watt homebrew transmitter and some half-dozen full-kilo-watt power amplifiers. Larry is the VP of Electro-Voice, Inc.

HI-FI RECORD GUIDE

by Warren DeMotte

SOMETHING NEW has appeared in the world of high-fidelity stereo recording: 12-inch 45-rpm discs. The first one I have heard (see cut) is Flute Concertos of Eighteenth Century Paris, the



initial release of the Connoisseur Society, a new company that obviously is dedicated to elaborate production procedures and high quality, cost be hanged.

The music is charming, six works for one, three and five flutes, supported by cello and harpsichord, and the playing is lively and sensitive. And the sound has breadth, crispness, and marvelous presence. There is no deterioration in its fidelity, right through to the innermost grooves. An intriguing five-year guarantee accompanies the disc; the manufacturer will replace a damaged or worn record with a new one as often as requested during that period for \$1 per replacement.

A new Rigoletto requires something special to make it attractive to case-hardened collectors, and London's latest release of that melodious, but overly familiar, opera offers as its justification beautiful singing by Joan Sutherland, Cornell MacNeil and Renato Cioni, plus vivid, spacious recording. Nino Sanzogna conducts a fluid, moving performance that manages to give the singers

the spotlight without slighting the orchestra or the chorus. However, I think he over-indulges Miss Sutherland by permitting her tempos so leisurely that she sounds lugubrious when she should be ecstatic.

Nobody evokes the Age of Minstrelsy as effectively as Richard Dyer-Bennett. His white tenor voice and incredibly deft guitar accompaniment create a convincing olden-time illusion. His program of 12 folk songs and ballads is attractive in performance and sound.

Vitality is never in short supply when the Weavers are on the stage or before the microphones. In *Weavers' Gold*, the quartet does a dozen folk songs with characteristic zest and spontaneity. The material and the manner are equally familiar and enjoyable.

In *Sounds Unheard Of!*, guitarist Jack Marshall and drummer Shelly Manne indulge in a sonic tour de force that gives the impression of many players actively engaged. However, no overdubbing has been employed; the recorded sound is honestly produced by one versatile percussionist at 25 percussion instruments, plus one splendid guitarist. The harmonies, timbres and rhythms they achieve place a heavy burden of proof on those disciples of Electronic Music who complain that traditional instruments no longer are capable of expressing new sounds. Sound Engineer Howard Holzer deserves a special bow for the clarity of the recording.

At New York's Metropole, a tavern with jazz, stereo comes naturally. The musicians are strung along a narrow, raised platform that runs behind the bar and parallel to it. The music they play usually is some variety of Dixieland. Jazz at the Metropole offers a typical program, recorded on location, complete with applause and encouragement from the audience. Sol Yaged and Pee-Wee Erwin are the featured regulars, and Coleman Hawkins is the esteemed guest. They play enthusiastically ex-
[Continued on page 112]

WHICH FM ANTENNA W2ZLF

By Herb Friedman,

FOR YOU?

A crowded band and stereo make good FM antennas necessary now. Here are tips on how to pick a new one.

STEREO FM broadcasting has made true high-fidelity radio listening possible but it also has created problems at the receiving end, particularly at the antenna. When FM signals are transmitted in stereo multiplex, the range automatically is reduced from 30 to 50 per cent.

Whether you are listening on a monaural or stereophonic tuner does not matter: if the station is broadcasting multiplex, the signal you receive is weakened. In bad cases, an improper antenna makes it sound as if the studio engineer is changing the volume on every note. A poor antenna forces you to dig your favorite station from under snaps, crackles and pops, or you're bothered by multi-path reflections—signals from the side that cause masked or fading sound.

The time when you could say your tuner was so sensitive all you needed was a piece of wire for an antenna is past. The increased crowding on the FM band and multiplex broadcasting demand a *good* antenna.

True noise-free reception requires a strong signal to drive the noise-limiting amplifiers to saturation and to develop sufficient automatic-frequency-control voltage to insure lock-in operation and no drift. Only a rooftop model makes the fidelity truly high.

When you start thinking of a better antenna, you should know what you're looking for. The *half-wave dipole* antenna (see Fig. 1) is obsolete for FM reception but has become the standard reference to which all other antennas are compared. In the direction of maximum

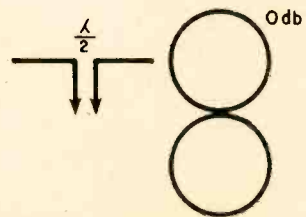


Fig. 1. Obsolete half-wave dipole is used as reference; radiation pattern shows even front-back pickup, 0db gain.

sensitivity (broadside to the antenna), the reference dipole is said to have a gain of zero decibels (0db), or unity gain. In an antenna which *does* have gain, the signal developed across its terminals is greater than that of a reference dipole in the same location. An antenna which develops twice the voltage of a reference dipole has a gain of 6db.

At the bottom of the price range of FM antennas are the non-directional types, such as the turnstiles, the halos and S-dipoles. Regardless of what they're called, they cost about \$16 each

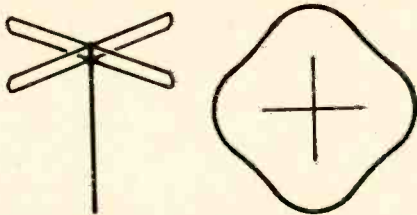


Fig. 2. Turnstile's odd radiation pattern boils down to non-directional; 0db gain is same as in dipole.

and have a common characteristic: they receive signals from all directions with essentially equal sensitivity.

The signal pattern of the popular *turnstile* antenna (see Fig. 2) looks like some free-flowing square, with loops broadside to the two elements and slight dips between, but for practical purposes

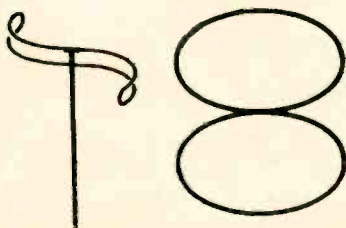


Fig. 3. Lobes of S-dipole's pattern show front and rear sensitivity; center overlap shows end pickup.

it receives equally well from any direction.

The pattern of the *S-dipole*, also a popular type, resembles one egg lying on another (see Fig. 3). The top lobe corresponds to one side of the S-dipole and the bottom lobe to the other, indicating sensitivity on the two sides. But the fact that the lobes overlap indicates

pickup off the antenna's curved ends. Despite the two lobes and overlap, the S-dipole is as non-directional as the turnstile.

Still within the low price range is an antenna that does offer some forward gain—the *two-element beam* (see Fig. 4). The small beam is rated at approximately 3db gain, which means it develops a voltage some 50 per cent higher than would a reference dipole. In our drawing of the beam's signal pattern this gain is indicated by a large lobe on top (the forward end of the antenna, as indicated by the arrow) and a smaller one at the bottom, or to the rear. The forward end, of course, is pointed toward the transmitting station.

The two-element beam has a folded dipole (called the driven element) on the front and a single rod called a *reflector* on the rear. The reflector inter-

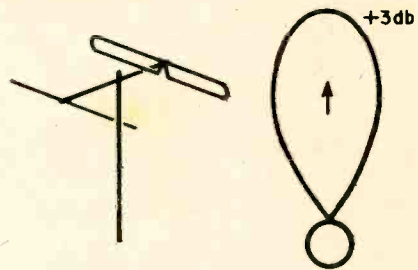


Fig. 4. Two-element beam has increased sensitivity in front (arrow) for 3db gain, reduced side pickup.

cepts an FM signal and re-radiates it into the dipole in somewhat the same way that any piece of metal re-radiates or reflects a radar signal.

The spacing between driven element and reflector is such that the reflected signal is radiated into the dipole in phase, which means you in effect have two electromagnetic waves marching along in step. When two waves in a body of water join together, the result is one wave that is higher than either of its parents. The same thing happens here. The reflector signal, radiated in phase, increases the strength of the signal in the driven element, to which is attached the download carrying the energy to the tuner. This strengthening of the signal is referred to as a gain of 3db.

While the two-element beam offers increased gain in the forward direction,

it is *less* sensitive at the sides and rear. Thus, multi-path signals from these directions are attenuated.

More sensitive antennas are the *multi-element beams* (see Fig. 5), which vary greatly in both price and design. To simplify matters, we will refer to all of them as yagis.

Depending on design, yagis have a forward gain of 9 to 12 db (the latter fig-

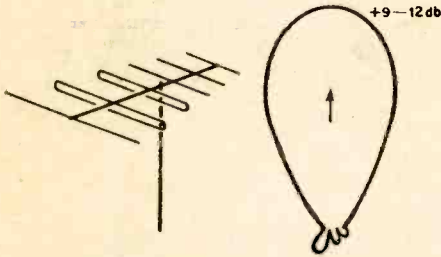


Fig. 5. A multi-element beam offers up to 12db forward gain. little side pickup; note rear lobes.

ure means a 5-microvolt signal is boosted to 20 microvolts). Like the two-element beam, yagis depend on secondary elements to achieve their gain. One reflector is put on the rear, but additional elements go in front of the driven element and are called *directors*. The directors also re-radiate signals into the driven element, but from the forward direction. Signals from the sides are further attenuated.

The reason for adding directors rather than more reflectors are complicated but, in general, directors maintain an antenna impedance (resistance to signals) that can be matched by a common downlead, while more reflectors would lower the impedance and cause a mismatch.

Our drawing shows one of the more popular types of yagis—one having two driven elements and three directors. Note that one of the rear lobes is larger than the other two—indicating one-sided rear sensitivity that is a phenomenon of big yagis.

The yagi, with its high forward gain, can give you good reception even with extremely weak signals. But it also has problems. Its forward gain results in a narrow angle of sensitivity (beam angle). Signals from any but the forward direction are attenuated so much

they simply are not received.

Which FM antenna is best for you depends on two factors: 1) your distance from the transmitters, and 2) the direction of the transmitters from your location. If all of the stations are in the same direction, of course, your distance from them, which affects the strength of the signals, is your only worry.

If you live in a metropolitan area, such as indicated by receiver X in Fig. 6, with stations all around you and not more than 20 or 30 miles away, your best bet would be one of the non-directional, 0db antennas—a turnstile or S-dipole. Signal strength is no problem here and a non-directional skyhook means you can pick up stations in any direction.

Receiver Y in Fig. 6 is a suburban or semi-fringe location (see chart at end of article) up to 50 miles from multiplex stations or 75 miles from monaural transmitters. Obviously, this location demands a boost for signals weakened by distance. The answer is a two-element antenna, whose 3db gain is sufficient. Although the two-element rig is directional, its wide beam angle permits you to pick up any station in the general

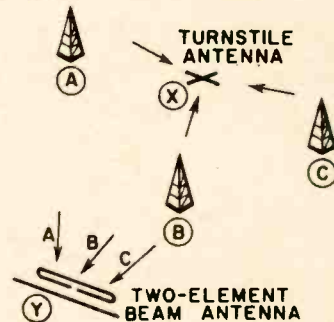


Fig. 6. To get stations A.B.C. city location X can use non-directional type; suburban Y needs beam.

forward direction (such as stations A, B and C in Fig. 6).

It is in the fringe and deep fringe areas that antenna cost and complexity mount. In order to get the maximum out of a weak signal that has traveled 100 miles or so, the high-forward-gain yagi is required. The yagi gives you the needed signal boost, all right, but it has its own problems, as we mentioned ear-

lier. Fig. 7 shows the situation. The multi-element beam at fringe location Z is pointed toward station A, providing good reception. But the yagi's narrow beam angle means transmitters a little to the side, such as station B, are not received at all.

The easy solution, if only two stations are involved, is to use two yagis, as shown in Fig. 8, with each one pointing toward a different station. The antennas should be separated on the mast at least a quarter wavelength of the low frequency signal. To get the number of inches of spacing, divide the frequency in megacycles into 2952. For instance, if the lower-frequency station is transmitting on 91 mc, the spacing would be about 32 inches.

If the difference in frequency between the high and low signals is no more than 10 per cent of the low-frequency signal, you must use a separate downlead for each antenna, spacing the leads several inches apart and installing a knife switch to select the proper yagi.

When the difference is more than 10 per cent, the yagis can feed a common downlead if you install quarterwave matching sections as shown in Fig. 8.

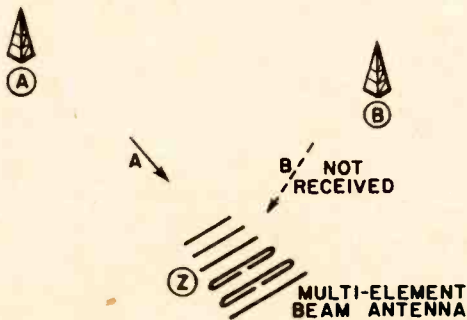


Fig. 7. Multi-element beam in fringe hauls in station A but attenuation of side signals cuts out B.

The length in inches of each 300-ohm twinline section is figured by dividing the frequency into 2420. The section connected to the low-frequency yagi is a quarter-wavelength of the high-frequency signal, and the section connected to the high yagi is a quarter-wavelength of the low signal. Use the formula to determine the length of each section, join the ends together and connect the com-

mon downlead at that point.

The more expensive—and ultimate—solution to the deep-fringe problem is a high-gain yagi with a rotor to turn it in any direction. Such a setup will run you around \$90 but there can be no doubt as to its versatility and the quality of reception it produces.

Some yagis come equipped with antenna-mounted boosters, or you can add

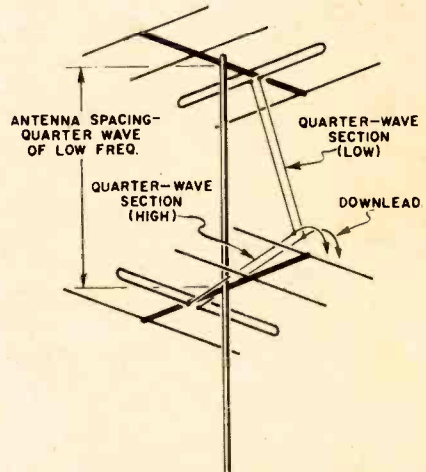


Fig. 8. A two-beam setup receives stations in 2 directions; matching twinlines feed 1 downlead.

one to an existing antenna for an extra boost in signals. A somewhat similar accessory is the booster-distribution amplifier (BDA), which amplifies the signal after it has passed through the downlead and also has connections to feed up to four tuners. Either type amplifier can give 9 to 15 db of gain but multiple connections to the BDA cut the gain by about 3db per tuner.

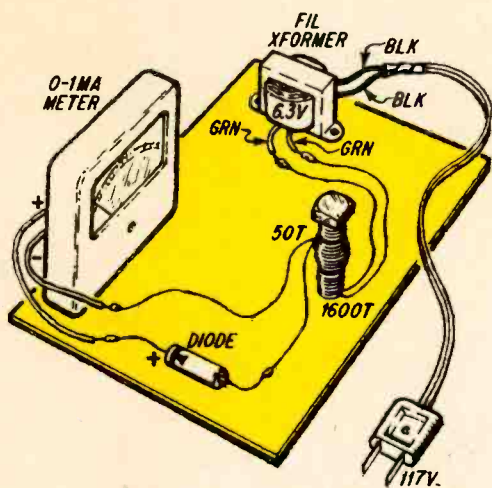
A final tip: when installing your 300-ohm twinline, keep as much of it vertical as possible to reduce noise pickup, and use high-quality line. Twist it a few times every few feet to reduce harmful capacitance effects.

WHERE ARE YOU?		
Reception Class	Monaural FM Up to:	Stereo FM Up to:
Metro-suburban	40 miles	20-30 miles
Semi-fringe	75 miles	35-50 miles
Fringe	100 miles	50-75 miles
Deep fringe	125 miles	65-90 miles

AC Electromagnetism

LAST issue, an electromagnet operated by batteries (DC) was investigated. We saw that a current travelling through a wire sets up a magnetic field—and that a magnetic field cutting through a wire creates a current potential. Now let's take a look at the properties of an electromagnet powered by alternating current.

The additional parts required over the previous experiment (Sept. '62 EI) are a general-purpose diode, such as the



1N34, and a 117- to 6-volt filament transformer (any current rating).

The experiments are conveniently assembled on a piece of standard pegboard. When joining the AC line cord to the 117-volt winding (black wires) of the filament transformer, solder or twist the connections first, then wrap each with tape to prevent shocks and shorts. Other voltages on the board are low and need not be insulated.

The basic AC electromagnet is first observed by setting up the board according to the pictorial, but omitting the diode and meter. When the transformer is plugged in, the green wires supply approximately 6.3 volts AC to the electromagnet's primary. If you hold a razor blade flat against the top of the big bolt and slowly lift the blade away you should feel a strong pulsating magnetic

attraction. Although the current is 60 cps, 120 magnetic fields per second are produced in the bolt since a single cycle is made up of current flowing first in one direction, then in the other. This causes a similar reversal of magnetic polarity. However, the blade responds only to the magnetic field and not its direction. Thus, it is attracted to the bolt 120 times per second (60 times for positive, 60 for negative).

If you performed the earlier experiments with DC on the electromagnet, you know that a magnetic field in motion can induce a current in a wire or coil. This principle is used by the transformer in working with AC voltages. Add the secondary coil by winding 50 turns of #22 enamel wire around the mid-portion of the 1600-turn primary.

After the power is applied, the meter will read a small amount of current. Notice that there is no direct physical connection between the primary and secondary wires. The current reaches the meter this way: The filament transformer provides an alternating current to the 1600-turn primary of the electromagnet. This current sets up magnetic fields in the turns of wire which move away from the primary and cut across the secondary. There, a second flow of current occurs—the result of magnetic fields cutting the secondary wires.

Why the diode? It is inserted because the meter works only on DC, and the current is alternating. The diode permits only pulses of positive-going current to reach the meter. And notice that the meter gives a steady reading, although it is being fed by pulses that repeat at the rate of 60 times per second. The meter pin simply cannot rise and fall so fast and settles down to an average value of pulses.

Viewing the operation of an electromagnet on AC opens the way toward understanding how a variety of important electronic devices performs: transformers, chokes, coils, relays, solenoids and others. In some way, each uses the effects of varying currents and/or magnetic fields.—H. B. Morris

If you've bought a new car lately you may still be wondering how that friendly salesman knew you would buy if he cut the price exactly \$150. Well, he might have made a lucky guess. But if he suddenly excused himself and went into another room it is not unlikely that he slipped on a pair of headphones and, with the aid of an eavesdropping device, heard every word in the family discussion he knew would follow his departure.

A doubtful hypothesis? Not according to the information turned up by a congressional committee and other federal investigations. Electronic surveillance is both widespread and well-developed as an art. Snooping has become a normal part of contemporary living.

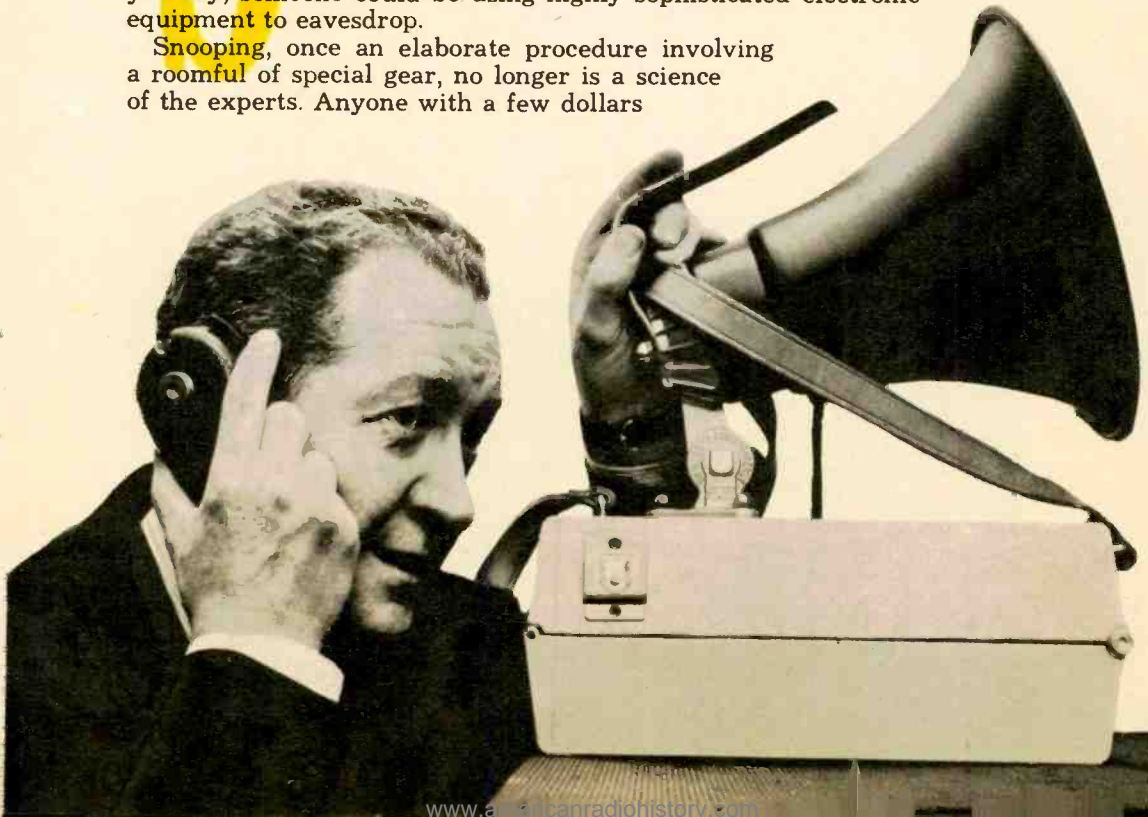
That international spies, law-enforcement authorities and private detectives use eavesdropping equipment is no surprise to us. Wiretap evidence has become an everyday expression. But more and more of us are being surprised and not a little shocked to find that our conversations are bugged. Maybe your car salesman didn't do anything of the sort, but some of the verified instances of snooping are no more bizarre.

Take the case of a large manufacturing firm which holds an annual employee convention. Only a handful of the top brass knows that in each of three recent years the convention hall was sown with 40 hidden tape recorders, taking down every word spoken near them. After the get-togethers were over, an outside company analyzed the tapes and reported on employee thinking. No one was identified and the company had no ill intent. But its employees might have interesting reactions if they found out.

And then there was the high-priced defense attorney who insisted that all conferences with a wealthy client, being sued for a bundle, be held in his own car as it sped along a highway he selected. What happened? The plaintiff's lawyers bugged his car with a self-contained transmitter and recorded every word from a second vehicle. The defendant settled quickly out of court, despite a few questions of ethics that were left dangling.

Today you must face the fact that wherever you are and whatever you say, someone could be using highly sophisticated electronic equipment to eavesdrop.

Snooping, once an elaborate procedure involving a roomful of special gear, no longer is a science of the experts. Anyone with a few dollars



Photographed for EI at Harvey Radio,
New York City, except as noted.

and some nerve can snoop on your most intimate conversations. As in so many areas of electronics, the transistor has been the key to better surveillance.

The portable tape recorder, now shrunk to hand size, is a vital tool of eavesdropping, for conversations must be recorded to be of value in most cases. But it is in the microphones that feed the recorders, and the other pickup devices that American ingenuity has triumphed.

Miniature mikes decked out as tie clips, lapel buttons and wristwatches are part of the modern snooper's costume, for they can be connected easily via hidden wires to a recorder that is worn in a shoulder harness. Wall pickups—special mikes which are activated when sound waves, as from a voice, strike the opposite side of a wall—are more sensitive than ever.

Most diabolic (or clever, depending on how you look at it) of the snooping mikes are tiny microphone "cells" that can be hidden in holes in the floor or wall. The cord is a wire so fine it is hidden in a crack or sewn in curtains and is almost impossible to spot unless you know what you're looking for. It naturally leads to a recorder in a remote lo-

cation, depending on circumstances.

The new wireless microphones, it is generally agreed, are the handiest of all. Each tiny unit contains a miniature transmitter capable of broadcasting several blocks. Many of these units are limited-radiation devices operating around 27 mc on the license-free band that parallels the Citizens Band. Some bugs are the size of a cigarette pack, others as small as a wristwatch. They can be sown like wheat and then, if recovery is dangerous, simply abandoned.

The working mate of a wireless mike is a highly selective and sensitive receiver which can be concealed in a building or vehicle several hundred feet away. What the receiver picks up can be either monitored or recorded, of course. It was this type of equipment that victimized the lawyer mentioned earlier, for wireless mikes will transmit wherever they happen to light—whether in a room, a car, boat or plane.

The innocent-looking attache case is especially useful to the snooper because it can carry a lot of genuine business papers that tend to distract you from the small compartment holding a tape recorder. The manufacturer's emblem is a handy device for turning into a mi-

Eavesdropper looks like a businessman, but his watch and tie clip are miniature mikes, and . . .

. . . attache case has recorder under flap at left, phone scrambler, shoulder recorder at the right.



crophone (beware of emblems that come bearing tiny holes).

The most dramatic listening device is the directional microphone. It necessarily is large and has an odd appearance. Many have long barrels and are called shotgun mikes. They are able to focus on a spot and pick up sound from a small area that is several yards away.

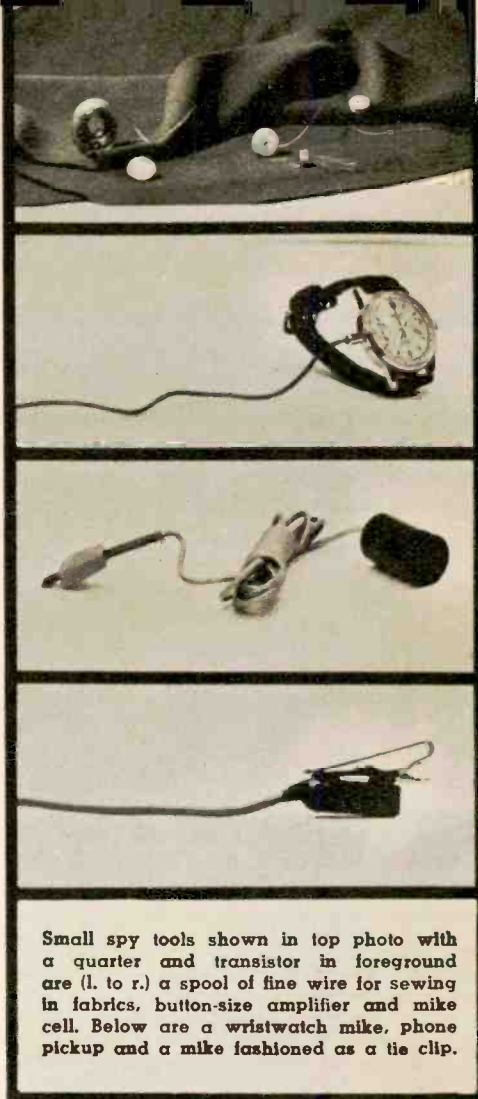
An unexpected directional microphone is the police bullhorn (see photo on first page). With the flip of a switch, the megaphone becomes a sensitive mike able to pick up individual voices along a parade route or in a large crowd. The bullhorn's own mike becomes an earpiece. Police find the two-way megaphone useful in protecting visiting dignitaries from violence-bent spectators.

The spy trade has special equipment for almost everything. For instance, when you merely want to know the location of or the route taken by a person or vehicle, you employ a little transmitter that sends out a continuous tone or beep. For tracking purposes, you use a radio direction-finder. More than one beeper has been dropped into a person's pocket and has successfully pinpointed his location all day without his being

Modern telephone tap is tiny transmitter that goes in wall box, broadcasts all conversations.



Stephens Tru-Sonic, Culver City, Calif.



Small spy tools shown in top photo with a quarter and transistor in foreground are (l. to r.) a spool of fine wire for sewing in fabrics, button-size amplifier and mike cell. Below are a wristwatch mike, phone pickup and a mike fashioned as a tie clip.

any the wiser—until he cleaned out his pockets at home. Perhaps the next step is hiring a pickpocket to recover the gadget.

Escaping snoopers, as we've said, is difficult. Take the errant husband who confined his hanky-panky to a cabin cruiser off the West Coast. A hidden wireless mike was his undoing, broadcasting first to a dock and then to an innocent private plane that tagged along when the boat steamed toward an island. A little reception committee, tape in hand, was waiting when the cruiser finally moored.

But there is one way to foil eavesdroppers. Follow the advice in the title of this article: shhhhhhh!

—John D. Lenk

For The First Time ANYWHERE!

build-it-yourself

By Bert Mann

FOR ALMOST 20 years we've known you can get the cleanest clean, not by using those detergents you hear about on TV, but with an ultrasonic cleaner. The only flaw lay in the price of silent-sound scrubbers. The smallest ones cost \$75 to \$100.

EI herewith presents the first build-it-yourself ultrasonic cleaner, which you can put together for about half the cost of commercial units.

In an ultrasonic cleaner it's the cleaning fluid that does the work, doing a better job in seconds than you could do in hours of hand-scrubbing. Jewelry, small parts, even your eyeglasses come out with more sparkle than when new.

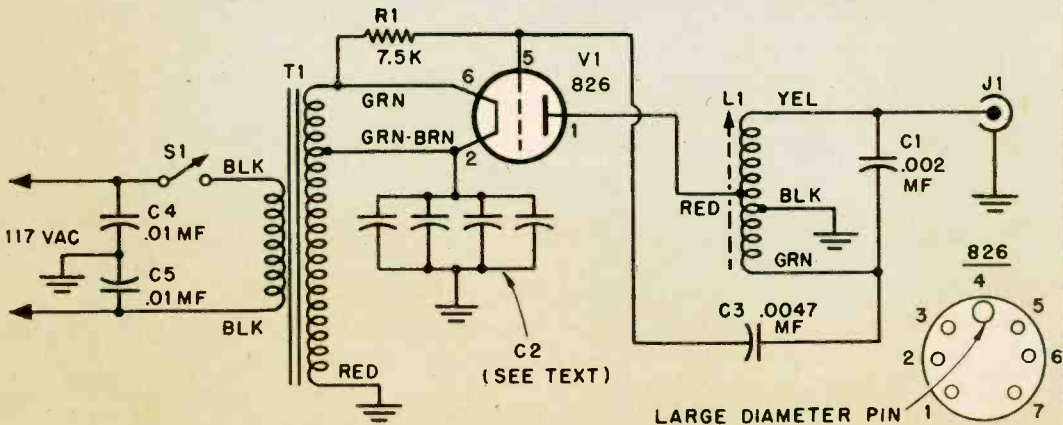
An ultrasonic cleaner is a comparatively simple device consisting of a generator (or power oscillator) producing a high-frequency electrical signal and a transducer which converts this electrical energy to mechanical energy (sound

waves) and couples it to a cleaning fluid. When the h-f acoustic energy hits the cleaning fluid, cavitation takes place and that's what does the scrubbing. Millions of microscopic vacuum bubbles or cavities are formed. As the cavities collapse (implode) they create pressures up to 20,000 pounds per square inch. The term cavitation comes from these cavities.

Anything immersed in cavitating fluid thus is subject to immense pressures, and dirt clinging to it is blasted away. Yet ultrasonic cleaning is so gentle that a delicate microscope slide comes out spotless and also in one piece.

EI's ultrasonic cleaner has a one-pint capacity and uses an easy-to-build generator circuit. Arrangements have been made with a manufacturer of ultrasonic cleaners (see Parts List) to supply all special components as a kit for \$39.95. While some of the items are standard, the kit includes them because we were able to obtain an extremely low price on them. Including chassis and finishing

Cleaner's power oscillator schematic is relatively simple despite many special components.



ULTRASONIC CLEANER

components, the total cost is approximately \$45.

The generator is built on a 7 x 9 x 2-inch aluminum chassis with the layout shown. To avoid an arc-over from the tube socket to the chassis, use a 2-inch diameter cut-out for the socket. Notice that the tube socket has seven pins, one larger than the others. Position the socket so the large pin is toward the front panel. Be sure to leave sufficient space between the socket and panel for power switch S1.

L1 is tuned by a metal slug attached to a rod. Since the slug must slide freely inside L1, the rod's grommet hole must be carefully positioned on the front panel. Drill a $\frac{3}{8}$ -inch hole $\frac{1}{2}$ -inch down from the top of the chassis on the centerline of L1's cut-out.

Assemble as follows: First insert the tuning rod inside L1. Then mount L1 in place with a $\frac{1}{2}$ -inch conduit strap at each end; the straps may have to be expanded to fit around L1. With the

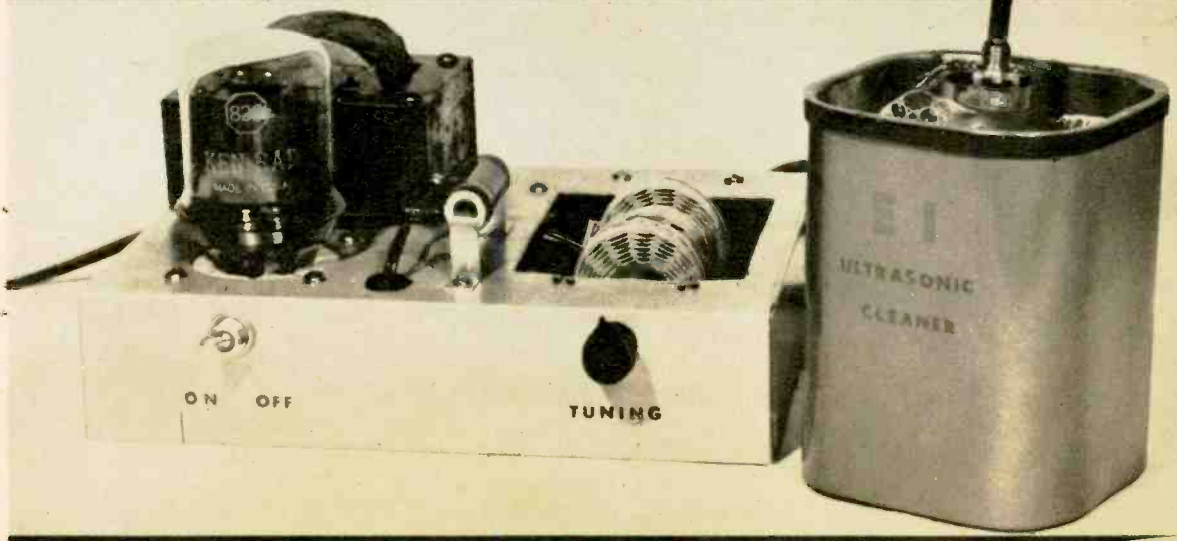
mounting strap screws loose, position L1 so the tuning rod slides in and out through the grommet without binding. Tighten the strap screws, then push the tuning rod all the way back into L1. The

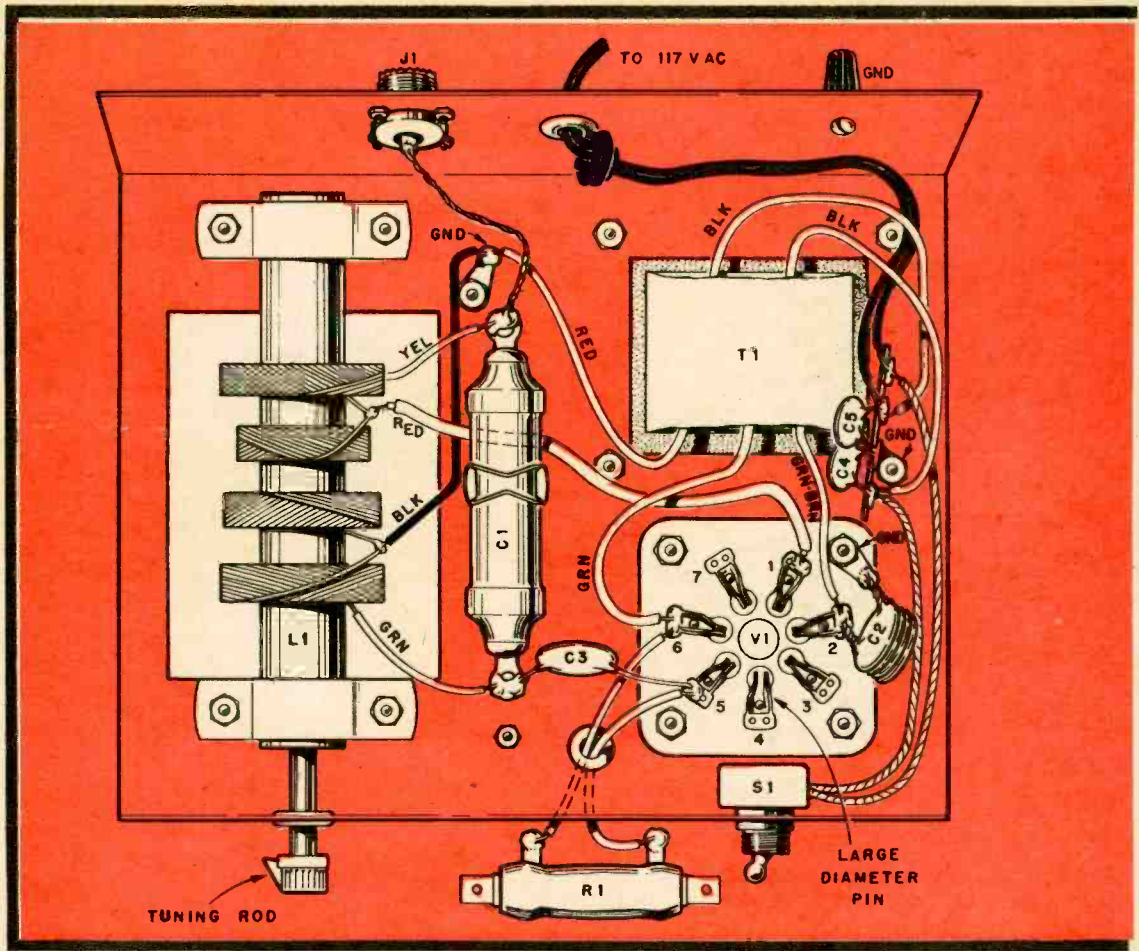
PARTS LIST

- R1—7,500 ohm, 25-watt resistor
- C1—.002 mf, 3KVDC (Special or transmitting mica capacitor, UI 40C1-42)
- C2—.02 mf, 3KVDC (4 parallel-connected .0047 mf, 3KV disc capacitors)
- C3—.0047 mf, 3KVDC ceramic disc capacitor
- L1—Coil and tuning slug assembly (Special, UI 40C1-24 and UI 40C1-20)
- V1—826 tube and socket (Johnson type 247)
- T1—Power transformer (Special, UI 40C1028)
- Misc.—transducer, tank and hardware (Special)

The above components are available as a kit from Ultrasonic Industries Corp., Ames Court, Engineers Hill, Plainview, N. Y. The price is \$39.95 postpaid. Optional tank housing is \$3.50 additional postpaid.

- C4,C5—.01 mfd 600 vdc ceramic disc capacitors
- J1—Coaxial jack type SO-239
- PL1—Coaxial plug type PL-259
- S1—SPST
- Misc.— $2\frac{1}{2}$ -inch conduit straps (to clamp L1) available at hardware stores; 4 feet coaxial cable (type RG59A/U)





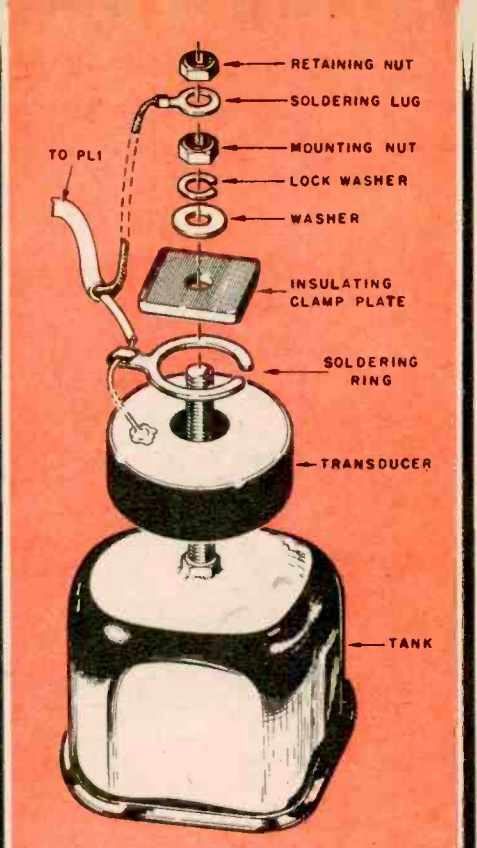
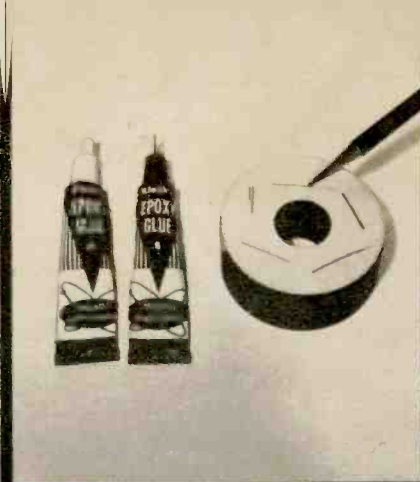
rod will stay inside the chassis, avoiding damage as you complete the wiring.

Capacitor C2 is four paralleled .0047 mf ceramic discs totaling approximately .02 mf. Use the parallel arrangement since a single .02 mf capacitor may be destroyed by internal heating. Prior to installation, twist C2's leads together and solder each as one heavy lead.

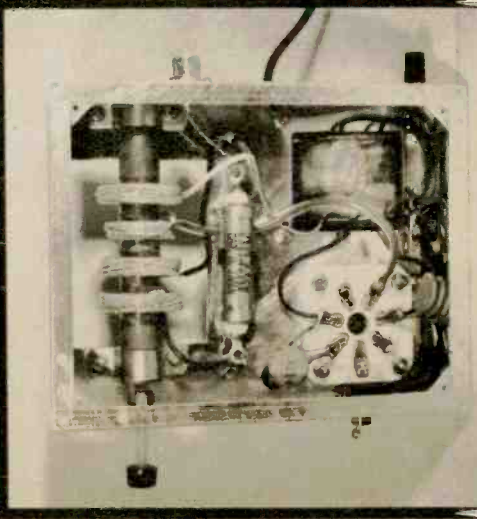
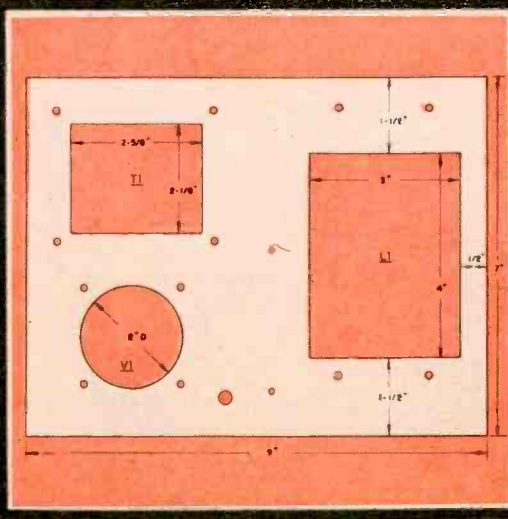
While there is room for R1 under the chassis, it gets fairly hot and is best mounted on the top as shown. After mounting, make sure R1's contacts cannot touch the chassis. When all wiring is completed, pass the tuning rod through its grommet and attach a knob. Since the generator develops over 1,000 volts, both a protective bottom plate and a well-ventilated chassis cover should be provided.

The tank assembly is shown in an exploded view. Note that both sides of the transducer appear to be painted white. It is not paint however, but a layer of silver and must be handled carefully. Prior to assembly, clean both sides of the transducer and the bottom of the tank with a solvent such as Chlorothene (a household detergent will do in a pinch, but be sure to rinse the components).

For proper transmission of the acoustic energy, the tank must be assembled with epoxy. And since the bottom of the tank serves as the ground connection it must also be in good electrical contact with the transducer. Arrange short lengths of stranded wire on one side of the transducer (see photo) and coat the
 [Continued on page 112]



Assembly of transducer is critical. Follow the text carefully as an assembly error after the use of epoxy glue cannot be remedied.



Chassis layout (top view) should be followed. Space high-voltage components away from chassis to prevent arc-over. Tuning rod hole is drilled last.

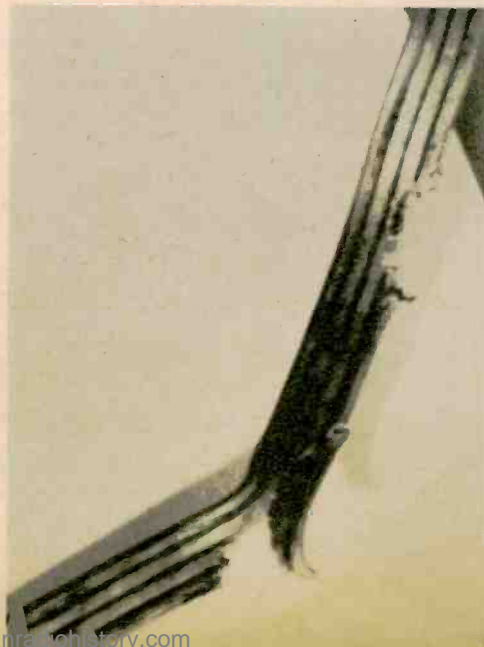
HINT FOR HAMS

GET READY FOR
WINTER

By Carole F. Hoover, K9AMD

Antenna connections and feedline loop should be checked while tower-climbing weather is around. Note second antenna at upper right in picture.

Lightning? Long years of wear? Misplaced foot? Not at all. It's what the author's rotor cable looked like after a gray squirrel got through.



CARS aren't the only things that need to be tuned up for winter. How about your amateur radio equipment? One obvious reason for getting your station in shipshape condition before the snow flies is that hamming activity always picks up in winter. You're no longer distracted by lawn-mowing, picnicking, the beach and those other summer pleasantries. But an equally good reason for doing your checking and repairing in summer or fall is working conditions, particularly in regard to your antenna, feedline and other outside components. Winter is just not a pleasant time to climb an antenna tower or to go sliding around the roof with a cable in your hand.

A good place to start checking is at your ground rod and the heavy-gauge wire you have running to it (if yours is more the size of a transistor lead, now is the time to change). Make sure first, of course, that somebody's misplaced step hasn't pulled the wire loose from the rod. And the clamp must not only be tight—it also must produce a good electrical connection to the rod.

Your feedlines demand a clear path through bushes or trees. Clipping back the foliage may prevent a broken cable when heavy limbs start creaking in winter's first ice storm. This little job also will give you better operation right now.

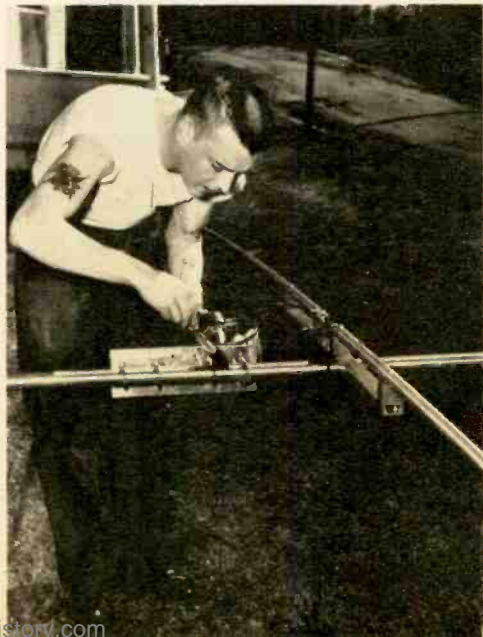
If you have a tower, it's a good idea to clean and repair all the fittings. Take a look at the loop. The slightest wear in it calls for a new replacement. To prevent corrosion, a metal tower should have a paint job every three or four years, and winter is just not the time to paint outside. Do it now. Inspect all the guy wires. If you find too much slack, be sure to tighten the guys evenly. The ham who uses ropes to hoist his beam antenna should start at an even more basic point by checking his hemp before he ties onto anything.

After your outdoor equipment is in top condition, move inside and start the same process there, checking and adjusting and repairing. But that job can run on into the winter. It's the outside work that the thinking ham does when the weather is fair.

Clipping foliage around the feedline or antenna in summer or fall can prevent serious problems when ice-coated limbs begin to snap next winter.



After fittings of antenna have been cleaned the elements can be protected by coating them with lacquer, as demonstrated by Dan Hoover, W9EZA.





THE REGS . . . It's surprising to hear complaints of CW interference on the phone bands. You'd think anybody with a General ticket would know the FCC regs permit CW operation through the full sweep of all the bands. It's phone operation that is restricted to certain sections. Think about

it a little. Which would you rather have as interference: a needle-sharp CW signal that probably can be tuned out with a rejection filter, or a broad voice signal that smears over several divisions of the dial? There may be a complaint about interference on the phone bands, but it shouldn't be about CW signals.

Missing Cans . . . I've visited quite a few stations during the summer and couldn't help noticing that many of them lacked what I consider an important and useful accessory, a pair of cans, otherwise known as earphones. If there are children or light sleepers in a house or you like to operate at owl hours, cans maintain the peace by putting the signals where they belong: right into your ears. No matter how you try to ride gain with the speaker in the circuit, a single unexpectedly loud blast is sure to make you and your gear unpopular with other members of the family.

The remarkable sensitivity of earphones is something you rediscover every time you use them. Signals that are too weak to shake the cone of a speaker are still strong enough to actuate the thin, light diaphragms of cans. Try 'em and see.

Cool War . . . It seems consistent with a few other things the Russians have done—their picking the middle of the 40-meter ham band for propaganda broadcasts from Radio Moscow. Then they have the gall to put on The DX Club and other programs aimed at American hams, the very people who are most nettled by their signals.

The Reds may be masters at brain-washing, but the lad who runs this show must have slept through his propaganda classes. Most of the programs seem laughable and self-defeating. Some sound like the writers are burlesquing what they're supposed to be doing.

If the Russians really want to make friends among the ham fraternity (which is doubtful) they should stop this kind of nonsense and concentrate on operating pseudo-private stations with regular ham calls. Some of their agents now assigned to ham work are real smoothies. Worth special note is UA1KBW, who speaks perfect American (not British English) and gives his name as Alex and his QTH as Lenin-grad. If he runs less than eight kilowatts I'll eat my S-meter.

Top Brass . . . The new Chief Signal Officer of the Army is electronics expert Major General Earle F. Cook, long known to brass-pounders as W4FZ (see photo at bottom of page). A ham for 36 of his 57 years, Earle remains active on the air from his Arlington, Va., QTH after assuming his new duties. He is shown in his shack. W4FZ has a complete Hallicrafters station and a backyard tower supporting a three-element beam. He's a speedy and skilled operator. His favorite rag-chewing time is after breakfast and before he leaves for his office in the Pentagon.

Army's new Chief Signal Officer is Maj. Gen. Earle F. Cook, a ham for 36 years; he's W4FZ.



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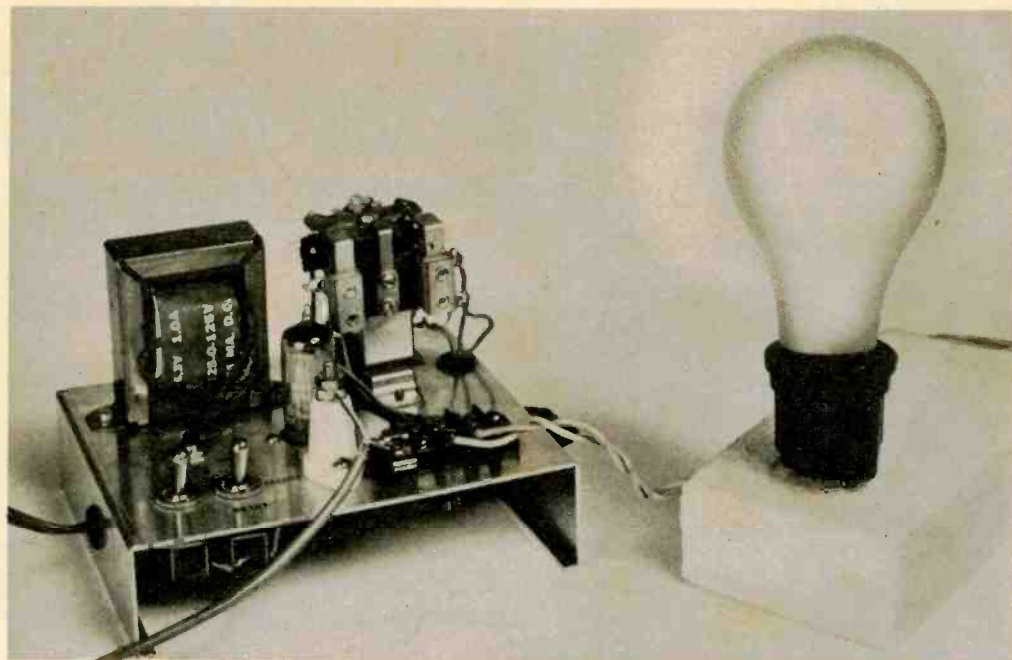
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a new design

PROXIMITY DETECTOR

Use of 60-cycle AC fields instead of RF oscillator permits special features, such as multiple sensors, to be built into this multi-purpose, stable unit.

By John Potter Shields

THE proximity detector is a device that closes a relay when a person or object approaches its sensing antenna. And when you set it to work, it can be an entertaining party gadget or a performer of countless useful tasks around the house, workshop or ham shack. It can serve as a burglar alarm, a safety shut-off on tools, or as a display gimmick that lights up a store window when a shopper comes close (it can operate through glass).

Unlike many previously described capacitance relays, using critical oscillator circuits, this PD unit's novel principle assures excellent sensitivity, stability and easy adjustment. In addition, it can be triggered from any of several separate antennas.

The PD depends for its operation on the fact that the wiring of most buildings radiates a fairly intense 60-cycle AC field. (This same 60-cycle field causes that buzz you hear when you touch an open input of a hi-fi amplifier.) The detector's sensitivity control (R3) is adjusted so that the normal AC pickup does not trigger the unit. Then when a person approaches the sensor his body

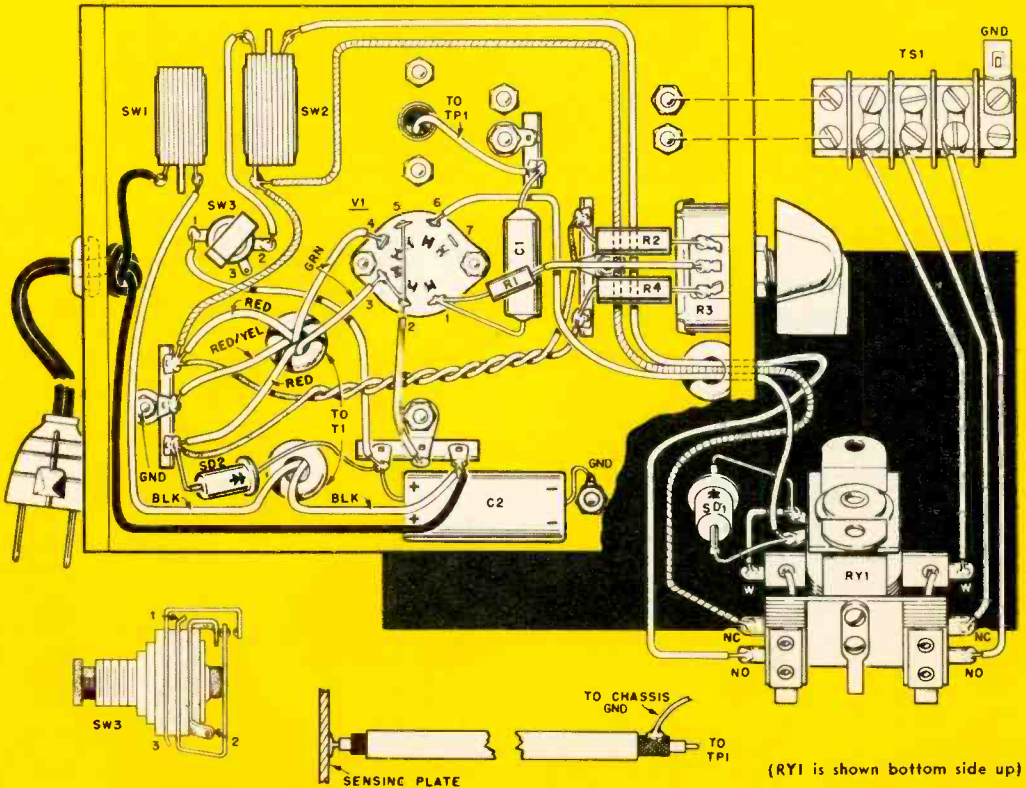
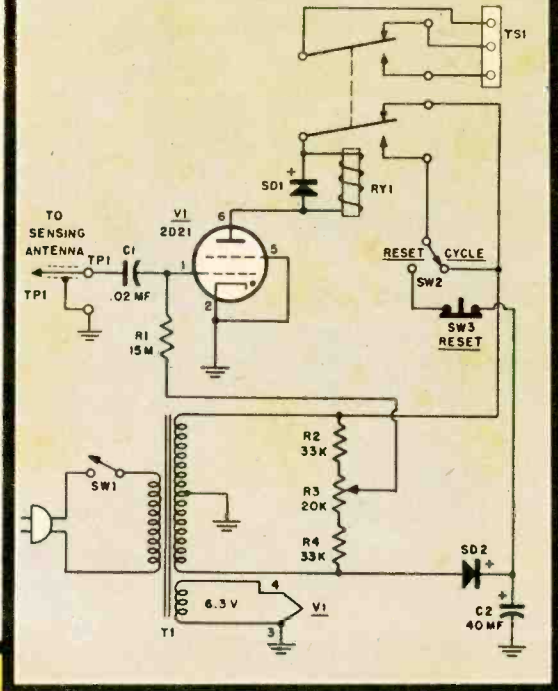


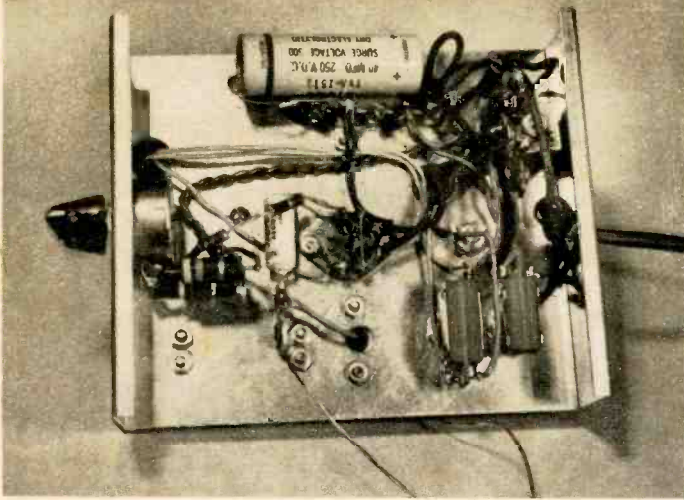
One set of contacts of RY1 is used for the reset-cycle function, the other activates the device to be triggered by proximity.

PARTS LIST

- R1—15 megohms, 1/2-watt resistor
- R2, R4—33,000 ohms, 1-watt, 10% resistor
- R3—20,000 ohms, 2-watt carbon or wire-wound potentiometer (linear taper)
- C1—.02 mf, 600 v tubular or ceramic capacitor
- C2—40 mf, 150 v electrolytic capacitor
- RY1—DPDT relay, 5,000 ohms (Potter & Brumfield, LM11—5000 or equiv.)
- SD1, SD2—Silicon diode, 130 v, 500 ma
- SW1—SPST slide or toggle switch
- SW2—SPDT slide or toggle switch
- SW3—SPDT push-button
- T1—Power transformer, secondaries 250 v, center-tapped @ 25 ma, 6.3 v @ 1 amp. (Stancor, PS-8416 or equiv.)
- TP1—Insulated standoff or 5-way binding post
- TS1—3-terminal barrier strip
- V1—2D21 thyratron tube

Terminals labeled NO, NC and W on RY1 indicate Normally Open, Normally Closed and Wiper contacts. Check them visually.





Although author's model was constructed on open-ended chassis, any type of metal housing and chassis will serve. It would be best to enclose the unit entirely.

serves as a loosely coupled antenna that feeds additional 60-cycle signal into the circuit. This triggers thyatron tube V1, which operates relay RY1.

Construction takes only one or two evenings and the parts should cost less than \$15.

Circuit Design

The sensing antenna is coupled to the control grid of thyatron V1 through capacitor C1. The same grid also is connected by isolating resistor R1 to the arm of *sensitivity* control R3. The plate of V1 feeds the coil of relay RY1.

For either setting of mode switch SW2, the plate of V1 is supplied with 60-cycle AC from T1's high-voltage secondary. Since R2, R3 and R4 are connected directly across this same center-tapped winding, the phase and amplitude of the 60-cycle signal applied to V1's grid may be varied by R3. Therefore, if R3 is adjusted so that the voltage is out of phase with the signal picked up by the sensing antenna, V1 will *not* conduct.

When a person approaches the sensing antenna, the induced signal increases and V1 conducts, closing the relay. It is obvious that the phasing of the voltage on both the grid and plate of V1 must be correct with respect to the signal voltage or the induced signal will only increase the amplitude of the out-of-phase voltage at the grid of V1. To get the proper phasing, it is necessary to reverse the PD's line plug.

Mode switch SW2 selects either *cycle* or *reset* operation. In the *cycle* position RY1 opens after the person has moved

away from the antenna. When SW2 is in *reset*, RY1 will continue to conduct until the DC plate supply is interrupted by depressing the normally closed *reset* switch, SW3.

Note that in both the *cycle* and *reset* position, V1 receives its plate voltage (before the relay is energized) from the contact of the relay which is connected directly to one side of T1's secondary.

Diode D1, across the relay coil, prevents relay chatter. Do not substitute an electrolytic capacitor here. Its long discharge time will upset circuit operation.

Initial Adjustment

Turn on power switch SW1 and allow V1 to warm up. With a metal plate or other antenna connected through shielded wire to antenna terminal TP1 and ground, advance R3 until RY1 closes. Now back off R3 until the relay *just* opens. Bringing your hand to within several inches of the wire or plate should now cause RY1 to close. The maximum range of this type of unit is about 8 to 10 inches with a 6-inch metal plate connected to the antenna terminal. If the unit does not operate, reverse the line plug. For maximum sensitivity, it is important that the antenna be clear of nearby objects.

A novel feature of this unit is that the sensing antenna wire or plate may be located some distance from the detector. Note that the sensing element(s) *must* be connected to the unit's input by shielded cable. The cable can be almost any reasonable length and several sensors may be connected in parallel.

THEY ARE found in radios and along high-tension lines, in your car's ignition system and in your soldering gun, in cyclotrons and intercoms—in fact, anywhere electricity is used there's apt to be a power transformer at work. It may be no bigger than the end of your finger—or larger than your garage. Without the power transformer and its special properties, today's technology would be vastly different.

Primary or Secondary

By definition, a transformer is two or more coils coupled in such a manner that electrical energy (usually alternating current) can be transferred from one coil to the other with no direct connection. During this process the voltage may be increased or decreased.

An example of voltage-changing is demonstrated by the transformer on the pole behind your house (it's called a pole-pig by the linemen). It *steps down* the 4,400 volts of the transmission line to a nominal 117 or 234 volts (often rounded off orally to 110 and 220 volts). The 117 volts can be used for your lights, radios, television sets and other appliances. The high-voltage circuit is useful for such heavy-duty equipment as electric stoves, air conditioners and heaters.

The transformer coil connected to the *source* of power is called the *primary*. The *secondary* coil is connected to the *load*, or the circuit which consumes the power. The device that provides filament power for a vacuum tube is an example of a basic power transformer. You *could* use a resistor to drop the 117-volt line down to the 6 or 12 volts the tube requires, but resistors in that job would be large and hot. In the case of the filament transformer, the power line is the source and the filament the load.

If there are several loads requiring a variety of voltages (such as in a television set or hi-fi amplifier) more than one secondary is used. Some may step up the voltage and others step it down. Remember that the primary and secondary are interchangeable. If the correct voltage can be obtained by reversing the windings, the

MEET THE POWER TRANSFORMER



Transformer drawings courtesy Stancor;
cartoons by Cober.

By Don Stoner, W6TNS

primary can be used as secondary, and vice versa. In other words, you can use the same transformer to step voltage up or down simply by changing the way you connect it in the circuit.

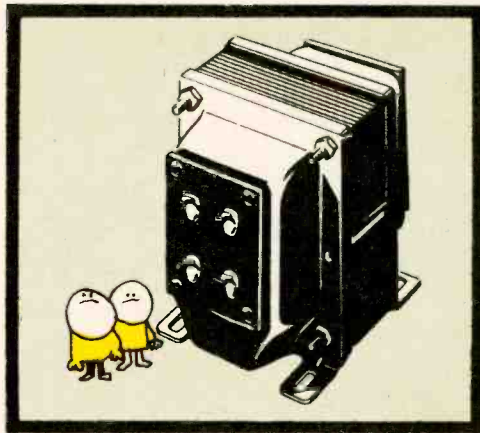
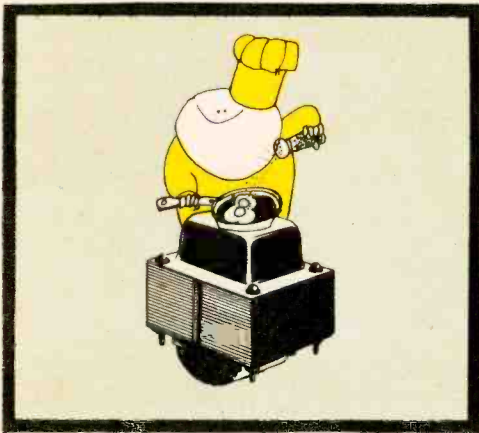
Voltage on the Move

The power lines bringing energy to your house carry alternating current. The current is termed alternating because it alternates from positive to negative 60 times a second.

There are some facts about these alternations you should remember. Dur-

the opposite terminals. Once again, as the negative voltage builds up, the lines of force increase. Thus, for each cycle two magnetic fields are generated.

You can see that the coil actually converts the electron motion into magnetic fields which change in intensity and direction. If the field is to work for us, it must be contained. For this reason, the coil usually is wound on a metal core. The core material is selected to be a good conductor of magnetic lines of force just as we select copper as a good conductor of electrons.



If wire size is too small, temperature rises. . . If wire is too large, transformer will be oversize.

ing, say, a positive alternation the electrons in the wire travel in one direction. Then, when the alternation goes negative, the electrons do an about-face and travel in the opposite direction. This action is vital to the operation of a power transformer. Whenever electrons travel through a conductor, they create invisible magnetic *lines of force* or *flux lines* which encircle the wire. If the wire is wound in the form of a coil the flux lines combine to produce an intense *magnetic field*. When the alternation swings positive the magnetic lines of force expand from the coil, and the electrons travel from one terminal to the other. Then, as the alternation passes the peak, the voltage starts to decrease and the lines of force contract. When the voltage passes through zero and goes negative, the electrons reverse direction and travel to

On the same core you will find the secondary coil arranged so the lines of force expanding and contracting around the primary winding cut the secondary. When this happens, electron motion is induced in the secondary. In short, we create lines of force by moving electrons through the primary. These lines of force, in turn, move electrons in the secondary winding with no visible connection between the two windings. This process is known as *induction*.

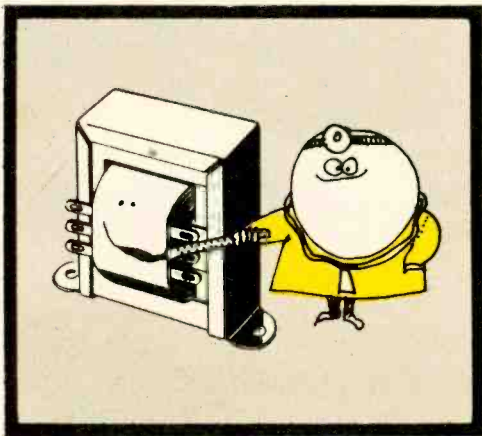
Turns Ratio

In a practical transformer, the voltage relationship of the two windings is directly related to the number of turns on each. Let's say the primary has 100 turns of wire and is connected to a 117-volt source. The voltage across the secondary also will be 117 volts if it, too,

has 100 turns (neglecting small losses). By the same token, if the secondary is wound with 300 turns, the voltage induced in it will be 351 volts.

If this same transformer were turned around so the 300-turn winding was connected to 117 volts, the voltage across the 100-turn winding would be 39 volts.

With any transformer, if you divide the number of turns on the secondary by the number on the primary and multiply this figure by the primary voltage, you will be able to determine the secondary voltage.



It's possible to check the winding temperature.

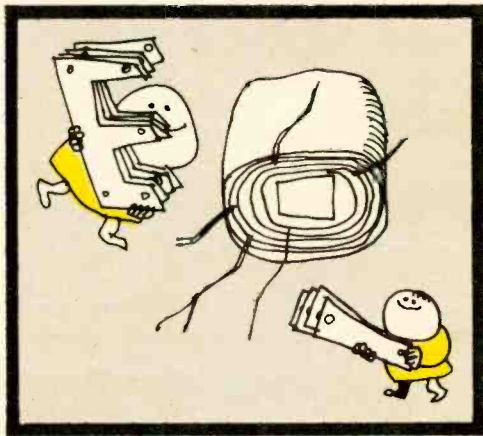
The formula for determining the number of turns on the secondary for a given load voltage also is quite useful. In this case the experimenter would know the primary voltage, the primary turns (how this is determined will be explained later) and the desired secondary voltage. The only unknown is the number of turns required on the secondary. To find this figure, you multiply the secondary voltage times the number of primary turns and divide this by the primary voltage.

Load Effects

The two windings on the transformer core are tightly coupled through the magnetic lines of force which traverse the core. Any change in load current in the secondary will be reflected directly in the primary circuit.

When no load is connected to the secondary, the primary winding consumes only enough power from the source to magnetize the core. However, when the secondary circuit is completed by connecting a load to it, the secondary generates its own magnetic field. The fact that the voltage was induced in the secondary, rather than applied, has no bearing on the situation. Whenever the electrons are in motion, they are accompanied by magnetic lines of force.

Since the currents flow in opposite directions in the primary and secondary



The coil is stacked with a core of I's and E's.

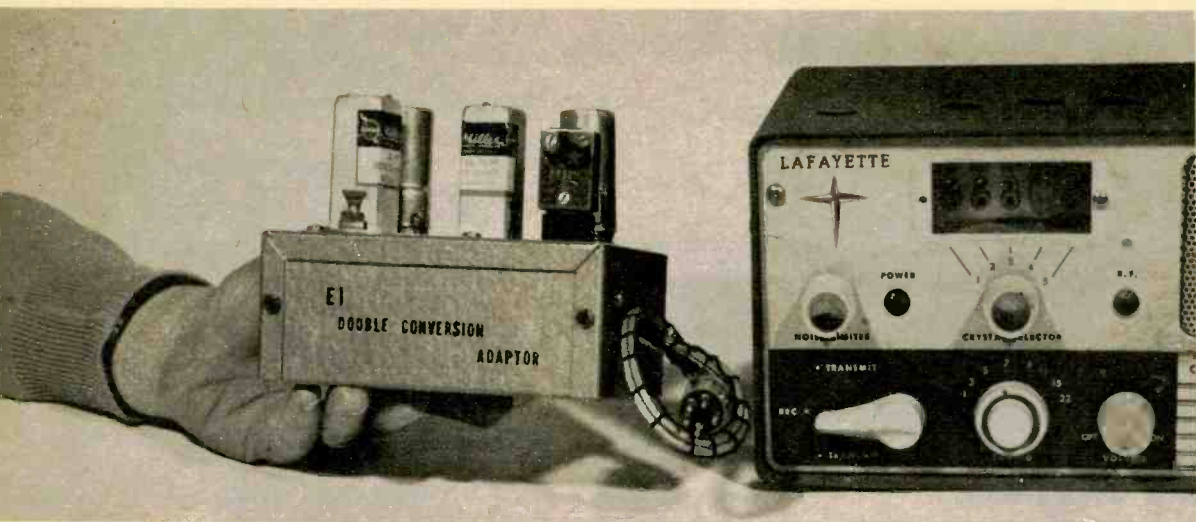
windings, the magnetic fields they generate oppose each other. To overcome this opposition, or magnetic resistance, the primary must draw more current from the source. And this is the reason why the primary current is directly related to the current being drawn from the secondary by the load.

How's the Efficiency?

The transformer theoretically is capable of delivering as much as 97% of the source power to the load. Practical considerations, however, drop it to between 60% and 90%, depending on size and application.

The efficiency of a transformer is determined principally by core losses and the winding resistance, commonly called *IR loss*. Any power going into the

[Continued on page 118]



Soup-up your CB with EI's

Double-Conversion Adaptor

By Herb Friedman, 2W6045

THE MOST serious limitation of low-priced Citizens Band transceivers (and short-wave receivers) is their lack of selectivity. Inadequate selectivity permits signals on nearby frequencies to jam the one you're trying to pick up. And if you can't hear 'em you can't work 'em.

EI's Double-Conversion Adaptor (DCA) increases the selectivity of your receiver to where it matches the performance of more expensive units. Though the adaptor was designed for CB gear, it achieves the same results when added to budget-priced communications receivers.

The DCA uses a crystal-controlled oscillator to convert the receiver's IF signal to a new and lower IF frequency. The converted signal is then fed through an IF amplifier tuned to this new frequency. Since selectivity is an indirect function of IF frequency (the lower the frequency the higher the selectivity), the addition of the DCA results in high total selectivity and additional gain. Crystal control insures that the original receiver calibration is maintained and eliminates the need for instrument alignment on receivers with a 1,500-1,800 kc IF frequency. Unfortunately, a 455-kc crystal is prohibitively expensive, so a compromise alignment requiring a signal generator is used for 455-kc IF receivers.

The DCA will work with 100-250 volts B+. Current drain is only 13 ma (at 250 volts) so connection usually can be made to the receiver's power supply. If the receiver is overloaded by the DCA, or the DCA is to be used with an AC/DC SW receiver, the separate supply shown in Fig. 2 is a must.

PARTS LIST

- Resistors: 1/2-watt, 10%
 R1, R2—100,000 ohms
 R3—150 ohms
 R4—22,000 ohms
 R5—47,000 ohms
 R6—2.2 megohms
 R7—68 ohms
 R8—33,000 ohms
 Capacitors: 300 V or higher ceramic disc
 C1—2.7 mmf
 C2, C3—68 mmf
 C4, C6, C8, C9—.02 mf
 C5—.005 mf
 C7—.05 mf, 200 V tubular
 V1, V2—see text
 Xtal—Crystal (see text)
 D1—1N34A
 T1—262 kc IF transformer (Miller 12H-1)
 T2—262 kc IF transformer (Miller 12H-6)
 Misc.—Shielded tube sockets; FT-243 crystal socket;
 Minibox; chassis hardware, etc.

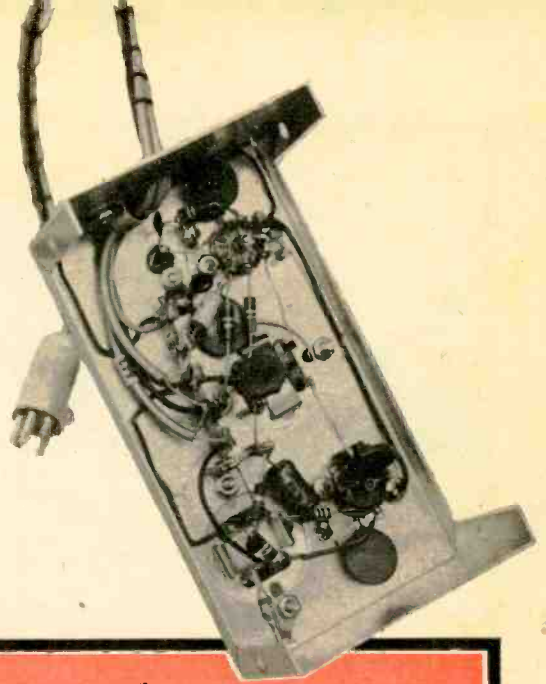
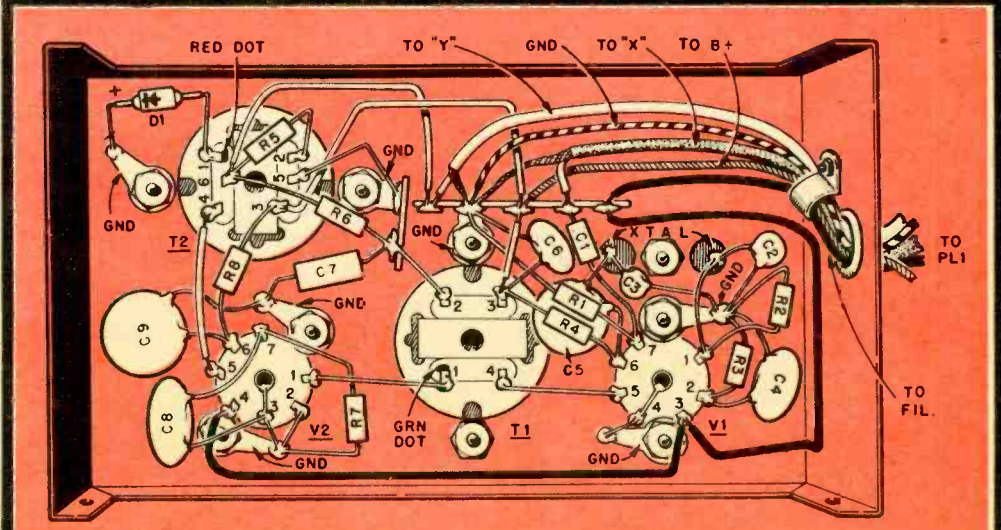
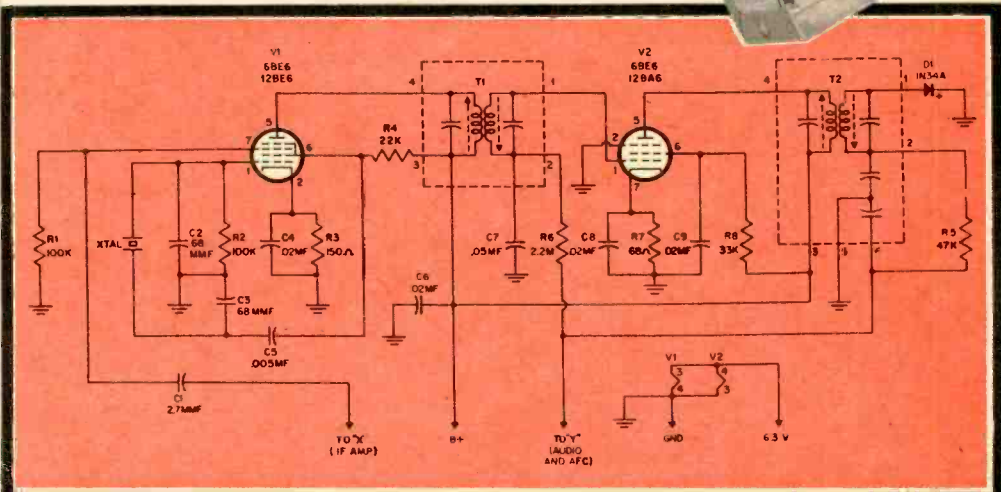


Fig. 1. Some leads in pictorial below are shown longer than necessary for clarity. Keep leads as short and direct as possible. Note shielded wires to receiver points X and Y in Fig. 4.



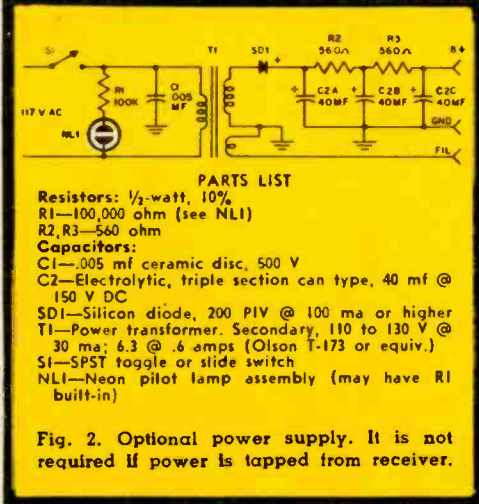
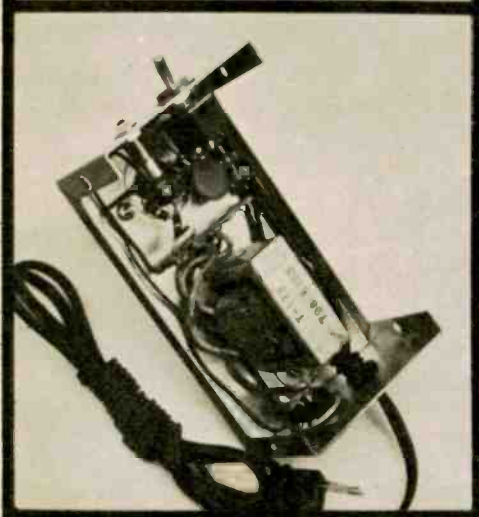
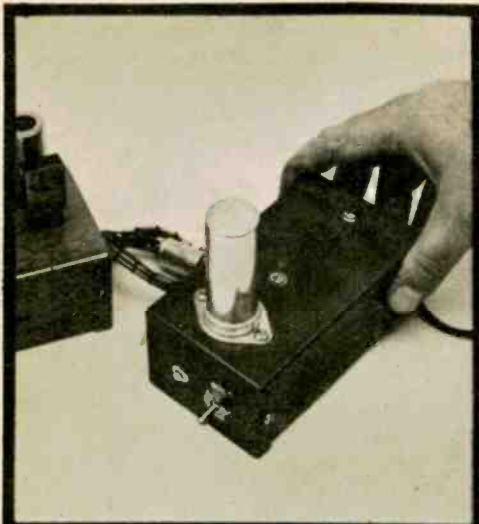


Fig. 2. Optional power supply. It is not required if power is tapped from receiver.

When using the DCA with an AC/DC receiver precautions must be taken to avoid shock hazard. Make certain the AC power plug is inserted so the chassis is at AC ground. To check, connect an AC voltmeter between the DCA chassis and a ground (such as a water pipe). With the receiver on, plug the power cord into the wall receptacle. If the meter reads line voltage, indicating the chassis is hot, reverse the power plug.

Construction. Wiring is not critical, but for best results follow the pictorial. The components are mounted on the main section of a 2 1/8 x 3 1/8 x 5 1/4-inch Minibox. The clip-mounting IF transformers, T1 and T2, are supplied with an adaptor plate which fits a 1 1/8-inch hole. In order not to crowd the terminal strips, T1's hole is punched as close as possible to the chassis edge. To avoid a parts jam, complete the lead wiring to the tube sockets, T1 and T2 before other components are mounted.

Be certain the filament wiring mates with your receiver. The standard filament setup is shown in Fig. 3 (A). For 6-volt operation, the DCA uses a 6BE6 and a 6BA6; for 12-volt operation, 12BE6 and 12BA6. The circuit in Fig. 3 (B) is for receivers which use a 6-volt filament supply for line operation and a 12-volt supply for mobile. Filament voltage selector switch S1 is part of the receiver's original equipment.

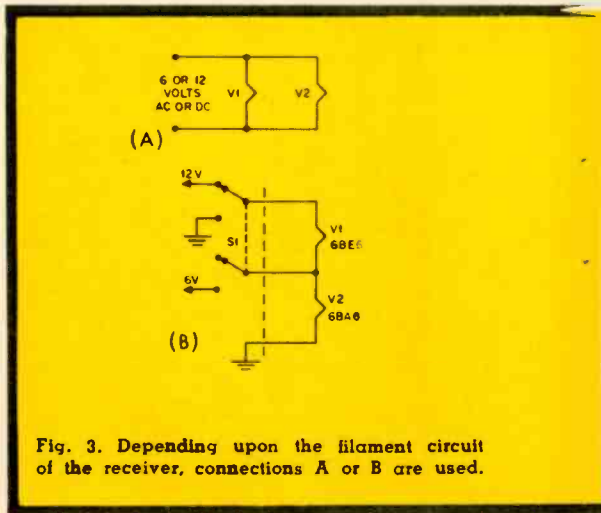


Fig. 3. Depending upon the filament circuit of the receiver, connections A or B are used.

The wiring of T1 and T2 in our diagram is slightly different from the connections in the data sheets supplied with T1 and T2. Our connections result in slightly less gain (there's more than necessary, anyway) but in higher selectivity.

Detector diode D1 is wired last with a heat sink on each lead to prevent heat damage.

The connecting wires run through a 1/2-inch rubber-grommeted hole. Input and output leads are shielded cable. For ease in handling, a thin, spiral-wrap type, such as Alpha #1702, is recommended.

Connections to the Receiver. Only two signal connections are required at the receiver. B+ and filament voltages may be tapped from the receiver's power supply, or the separate power supply shown in Fig. 2.

To facilitate servicing, the DCA is connected via a jack and plug to the receiver as shown in Fig. 4. The circuit break-in points are at the last IF transformer's secondary. The diode originally connected to the IF transformer terminal (point X) is now connected to pin 2 of the socket (SO1) installed on the receiver chassis. Unsolder the components from the transformer lug that feeds the AVC/audio line. The free leads are then twisted together (point Y) and brought to pin 5 of SO1. Free

transformer lug "X" is now connected to pin 1. The transformer's other terminal (which normally feeds the AVC line) is connected to pin 3. With this arrangement, inserting jumper plug PL1 restores original operation. If a separate power supply is used, ignore pins 7 and 8 on SO1. Connect a B+, ground and filament lead from the power supply to the DCA.

Selecting the Crystal. If your receiver's IF frequency is in the 1,500-1,800 kc range, the crystal frequency must be 262 kc above the IF frequency. For example, if your receiver's IF is 1,600 kc, order a 1,862-kc crystal ($1,600 + 262 = 1,862$). Specify type FT-243.

For a 455-kc IF, order a 729-kc crystal, type FT-241. This is available in surplus and is marked Channel 700. With 455-kc receivers, the IF frequency of the DCA is 274 kc ($455 + 274 = 729$). The crystals are available from the Texas Crystal Co., 1000 Crystal Drive, Fort Myers, Fla. Cost prepaid is: Type FT-243, \$2.80; type FT-241, \$1.30.

Alignment. The DCA does not require instrument alignment when used with receivers having an IF in the 1,600-kc range.

Connect an antenna to the receiver and tune in a weak signal (or use EI's CB SIGNAL GENERATOR, May '62 issue). Using a K-Tran alignment tool, [Continued on page 117]

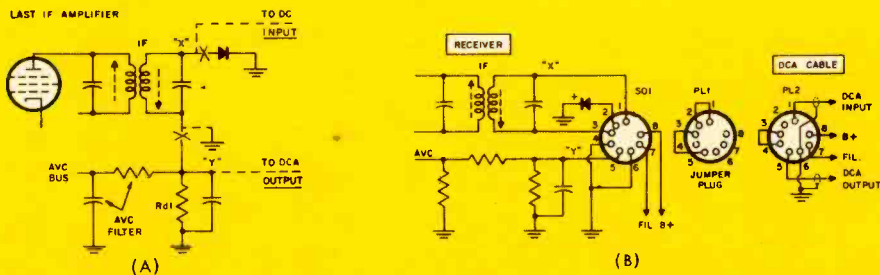
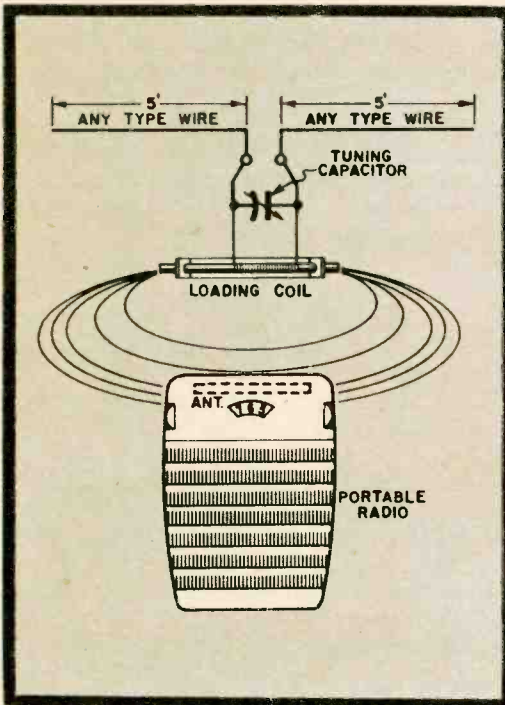


Fig. 4(A). DCA is connected to receiver as shown. Actual circuit changes are minimal. (B) If receiver wiring is brought to socket SO1, insertion of PL1 restores normal operation. DCA cable carries signal and power to adaptor.

A SIGNAL BOOSTER

for your portable radio



The portable radio is positioned so that the field around the loading coil impinges on its antenna.

WHEN Americans head for the campsites and cabins to rough it they usually take pocket portable radios along. Sad to tell, however, up in the hills even eight-transistor jobs frequently have a hard time delivering more than a weak mumble buried under a mountain of hiss. And if your radio has six transistors or less you might as well give up.

The Portable Signal Booster is the answer to the problem. Simply, it consists of two five-foot dipole elements connected to a loading coil. This makes the two antennas electrically equivalent to a 400-foot length of wire. The magnetic lines of force around the coil cut through the plastic case and induce a

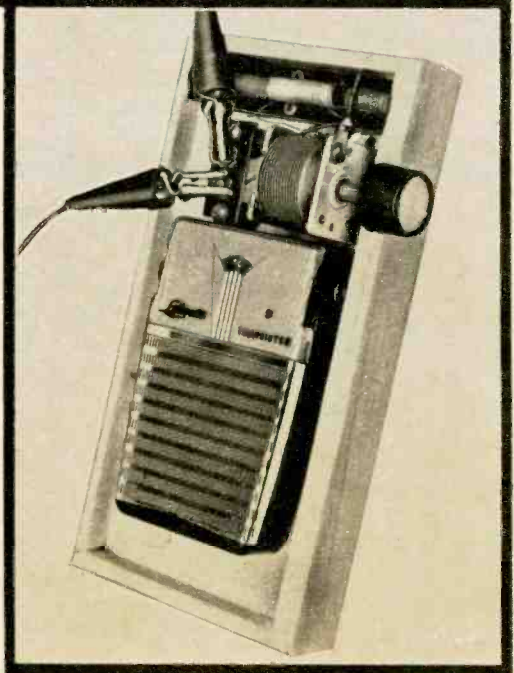
souped-up signal into the radio's loopstick antenna.

Construction can take just about any form you desire. But the loopstick in the radio (check its position) and the loading coil should be parallel and spaced one to three inches apart.

The coil is a J. W. Miller #2003 with approximately 50 turns removed from one end. Note that the tap wire, at one end of the coil, is not used and the 50 turns may be removed from this end of the coil. The tuning capacitor can be any type with a maximum capacitance of 365 mmf.

To test out the Booster, tune in a weak station on the portable, set it near the coil and tune the Booster's capacitor to resonate with the station you are receiving. Experiment to find the position that will best lift the signals out of the soup. ●

If desired, a small box may be built to house both the portable and the Signal Booster's components.



By Howard Shop



CB CORNER

BY LEN
BUCKWALTER
1W6733

30-Watt CB

IGNORED

That's what you'd have to say about 30-watt CB operation. No one seems to be giving it a second thought. It's surprising how few manufacturers or CBers are aware of the golden opportunity to increase their operations on a vast scale. We're talking about the high-power provision tucked away in Part 19 of the FCC Rules and Regulations—the one that permits 30 watts on Channel 23 when the signal is used for attracting attention or for the operation of a remote device. No voice is allowed, but several advantages are apparent. Let's take a look.

First off, the operation is considered Class C, the kind used by the radio-control boys for model airplanes or boats. But there's little reason why the mighty blast of a 30-watt signal could not be used to benefit the Class D operator. Chief application is a form of radio paging. It's no secret that some business users of CB have been disenchanted by the short-range capability of the 5-watt Class D band. When their trucks get out of a pretty restricted area, for example, communications are wiped out.

The problem could largely be eliminated with a 30-watt booster in this way: when a truck ranges beyond the coverage of its base station, it tunes its Class D rig to Channel 23 and monitors

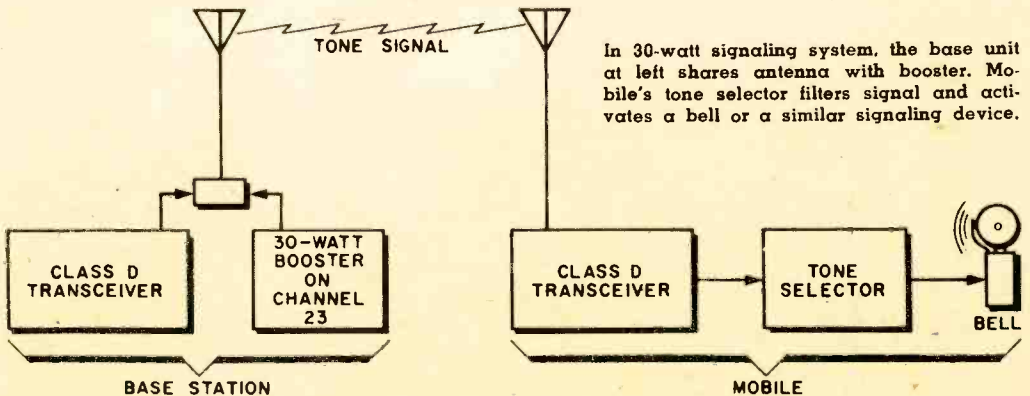
continuously. If the office is unable to establish contact it sends out a paging signal on 23. In the truck the signal becomes a ringing bell or other alerting device. The driver stops at a telephone and calls in for the actual message. A comparable system, operated commercially, is now in use in several cities.

It works the other way, too—from mobile to base. And it has some intriguing possibilities for distress and emergency signaling, especially where the five-watter fails.

With the possibility of more participation by CBers in Civil Defense, the 30-watt system takes on further appeal. A quick calculation reveals that approximately 60 CB stations could link New York with California to form the basis of a nationwide CB alerting system if the need ever arose.

Our sketch suggests how much of an existing CB unit could be modified for 30-watt Class C operation without interfering with any normal function. The big advantage is that present Class D receivers already can pick up 23. On the transmitting end a 30-watt unit (capable of Channel 23 operation only) is added. An adaptor on the receiver converts the tone to an audible signal. (The tone itself cannot be the attention-getting signal; it must activate another device, like a bell.)

Thus, Channel 23 opens up a whole new area of CB operations.





Next Best Thing To Being A Ham

It's being an ARM . . . an Amateur Radio Monitor.
Reward: interesting listening and QSL cards.

By C. M. Stanbury II

PERHAPS you never heard of the Amateur Radio Monitors . . . the ARM's. The term is so freshly minted that few know what it means. It was coined by a young man in Fairfield, Conn., to describe his own hobby, which is monitoring the amateur radio bands.

The term-coiner's name is Thomas W. Duignan. A letter from him appeared a few months ago in EI. It described the activities of ARM's and elicited a large number of letters from other readers who wanted more facts.

To transmit on the amateur bands requires a license, of course, but to listen takes nothing more than a short-wave receiver. Listening to the hams is nothing new. One of the top ARM's is LeRoy Waite, who started in 1928 and at last count had verified reception from 276 countries. But the ARM field has changed in the last several years, mainly because of the huge increase in the number of hams and short-wave listeners.

Listening to the amateurs can be the first step in becoming a ham yourself.

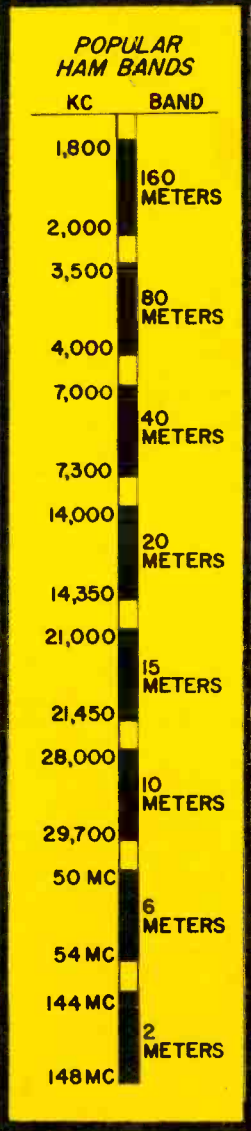
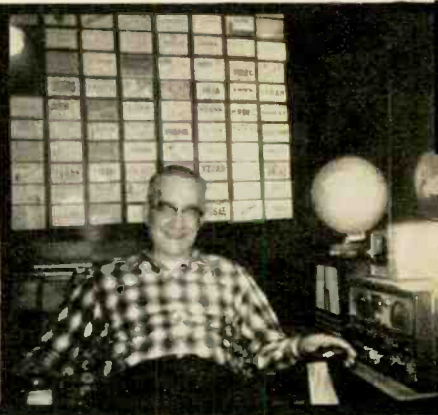
It helps you learn operating procedure, the lingo, how the various bands behave, and it makes good code practice. But not everyone who listens wants to be an amateur. Mr. Waite has no such desire, for instance. There are many like him. DX hunters, they're called. Their hobby is getting verified reception from as many countries as possible.

Listeners who go in for rare DX find the ham bands particularly productive because many far-away locations that are not heard on other short-wave frequencies can be bagged amongst the hams. In fact, amateurs arrange DXpeditions to such exotic spots as Navassa, Amsterdam Island and the Kerguelen Archipelago. If you aren't a ham and don't monitor them, such places simply aren't going to appear in your list. By covering the amateur frequencies, in addition to other bands, many veteran DXers have approached or passed the 300-country mark.

But most hams are interested primarily in activities in connection with



QSL cards at left are from one ARM's collection. SWL cards (right) are used sometimes by monitors. At far right is top ARM LeRoy Waite, who got started in 1928.



other hams. DXpeditions are not arranged to benefit ARM's. And it is for this reason that we say ham-monitoring has changed. At one time hams sent QSL cards to non-ham listeners fairly freely. The great increase in the number of hams and SWL's has made it difficult (and expensive) for amateurs to continue this practice, particularly those who live in rare lands.

One amateur, Hubert Philby, K7DLR, Boise, Idaho, expressed it this way: "Except under certain conditions, the exchange of an SWL card for a QSL card is a one-way street not particularly beneficial to the ham.

"Hams usually are not interested in hearing about routine operations. However, the SWL can provide a real service if he studies propagation a little and knows what is true DX and what is not."

So that is the secret to being a successful ARM. Make sure your reception reports are of value to the ham in question—that it's a two-way street between you and him. If you do supply information of value, most amateurs will reply with a QSL to enlarge your collection (the cards shown with this article are from the collection of Mr. Duignan, the ARM inventor).

DX criteria—and the value of a report—have to do with the band used, propagation conditions, aurora and so on. To hear that he was received under difficult or unusual conditions is of interest to the ham.

Before logging any amateur signal, check the rest of the band to find out whether it is wide open or only a few transmissions are getting through. If the latter is the case, what you hear probably is DX at that moment. Or, if signals from a certain continent are coming in like locusts—particularly if they're to hams in your area—you can't help. Listen for signals from countries rarely heard in your area, and on bands which are not supposed to be open right then.

One trick is to pick a band where distant stations are not normally received; i.e., the 75-80 meter band (see chart).

When you report, give full reception details and include an International Reply Coupon. To get a ham's address, use the Radio Amateur Call Book, available from the ARRL.

HOW TO MAKE \$135



70 Watts, Heath Rating; 100 Watts IHFM Music Power

"Startling Realism . . . Superb Dynamic Range . . . Smooth, full power delivery . . . Fast, effortless transient response . . . Professional . . . Convenient . . . Takes full advantage of the state of transistor art . . . Simple assembly" . . . these are but a few of the enthusiastic comments of those who have heard and seen the new Heathkit AA-21 Transistor Stereo Amplifier.

Rated at 35 watts per channel by Heath standards or 50 watts per channel by IHFM music power standards, this Heathkit combination stereo preamplifier, power amplifier delivers full power over a range of 13 cycles to 25,000 cycles, ± 1 db! No compromise in dynamic range, no faltering power at the important high and low extremes of response . . . just the most satisfying solid sound you have ever heard. Its other specifications are equally impressive . . . completely factual and guaranteed!

Featuring 28 transistors and 10 diodes, the latest, most advanced in RCA semi-conductor technology, the Heathkit AA-21 not only offers record-setting performance, but also provides operational characteristics unique with transistors . . . cool operation with low power line requirements . . . steady performance under wide, external temperature variations . . . complete freedom from annoying microphonics . . . instant operation.

More than two years in development, this pace-setting unit features transformerless output circuitry plus multiple feed-back loops for flat response and finest fidelity. All controls are front-panel mounted for operating convenience, with a 5-position, dual concentric input selector which permits "mixing" inputs for

tape recording purposes, etc., a 5-position "mode" selector, plus dual concentric volume, bass and treble controls. A hinged lower front panel covers all input level controls, the tape-monitor input switch, a speaker phase reversal switch, and a loudness switch which converts the volume control to a loudness control for compensated low-volume levels. The right-hand section of the lower front panel is a unique On-Off switch . . . touch to turn on, touch to turn off. All input and output connections are conveniently located on the rear chassis panel. Circuit safety is assured through the use of 5 new, fast-acting, bi-metal circuit breakers . . . no more annoying fuse-fussing.

Kit assembly is fast and simple through the use of 5 circuit boards which eliminate most of the conventional, time-consuming point-to-point wiring. The preamplifier circuits are "capsulized" to reduce wiring . . . 6 epoxy-covered modules contain 70 resistors and capacitors, all factory wired and sealed, ready for easy mounting on the preamplifier circuit boards.

Styling is in the Heathkit deluxe motif of luggage-tan vinyl-clad steel with polished, anodized aluminum trim, plastic upper front panel, extruded aluminum lower panel with matching vinyl inset, and soft, refracted panel-lighting.

Designed to set a new standard of value, this finest of all stereo amplifiers carries a surprisingly low price tag . . . order yours now for early enjoyment.

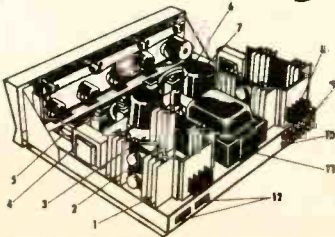
Kit AA-21, 28 lbs., no money down, \$13 mo. **\$134.95**
Assembled AAW-21, no money down, \$21 mo. **\$219.95**

SOUND LIKE A MILLION!



Build This New Heathkit Transistor Stereo Amplifier

Full Power, Wide-Range Sound As You Have Never Heard It



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If you are not already on our mailing list, fill in and mail the coupon below right away to receive this new Fall & Winter edition of the world's biggest electronic kit catalog. More than 100 new electronic luxuries have been added since the last issue... more than 250 in all, completely described and illustrated. Send for your free copy today!

1. Eight germanium power output transistors mounted on four finned heat sinks. 2. Output circuit breakers. 3. Two power amplifier circuit boards containing four transistors and six diodes. 4. Two driver transformers. 5. Two preamplifier circuit boards containing six epoxy-sealed component modules and ten transistors. 6. Two germanium driver transistors plus four electronic filter transistors. 7. Two 3,000 mfd filter condensers and four power supply diodes. 8. Two output terminal boards. 9. Stereo input jacks. 10. Tape recorder output jacks. 11. Power transformer. 12. AC power outlets. All primary and secondary controls accessible at front panel area!

SPECIFICATIONS—Power output per channel: (Heath rating), 35 watts/8 ohm load—25 watts/16 ohm load—18 watts/4 ohm load; (IHF-M music power output), 50 watts/8 ohm load—34 watts/16 ohm load—25 watts/4 ohm load @ 0.7% THD, 1 KC). **Power response:** ±1 db from 13 cps to 25 kc @ rated output; ±3 db from 8 cps to 40 kc @ rated output. **Harmonic distortion (at rated output):** Less than 1% @ 20 cps, 0.5% @ 1 kc, 2.0% @ 20 kc. **Intermodulation distortion (at rated output):** Less than 1%. 50 & 5,000 cps signal mixed 4:1. **Hum and noise:** Tapehead, 40 db below rated output. Mag. phono, 45 db below rated output. Aux. inputs, 60 db below rated output; Tape monitor, 70 db below rated output. **Channel separation:** 40 db min. @ 20 kc, 55 db min. @ 1 kc, 50 db min. @ 20 cps. **Input sensitivity:** (For 35 watts output per channel, 8-ohm load) Tapehead, 2 mv; Mag. phono, 3 mv; Tuner, 25 v; FM Stereo, 25 v; Aux., 25 v; Tape Monitor, 50v. **Input impedance:** Tapehead, 60 K ohm; Mag. phono, 30 K ohm; Tuner, 100 K ohm; FM Stereo, 100 K ohm; Aux., 100 K ohm; Tape Monitor, 47 K ohm. **Outputs:** 4, 6, & 16 ohm and low impedance tape recorder outputs. **Controls:** 5-pos. Selector (dual-concentric), 5-pos. Mode switch, dual-concentric Volume, Bass & Treble controls, Tape monitor sw., Loudness sw., Phase sw., Input level controls (all inputs except Tape Head & Tape Monitor inputs), Push-Push on/off switch. **Semiconductor complement:** 28 Transistors, 10 diodes. **Power requirements:** 105-125 volts, 50-60 cycles AC, 35 watts (dying, no signal), 200 watts, full power out. @ 120 volts with no load on AC receptacles. **Power outlets:** 2 AC receptacles; 1 switched, 1 unswitched. **Dimensions:** 15½" W x 5" H x 14" D.



HEATH COMPANY
Benton Harbor 39, Michigan

Please send my FREE 1963 Heathkit Catalog

Name

Street

City Zone State



miniature **SLAVE FLASH**

It fits in a photo bug's pocket!

By R. L. Winklepleck

THE ADVENT of the peanut-size AG-1 flash bulb and the tiny reflector designed for it has been a shot in the arm for the already vigorous flash bulb industry. The AG-1 flash assembly, paired with the 35mm, or smaller, camera enables the well-equipped photographer to carry his gear in his coat pocket.

There's only one fly in the ointment. The standard slave flash unit (a *must* for side lighting and fill-in) is still rather bulky—even the compact transistorized slaves designed for bayonet-base flash bulbs are large by comparison. The answer to this problem can't be found at your favorite photo shop. But for just an evening's work, and under \$5, a "shrunken slave" can be yours.

The complete slave is only slightly larger than the AG-1 reflector. A Mini-box houses all the components including the battery. With no moving parts and no adjustments, the only thing that wears out is the battery and it should last as long as the one in a camera-mounted flash gun.

The reflector from a Walz Reflector Adaptor is cemented with epoxy in a hole cut in the front of the Mini-box. A small square of punched circuit board is bolted to the reflector and two scraps of spring brass serve as flash bulb contacts. All the components are mounted on the circuit board except the battery,

which slips underneath, and the photocells which are cemented behind a cut-out in one end of the box. Heat sink the transistors while soldering. Leads to Q3's base and emitter pins are connected with flea clips or soldered. Brass grommets or flea clips may be used for attaching the components to the circuit board or they may be held in place by running their leads through the holes in the board. In any event, the wiring can be completed before the circuit board is fastened in place.

Try to select a low-leakage unit for C2 since this will prolong battery life. The battery is the familiar 9-volt type used in many transistor portables. No on-off switch is necessary, since inserting a flash bulb readies the slave for action and flashing the bulb turns the slave off.

Before inserting the flash bulb for the first time, be sure the photocell, condenser and battery are connected with the correct polarity. If you have a milliammeter, take a reading across the

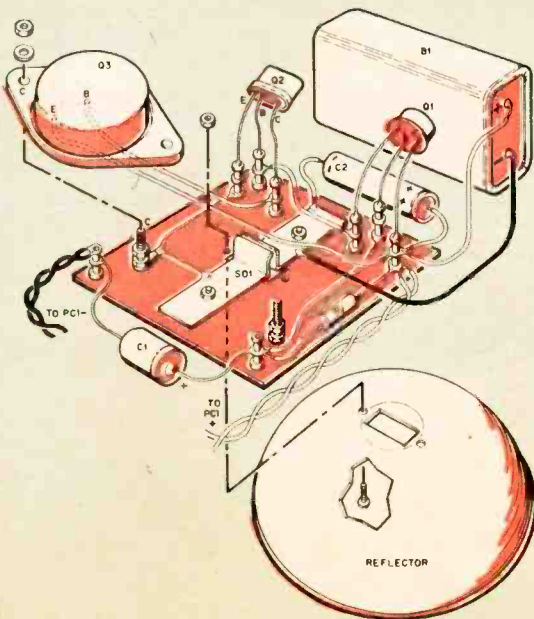
bulb contacts (without a bulb in place). Leakage current should be well under 100 ma and probably will be under 50 ma. If too high, it indicates that one of the transistors has high leakage and must be replaced. If no milliammeter is available, insert the flash bulb with caution protecting the fingers with glove or handkerchief against the burn of an accidental flash.

The shrunken slave is placed in position to properly light the subject with its photocell facing the general direction of the camera. A clamp may be mounted

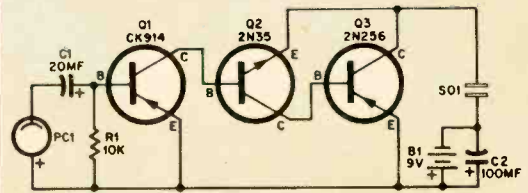
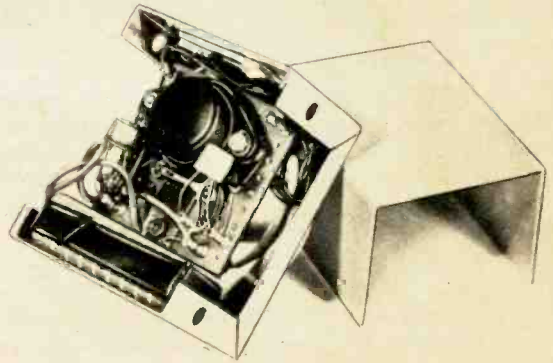
[Continued on page 121]

PARTS LIST

- R1—10,000 ohm, 1/2-watt resistor
- C1—20 mf, 6 V electrolytic capacitor
- C2—100 mf, 15 V electrolytic capacitor
- Q1—CK914 transistor
- Q2—2N35 transistor
- Q3—2N256 transistor
- B1—9 V battery
- PC1—One or two parallel-connected photocells (International Rectifier, B2M)
- Misc.—AG-1 flash bulb clips and Walz reflector adaptor; Mini-box, CU-3000A (approx. 2 3/4" x 2" x 1 1/2")



Reflector is insulated from SO1, but mounted so that bulb's base contacts touch SO1's wipers.



Direct-coupled circuit with power transistor output eliminates the usual high-speed relay.

WIRELESS

TELEPHONE EXTENSION

Compact oscillator/amplifier broadcasts both sides of phone conversation to any nearby radio

By Len Buckwalter, Contributing Editor



WHEN Grandma or Aunt Minnie makes a long-distance call to your house, everybody in the family wants to share the conversation. Trouble is, the phone fits only one ear at a time.

EI's Wireless Telephone Extension solves the problem by picking up both ends of a phone conversation and transmitting the voices to any nearby radio—without direct connection to either telephone or radio. The

little transmitter's 20-foot range means you can listen in from another room or even upstairs. This is particularly useful if an ailing person is confined to a room without a regular extension phone.

The Wireless Extension

comes under the FCC limited-

radiation devices rules and may be operated without a license so long as it doesn't interfere with existing radio service. The unit can be tuned to place the signal in any dead spot on the BC band between 900 and 1600 kc.

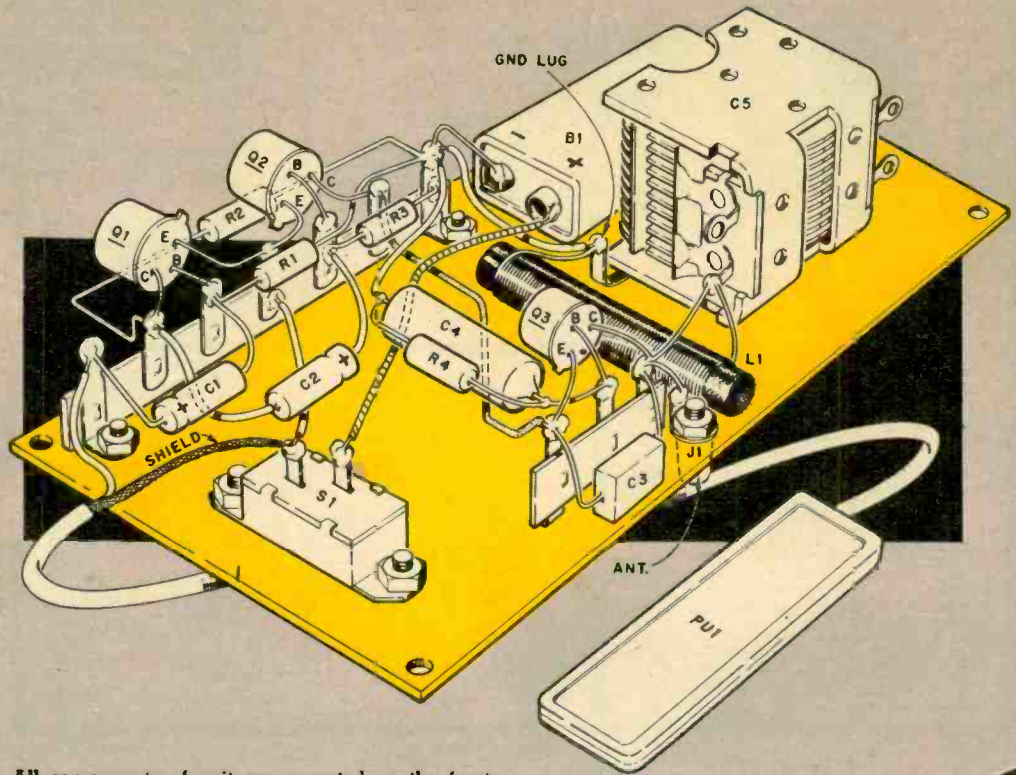
Construction is not especially critical because of the fairly low frequencies involved. First mount tuning capacitor C5 and the clip for battery B1. You may have to use several washers on the three screws that hold C5 to the panel since overlong screws will block rotation of the plates. If desired, a trimmer capacitor may be substituted for the one-gang variable type (see Parts List).

Coil L1 is hand-wound to the specs in the Parts List. Fix the windings in place with coil cement or Duco and hold the coil to the board with a loop of tape. Scrape the enamel from the coil wire ends before soldering.

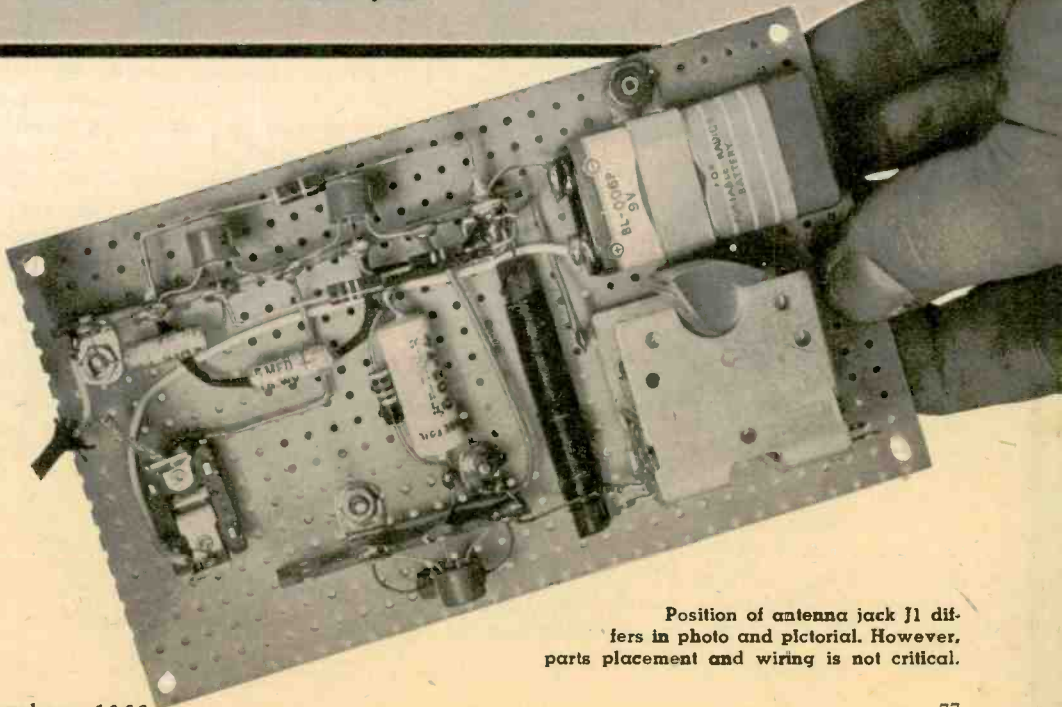
The only other point of caution concerns the transistors. Grasp the leads with a long-nose pliers before soldering to prevent heat damage.

Operation. Antenna length determines range to a significant degree. About a foot of wire connected to antenna post J1 will be adequate for most applications.

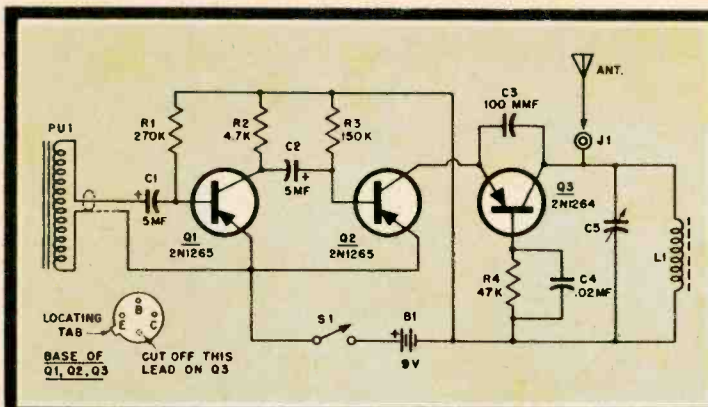




All components of unit are mounted on the front panel. Do not use a conductive or metal panel.



Position of antenna jack J1 differs in photo and pictorial. However, parts placement and wiring is not critical.



Complete schematic of Extension shows two-stage amplifier followed by oscillator stage.

Unit ready to operate. If a trimmer capacitor is used for C5, the tuning knob is omitted.

PARTS LIST

Resistors: 1/2-watt, 10%-20%
 R1—270,000 ohms R3—150,000 ohms
 R2—4,700 ohms R4—47,000 ohms
 Capacitors: 15-volt or higher rating
 C1, C2—5 mf electrolytic
 C3—100 mmf mica C4—.02 mf paper
 C5—365 mmf 1-gang variable midget or 25-280 mmf trimmer capacitor
 Q1, Q2—2N1265 Q3—2N1264
 PU1—Telephone pickup coil
 L1—Oscillator coil, 70 turns of #20 enamel wire closewound on ferrite rod (Lafayette MS-331 cut to 2" length)
 S1—SPST slide or toggle switch
 B1—9-volt battery
 J1—Binding post for antenna
 Case—Bakelite case, 6 1/4" x 3 3/4" x 2" with 3 1/2" x 6" perforated phenolic board as a front panel. One 3-lug terminal strip, one 7-lug terminal strip



Another factor to consider is hum pickup by coil PU1. It can be avoided by keeping PU1 away from transformers, fluorescent lamp bases, etc. Finally, best operation is attained when the Extension's case is rotated for maximum signal in the receiver. This is because radiation from L1 tends to be directional.

Experimentation Necessary

Because of internal variations in today's telephones, you may have to experiment to achieve optimum placement of pickup coil PU1. With the Wireless Extension transmitting to a radio, try moving PU1 around the base and sides of the telephone while listening to the transmitted dial tone. When the point of maximum sensitivity on the phone is located, mark it with a bit of masking tape. On some types of phones it may be necessary to tape PU1 to an area around the earpiece to obtain adequate sensitivity. If convenient, a phono jack and plug can be used with PU1.

The FCC considers all phono-oscillator type units to be low-power communication devices and has special regulations pertaining to their use. Broadcasting through a device such as the Wireless Telephone Extension is legal in the 510-1600 kc broadcast band if certain limitations in power are observed and you do not interfere with anyone else's listening.

The power input to the output transistor must not exceed 100 milliwatts and antenna length must not be more than 10 feet. Projects built according to the instructions of this article will meet FCC requirements.

If you are interested in exactly what the FCC has to say on the matter, you'll find the pertinent data in Volume II of the Rules and Regulations, Parts 2, 5 and 15.

For CBers



and Hams

the MONITOR meter

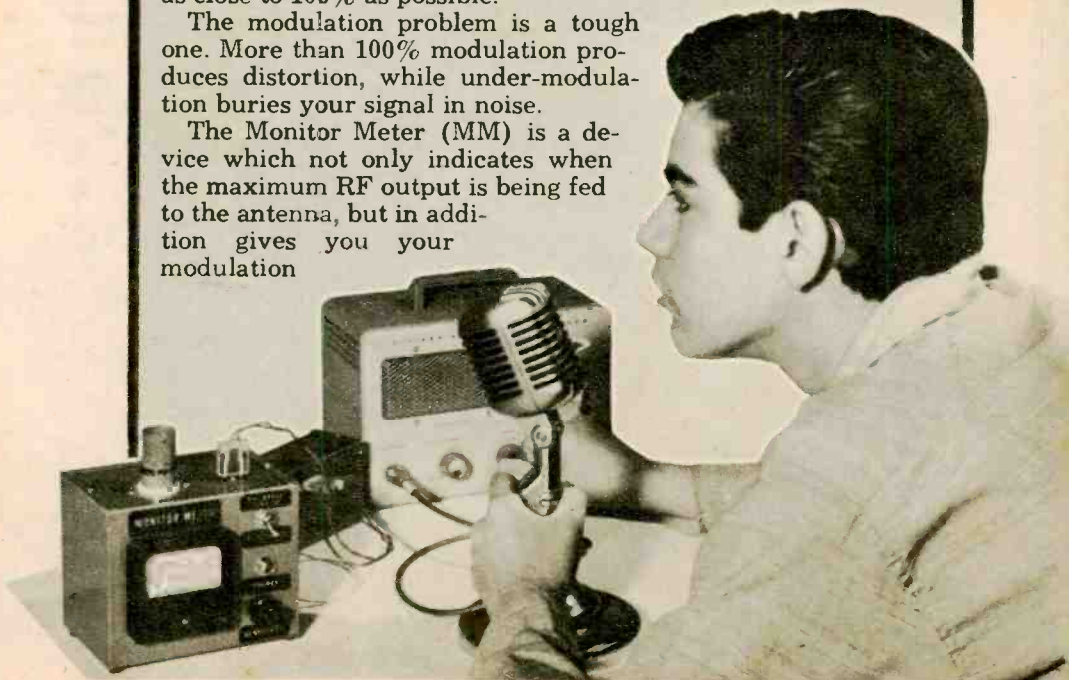
You get a direct power output reading, modulation percentage and audible signal-quality monitoring from this easy-to-construct transmitter accessory.

By Tracy Diers, W2OQK/2W4975

TO GET THE BEST REACH from any Citizens Band or amateur transmitter, all the radio-frequency (RF) power available must be pushed out the antenna, of course. But that's only part of the story. The transmitted carrier also must be modulated as close to 100% as possible.

The modulation problem is a tough one. More than 100% modulation produces distortion, while under-modulation buries your signal in noise.

The Monitor Meter (MM) is a device which not only indicates when the maximum RF output is being fed to the antenna, but in addition gives you your modulation



percentage. And by plugging a good-quality (2,000 ohms or higher) headset into monitor jack J1 you can determine whether your signal is clean and free from noise and distortion.

Construction. The Monitor Meter is built in a metal cabinet and, except for J2, SO1 and T1, all components are mounted on the front panel. While parts layout isn't critical, the RF leads must be separated from the audio leads as in the pictorial.

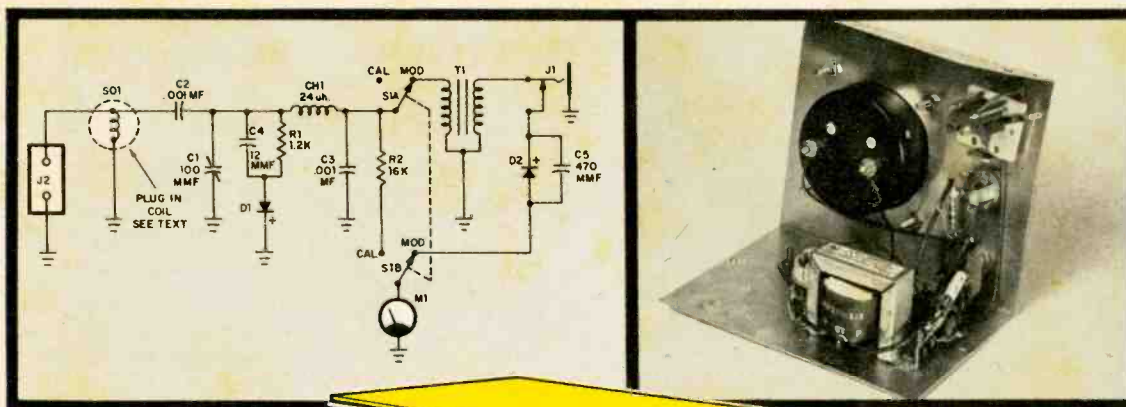
The value of the hand-wound pickup coil that plugs into SO1 (and is shown in position atop the MM box in our lead

photo) is determined by the frequency you are using. See chart for number of turns and wire size.

Install D1 and D2 last and use a heat sink (alligator clip) on each lead before soldering.

Because of the low output from a CB transmitter, a separate RF pickup unit is required. The center terminals of coax connectors J4 and J5 are joined with a short length of #16 wire or buss bar. The pickup coil is six turns of #18 plastic-insulated solid hookup wire wrapped tightly around the buss bar.

The pickup unit is connected between



PARTS LIST

Resistors:

- R1—1,200 ohm, 1 watt, 10%
- R2—16,000 ohm, 1/2 watt, 5% or better

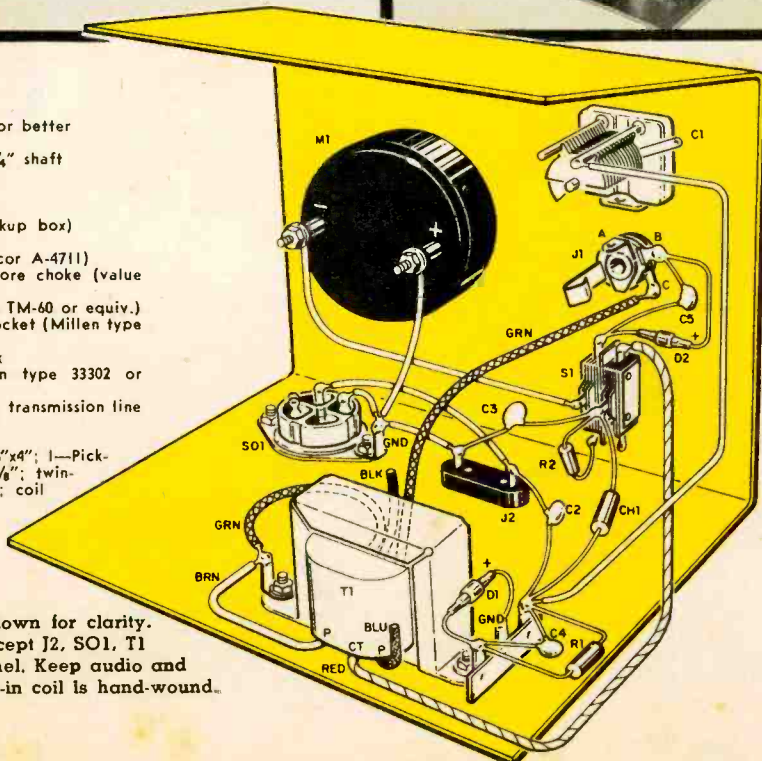
Capacitors:

- C1—100 mmf variable with 1/4" shaft
- C2, C3—.001 mf ceramic disc
- C4—12 mmf ceramic disc
- C5—470 mmf ceramic disc
- C6—50 mmf trimmer (in pickup box)
- D1, D2—1N34A crystal diode
- T1—Driver transformer (Stancor A-4711)
- CH1—24-microhenry ferrite core choke (value not critical)
- M1—0-1 ma meter (Lafayette TM-60 or equiv.)
- SO1—4-prong ceramic tube socket (Millen type 33004 or equiv.)

- J1—Closed-circuit phone jack
- J2, J3—Crystal socket (Millen type 33302 or equiv.)
- J4, J5—Coax sockets to match transmission line connectors

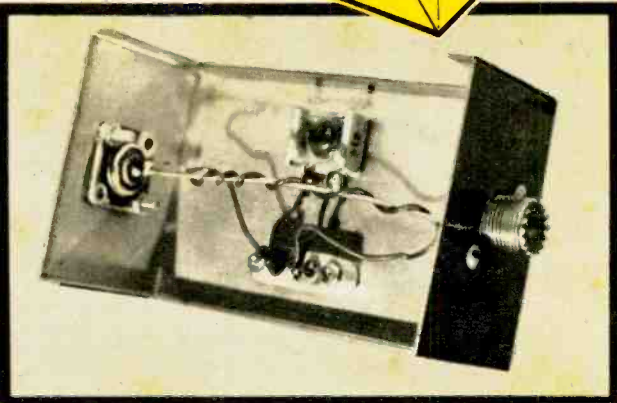
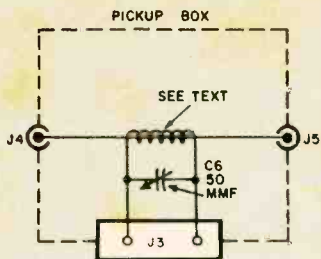
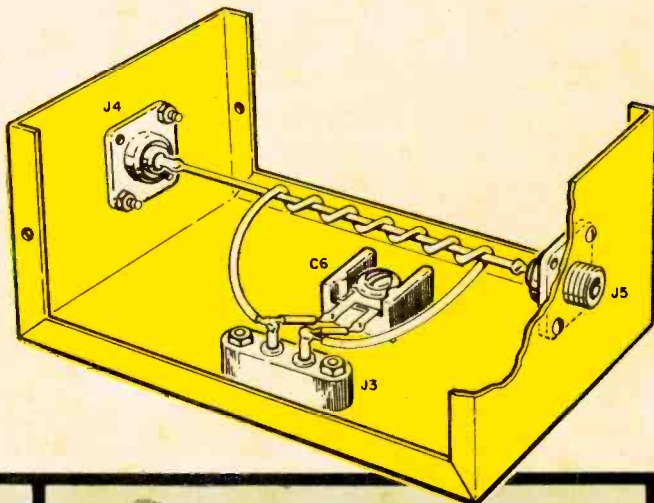
- S1—DPDT Toggle switch

- Misc.—1—Meter cabinet, 6"x5"x4"; 1—Pick-up cabinet, 5/4"x3"x2 1/8"; twin-lead connectors; wire; coil forms, etc.



MM is shown top side down for clarity. All major components except J2, SO1, T1 are mounted on front panel. Keep audio and RF leads separated. Plug-in coil is hand-wound.

Pickup unit, for use with low-power transmitters, is simple to construct. It is connected right into the feedline. Bare buss bar radiates more energy into the pickup coil than does coax cable.



the transmitter and antenna at a point 6 to 12 inches from the transmitter. The hookup line is a short length of coax cable (RG-58/U or RG-8/U, depending on which is used for the antenna feedline) with a PL-259 on one end and a plug which matches the transmitter output jack on the other.

The connecting link between the RF pickup unit and the MM is 18 inches of #20 plastic-covered hookup wire with plastic twinlead connectors at each end. (Twinlead connectors fit the crystal sockets.) The wires should be twisted together to prevent capacity changes.

Operation. Set S1 to *calibrate-tune* and connect the MM into your antenna system.

Turn on the transmitter and adjust C1 for a half-scale reading on meter M1. Now tune the transmitter for maximum meter reading (see **TUNE YOUR TRANSMITTER**, May '62 EI, for fur-

ther details on recommended methods).

If the meter needle goes off-scale, bring it down with C1. The meter reading is determined by the RF current flow in the antenna feedline and is an accurate indicator of transmitter tuning.

To check the modulation percentage, first set S1 to *calibrate-tune* and, without modulation, adjust C1 for full-scale (1 ma) reading on M1. Then reset S1 to the *modulation* position and speak into the microphone. The meter needle will follow the speech with the peak meter

[Continued on page 116]

PLUG-IN COIL DATA

Frequency (mc)	Turns	Wire Size
27-28	4	22
21	10	22
14	15	22
7	30	22
3.5	50	26

All coils closewound on 4-prong, 1-inch forms (Millen 45004 or equiv.). Wire is enameled type.

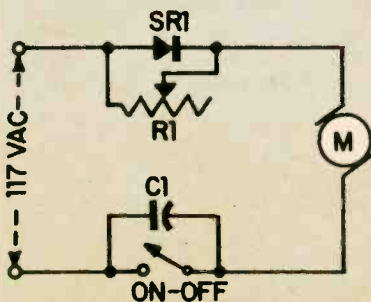
TWO-SPEED TURNTABLE

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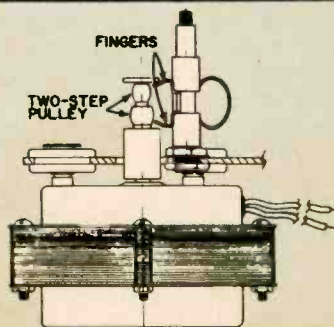
THE mention of turntable kits usually brings up two questions: is it practical from a time-and-money standpoint to build one, and do kits give you performance matching that of factory-assembled models?

We built a popular two-speed kit, the Fairchild 440, to find out. The 440 lists for \$55 as a kit and \$69.95 assembled. In both cases the mounting board is unfinished and a finished walnut board and wraparound (base) cost an additional \$19.95. So you save about \$15 with the kit.

Our builder, a novice, got the 440 together in two hours, which made his time worth \$7.50 an hour.



440's speed control is rectifier SR1 and pot R1 in parallel. R1 superimposes braking DC on the AC.



Speed changer is two wire fingers which shift drive belt on 2-speed pulley; 4-pole motor is at bottom.

There is no reason why building a turntable from a kit should degrade its performance. The variables are all predetermined by the manufacturer, and whether the components go into a factory model or a kit should not matter.

A turntable kit obviously is not difficult to put together. This one had a grand total of 47 parts, which includes the wraparound and every screw and washer. There are about 20 major parts and half a dozen electrical components. The instructions are detailed and clear.

The 440 has shown us that building a turntable kit makes sense, particularly when the final result is a high-quality audio component, which the 440 is. Assembly is easy, the savings substantial.

The Fairchild kit offers a unique feature in its ingenious fine speed control, which permits a variation of $\pm 1\frac{1}{2}$ per cent in the two speeds (33 $\frac{1}{3}$ and 45 rpm).


The control (see schematic) has a selenium rectifier (SR1), shunted by a 100-ohm wire-wound potentiometer (R1), in series with the motor. In the fast position the pot shunts out SR1 and normal AC line voltage is applied to the motor. In slower settings, pulsating half-wave DC is superimposed on the AC. The DC exerts a braking action by increasing magnetic slippage (the armature slips behind the magnetic

lines of force at a steady rate). The technique achieves speed control without loss of torque.

In common with other quality turntables, the 440 uses a belt drive, the belt encircling the rim of the platter. The bearing well has a nylon seat on which sits a ball bearing, in effect providing a single wear-free bearing point for the platter. The motor is a high-torque, four-speed induction type turning a two-step pulley. To change speeds, the belt is shifted from one pulley to the other by two wire fingers moved by a shaft and knob. A capacitor (C1) across the switch suppresses switch noise.

The 440's matching tone arm is the Fairchild 500 which, with an SM-2 cartridge, costs \$55. The arm's feature is an anti-skating device; skating being a tone arm's tendency to be pulled inward, causing distortion toward the center of a record.

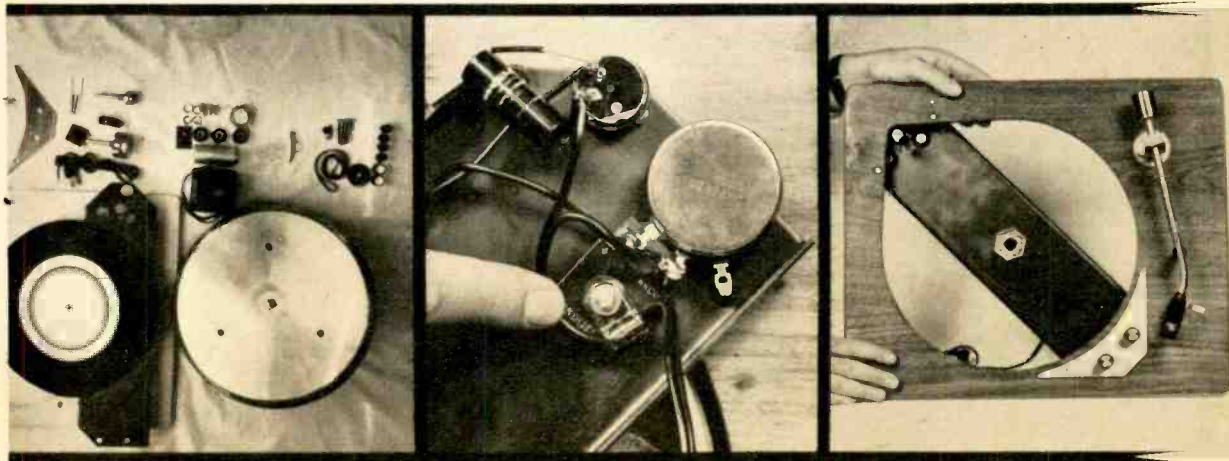
Fairchild's anti-skating mechanism is a spring in the tonearm post which exerts a force equal to and opposite from the skating forces. The arrangement, which gives you a spring-loaded tone arm toward the center of a disc, represents one of the first attempts to deal with skating.

However, the 440 is designed to take almost any tone arm. 

How many parts do turntable kits have? Below are 46 of the 47 in the Fairchild kit.

Pot and rectifier (R1, SR1) are speed control; capacitor C1 and on-off switch are at the top.

Chassis with bearing well in its center is shown in place on the wooden mounting board.



Program of an electronic music concert at Carnegie Hall put on by impresario Norman J. Seaman.



dig that **CRAZY MUSIC**

It's the most in far-out jazz, man. No performers. No notes. Just sound, man, sound, sound, sound. . .

By Ken Gilmore

A FEW MONTHS AGO I sat in Carnegie Hall and listened to a concert. There was not a single musician to be seen. The stage was bare except for six speakers from which came a weird collection of other-worldly tones, rhythms and harmonics.

A short time later I watched a ballet at the New York City Center. Again, no musicians. In the orchestra pit: 24 speakers.

These are only two of dozens of performances of electronic music, a new kind of sound being created in a joint effort by composers and electronic technicians. All but unknown a decade ago, electronic music suddenly is being performed all over the world. More than a score of phonograph records of this unusual new art form are available and record makers are rushing to get more on the market.

What is electronic music? Simply put, it is a series of more or less musical sounds, electronically recorded, altered, distorted and arranged to produce a new kind of sound.

A composer, for example, may take a flute, play a few notes and record them on tape. Then he plays them back at half or



double speed, re-recording on another tape. He may chop a little piece out of the tape and stick it in backwards, or combine several recordings at different speeds to give new combinations. Filters can alter the sound so that it comes out as something completely new.

The possibilities are endless. A composer can use any sound—musical instruments, street noises, drums, electronic oscillators and signal generators. Richard Maxfield, who teaches a course in electronic music at New York's New School, composed a selection called *Cough Music*. He used nothing but the recorded sound of a single cough, manipulated until it turned into a playful pattern of rhythmic sonorities. Is it music? Hard to say, but it is a sound pattern some find interesting.

Electronic music got started back in the 1890's. A chap named Thaddeus Cahill, most noted for the invention of the electric typewriter, put together a strange instrument called the Telharmonium and gave a few concerts. His contraption, now on view at the Smithsonian Institute, consisted of hundreds

of electrical generators putting out sounds of various frequencies, all controlled from a keyboard. But nothing ever came of the Telharmonium. It was not until after World War II that electronic music came of age. The tape recorder was the spark that did it.

Composers looking for new forms of expression began to experiment with recorders. Gradually, the techniques were developed. At the same time, instruments capable of creating electronic music directly were built. The RCA Synthesizer, for example, could produce an infinite variety of sounds. To play it, you shove in punched cards. The music it produces is controlled by holes in the cards.

An even more advanced electronic instrument is the Studio Trautonium, built by Oskar Sala of Berlin. This electronic octopus, spreading through several rooms, is played from a central control board more complicated than the cockpit of a B-58. And, according to its inventor, it can produce any sound man is capable of imagining. He may be right.

Wide variety of electronic music compositions is available on hi-fi records. Selection of albums below includes everything from sounds that are just a little different to the real-gone pieces. See list at the end of article.





Country's top electronic-music composers with RCA Synthesizer are (left to right): Vladimir Ussachevsky, Milton Babbitt, Charles Wuorinen, Otto Luening, Halim El-Dabh and Bulent Arel. Machine produces its own kind of music when fed punched cards or punched tape, as shown in photo.

Although the Trautonium was built primarily to make music, it can manufacture any kind of sound. When the movie of Dr. Wernher von Braun's life was made, the sounds recorded at rocket launchings didn't sound realistic enough. The producers went to Sala. He adjusted the controls, listened, adjusted again. The sound he came up with sounds more like a rocket takeoff than the real thing. Sala's sound is what you heard if you saw that movie.

There is no doubt that one of the appeals of electronic music today is its novelty. In the way that strange poetry and certain forms of speech appeal to beatniks, so electronic music has special meaning to some listeners. Almost anyone is interested enough to listen once or twice. But when the novelty wears off, one tends to accept this new art form for its own values . . . or reject it. Whether it's just a fad or something more enduring will depend on how many accept and how many reject.

Will you like electronic music? It's easy to find out. Here is a select list of the recordings now available, categorized according to sophistication.

You're most likely to enjoy:

POEM IN CYCLES AND BELLS. Composers Recordings CRI-112. Slightly other-worldly first selection uses a flute as sound source for a tape recorder, accompanied by an orchestra, but it resembles familiar music until it reaches some eerie sounds at the end. Second selection, *Piece for Tape Recorder*, is full of great rolls and crashes whose origin you can only guess, and the last piece, *King Lear*, represents the storm scene and Lear's madness. Shakespeare would be scared stiff.

ELECTRONICS. Westminster WST 14143 (stereo) and XWN 18192 (mono). This composition, performed as a ballet by the New York City Center Company, has as much in common with conventional music as does any electronic piece, although all its sounds are electronic in origin. At once unearthly, somber, stately and joyful. Second selec-

tion demonstrates some of the incredible sounds possible with the Studio Trautonium.

MUSIC OF EDGAR VARESE. Columbia ML 5478. *Poeme Electronique* was composed for the Brussels World's Fair and played over 400 speakers while lights and pictures flashed around the pavilion.

Far out:

VORTEX. Folkways Records F55 6301 (stereo). The basic character changes from one piece to another and makes you wonder whether this really is music. One selection is made up entirely of a woman screaming, scrambled countless ways. Others use musical instruments (flute, guitar, etc.) for haunting, far-away sounds.

Real gone:

WAKA AND OTHER COMPOSITIONS. Folkways FW 8801. Japanese poetry (in English) recited to accompaniment of electronic music.

INDETERMINACY. Folkways FT 3704. Weird monologue of pointless stories recited against a background of unrecognizable sounds. Not supposed to make sense. And doesn't.

For do-it-yourselfers:

SOUNDS OF NEW MUSIC. Folkways FX 6160. Electronic music pioneer Vladimir Ussachevsky shows how it is done: doubling and halving pitch by changing tape-recorder speeds; tape reverberations; sounds of natural pipes which you can use in your own experiments.

SCIENCE FICTION SOUND EFFECTS RECORD. Folkways FX 6250. The usual (?) kookie sounds of science-fiction movies: rocket blasts, drifting through space, approach of *The Creature*, etc.

SOUND PATTERNS. Folkways FPX 130. Birds, crickets, turtles, Eskimos and other sounds electronically manipulated.

Composer at work: Ussachevsky listens to music as he creates it, discards sounds he dislikes.



A SPECIAL CITIZENS BAND FEATURE



how to publish a GOOD CB Club Paper

By Tom Kneitel, 10Q3161



SOONER or later, the idea comes to every club: let's publish our own paper. Citizens Band clubs are no exceptions. More than 50 of the 350 active groups in the country put out some type of publication. New ones are springing up like crab grass. If your club does not have a publication, the chances are good you've talked about the idea and one of these days you'll take the plunge.

CB club papers—mimeographed newsletters, small bulletins, club-size newspapers, miniature magazines—now being published run the gamut. Some are well written, have good printing, and are interesting and informative. Others are poorly put together, perform minimum service and do no credit to the clubs that publish them. Several (but by no means all) of the better papers

are shown in the strip running through this article.

The leading cause of a sub-standard paper has to do with the reasons for publishing it in the first place. If the reason is nothing more substantial than the fact that other clubs are doing it the group is better off to forget the whole thing.

What is a good reason for having a club paper? Let's begin with the fact that the Federal Communications Commission favors the formation of CB clubs for self-policing of the band, passing along information about new FCC directives, helping members with technical and operating problems, and similar programs. It follows that club papers first of all should aid the club in carrying out these activities.

A well-run club has purchased Volume VI of the FCC's Rules and Regulations (which includes Part 19—CB) and is receiving the amendments. The club's publication should carry news about amendments and also should interpret them, explaining what they mean to the man with the mike.

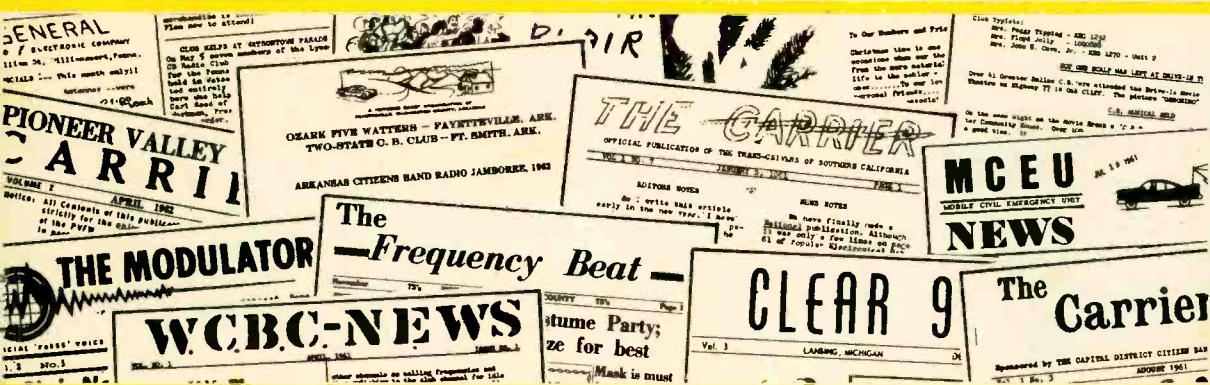
In this category also falls publication of items about the club's monitoring program and features on technical and operating problems and how they're solved. Ideas for the latter can be picked up from members who have problems and solve them and from national publications (such as EI).

Other interesting material includes news about club meetings and other functions; profiles which tell about a

he-and-she jokes, cooking recipes and reprints from other papers to fill space, think seriously about ceasing publication. Your club does not need a paper.

The job of picking editors and reporters for the club paper belongs to the group's president. He would do well to choose those who have had some experience in writing or editing, who have ability in this line and are intelligent persons. In any club you'll find many eager to help but, unfortunately, eagerness does not make up for talent here. A newspaper reflects on the club that publishes it. A publication filled with misspelled words and bad grammar creates a bad image.

Once the staff is chosen, reporters can be assigned to cover specific areas—



member's occupation, his family, his interests and (naturally) his CB equipment and activities; some type of personal column which tells who is doing what (it can be both interesting and humorous, but use good taste). When members receive FCC citations, it can be useful to others if you tell what brought about the ticket (don't identify the offender if it embarrasses him).

These are merely a few fruitful areas your paper might cover. You'll find others particularly suited to your area and club. Above all, avoid out-and-out gossip, pointless witticisms ("What blonde was seen in Lover's Lane with 2WXXX?") and funny or encouraging remarks about illegal operations (such as DXing). Let the high school papers keep them. If you find yourself running

FCC news, member activities, club functions, Civil Defense, technical items, etc. It is the editor's job to put this material together and make a newspaper of it. Opinions expressed must be those of the president, whose job it is to set policy. The editor must never take it upon himself to present news or editorials according to his own viewpoint.

The actual printing of a paper presents a problem in the choice of a process. A good mimeograph job is presentable and cheap but precludes pictures. There are two commercial printing processes: offset and letterpress. Offset is cheaper and simplifies make-up but letterpress quality is better. An average price for printing 250 copies of an 8½x11-inch sheet runs about \$20 for either process, but photos cost some

\$4 each extra for letterpress and \$1.50 each offset.

Consult several local printers to get prices and to look at their type samples for your headlines and text.

The main question remaining is who's going to pay the bills. If properly operated, a club paper should pay its own way via advertising from local businesses. Several members should serve as advertising salesmen. CB dealers and local radio and TV houses are prime advertising prospects. Restaurants, bowling alleys, filling stations and the like (particularly those owned by fellow members) usually are happy to buy advertising for the good will it creates.

A rule of thumb for ad rates is your expenses for printing a page plus 80 per



cent. A typical ad rate card might show these rates: 1 page—\$45; 1/2-page—\$25; 1/4-page—\$15 and 1/8-page—\$10.

When mailing your paper to members, be sure to ask your postmaster about third-class rates; they can save you money. You may wish to send sample copies to potential members (such as new CBers) to interest them in joining. A few copies left at local electronic stores also may bring in new members.

The best way to find out how to publish a good club paper is to look at good ones put out by other clubs. Many groups are willing to exchange publications on a one-for-one basis for this very purpose. Some 42 of them are listed on page 114 of this issue. Choose the ones you'd like to exchange with and write them a letter with your offer.

Awards For CB Papers

Well-organized Citizens Band clubs play a vital role in making CB radio an efficient medium of communication. Good club publications can help achieve this goal.

To encourage high standards, EI offers a series of Special Awards to be presented at year's end to clubs whose publications are judged most outstanding in the country in

ELECTRONICS
ILLUSTRATED



AWARD

For Production of an Outstanding

CITIZENS BAND CLUB PUBLICATION

presented to

Name of Publication

Name of Your CB Club

1962

Robert H. Beaman

content, layout and purpose. Five beautifully engraved 9x12-inch certificates will be given: First Prize, Second Prize, and three for Honorable Mention.

To have your club's publication considered for an award, send copies of the two best 1962 issues to: EI CB Editor, 67 West 44th St., New York 36, N. Y. They must be received by December 15, 1962. A story about the winning papers will appear in a future issue of EI.

CREDITS—The CB club papers on this and preceding pages are published by: Southern California 11 Meter News, Southern California 11 Meter League; C-B News, CB Assn. of Greater St. Louis; Lyco CB News, Lycoming CB Radio Club, Montoursville, Pa.; CB Broadcaster, Greater Dallas CB Club; The C-B Snooper, Blair House Communicators, Carteret, N. J.; MCEU News, Mobile Civil Emergency Unit, Syracuse, N. Y.; Five Watter, Fifth District CB Radio Assn., Concord, N. C.; Pioneer Valley Carrier, Pioneer Valley Five Watters, Holyoke, Mass.; The Modulator, Five-Eleven Radio Club, Pittsburgh; W.C.B.C.-News, Williamsport (Pa.) CB Club; bulletin, Ozark Five Watters, Blair House Communicators, Carteret, N. J.; Ft. Smith, Ark.; The Frequency Beat, Five Watters of Lake County, Painesville, Ohio; The Carrier, Trans-Celvers of Southern California, Pico-Rivera, Calif.; Clear 9, Five Watter CB Club, Lansing, Mich.; Break-Break, Ottawa (Ill.) 5 Watters; CBER Newsletter, Hillcrest Club-Band Club, Cleveland; 3rd Call District News, Akron (Pa.) CB Club; CB News & Views, Citizens Radio League, Northlake, Ill.

2 NEW DX AWARDS

- They're for Beginners and Broadcast Band fans.
- A new Award Period is declared.

TWO new DX Awards have been added to the series of certificates EI offers to Short-Wave Listeners, and our second Award Period, running through March 1, 1963, is declared herewith.

One new award is a *Special Class* certificate designed primarily for beginners. To qualify, an SWL needs verification of reception reports (QSL cards or letters) from only ten different countries. The signals may be of any frequency.

The second new award is for *Broadcast Band* fans. The qualification is 15

countries verified, and all stations must be on the BCB, between 535 and 1,605 kc. (See chart and photo on this page.)

EI's previously announced *General Class* awards are available to any SWL hobbyists who qualify, of course. One award is for 50 countries *verified*, the other for 100 countries. The latter is known also as the DX Century Award.

Two certificates available in our first Award Period are being discontinued. They are the *Medium-Frequency Class* (25 countries) and *Low-Frequency Class* (10 countries). It proved too difficult to qualify for these awards. For instance, of several dozen hobbyists who tried for the *Low-Frequency* certificate, only one was able to qualify. Letters from our readers also indicate much more interest in awards for broadcast-band fans and beginners than in the discontinued certificates.

Each award is a handsome four-color certificate measuring 5 3/8 by 8 3/8 inches. Predominant colors are red and green. Winners of our awards take special pride in them because each one—including the new certificate for beginners—requires skill and work, and it is *earned*. To administer the awards efficiently, we've created an EI DX Club. In qualifying for an award, you become a member of the club.

[Continued on page 110]



AWARD REQUIREMENTS

Class	Frequency Limits	Countries Needed
Special	None	10
Broadcast Band	535-1,605 kc	15
General-50	None	50
General-100	None	100

EI DX CLUB LOG

NAME ADDRESS

CITY STATE

CLASS AWARD YOUR
APPLIED FOR RECEIVER

INSTRUCTIONS. Clip along broken line at left. In *Class* blank write name of class as it appears in chart on opposite page. Give brand and model of receiver. Under *Date*, use figures (such as 12-1-61); under *Time*, use local standard time and 24-hour clock (0000 to 2359 hours). Fill in *all* items on each entry line. To list second 50 countries, make up additional log pages in similar style. All log entries must be dated Jan. 1, 1950, or later. Second Award Period ends March 1, 1963.

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Transvision Professional

23-INCH

CUSTOM TV SET

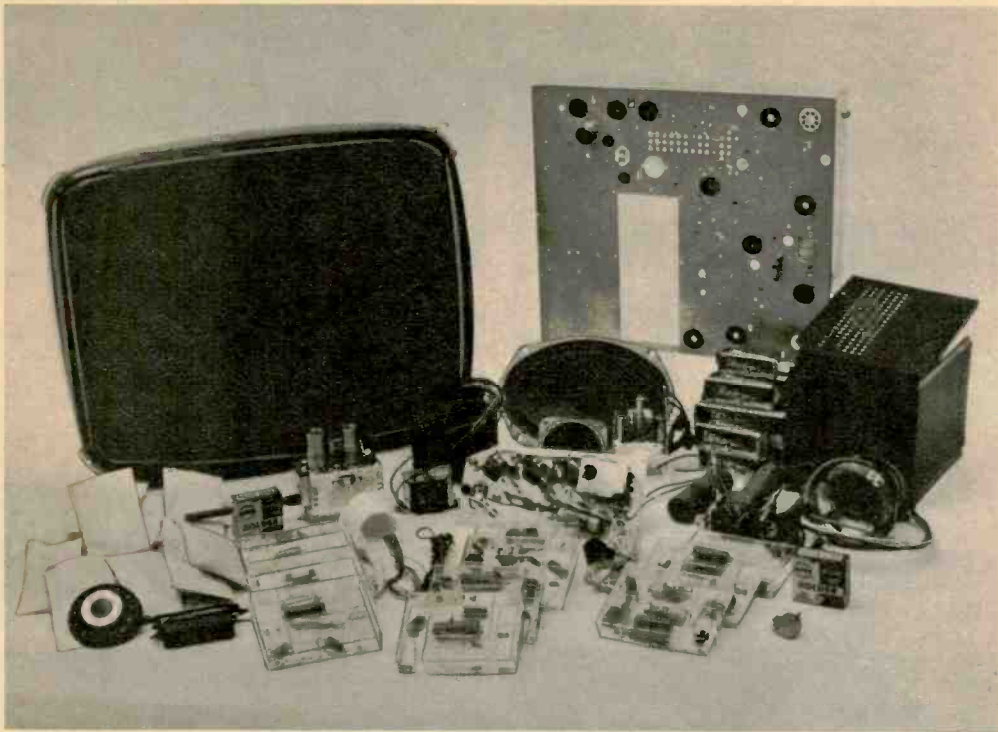
KIT
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REPORT



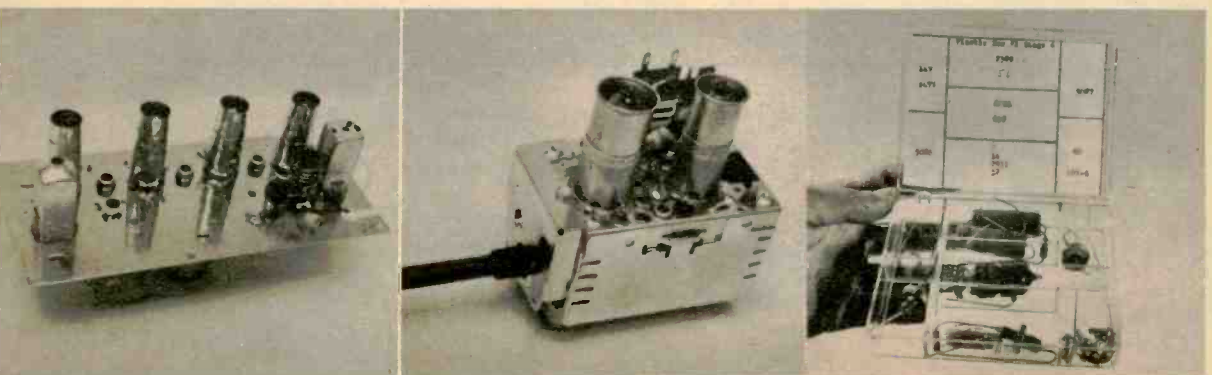
TELEVISION receiver kits, fairly popular in the industry's early days, are picking up interest again. One firm which markets a full line of high-quality custom TV kits is the Transvision Company. Far from being cheap second sets for the rec room, the Transvision receivers are expertly engineered units comparing favorably with the best factory-built models, and they are priced accordingly. A flexible design permits you to choose between vertical and horizontal mounting, type of audio output (cathode follower or 10-watt push-pull amplifier), and three picture-tube sizes: 19, 23 and 27 inches. There also are other options.

The Transvision kits truly enable the builder to learn the inner electronic workings of his set. A course, *Learning Electronics on Your Own*, is available and if read in conjunction with construction, it gives a good understanding of the circuits in a TV receiver. It also is a test and troubleshooting guide.

The model we selected is the Professional KG-10, which consists of a chassis with 10-watt amplifier and two-way (woofer and tweeter) speaker system. We also obtained an oiled-walnut front panel with a rigidizing assembly for custom-mounting in a wall. Because of the options available, total price varies. The price of our chassis was \$199, the front panel \$13, rigidizing assembly \$10 and the instruction course \$7.95 (free with a \$43.95 VOM offered by Transvision). The receiver can be purchased and constructed section-by-section.

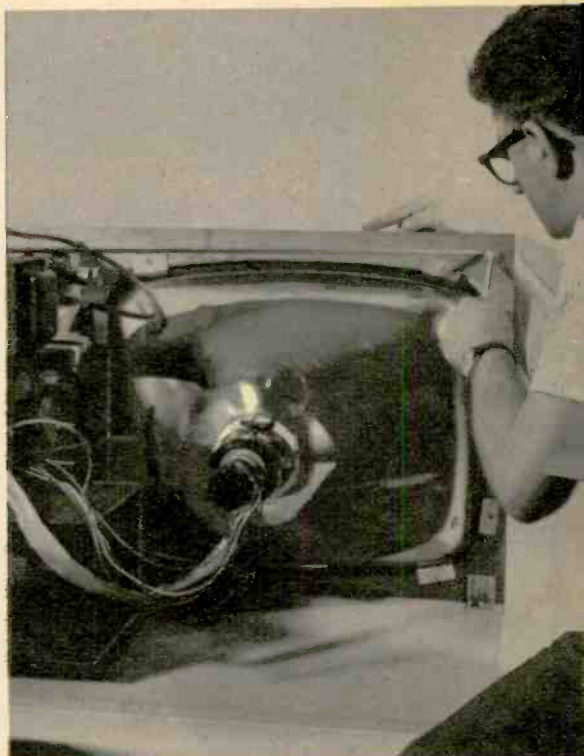
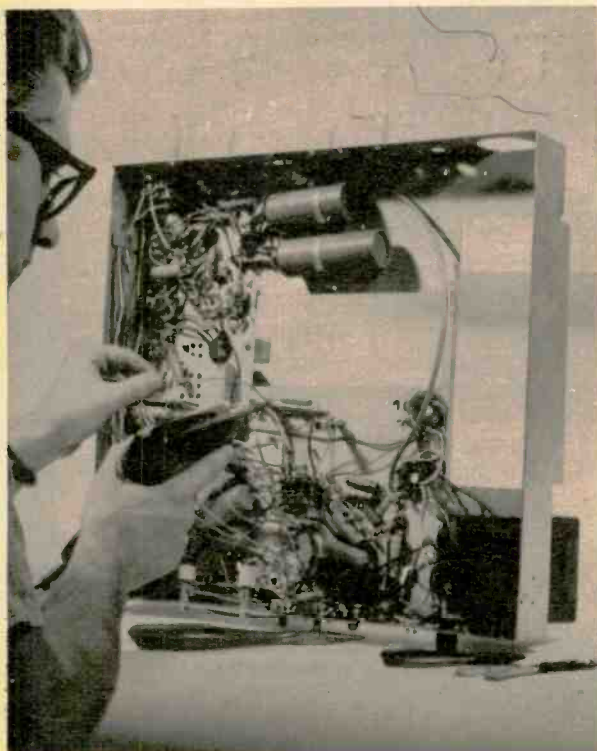


The kit of components prior to assembly. All sockets and terminal strips are riveted to the chassis by the manufacturer—a time-saving step. Good-quality components and standard brand tubes are used throughout. The set is AC-powered with a hefty power transformer and has an open, well-ventilated layout. Reading from left to right you see the bags of small parts, the picture tube, front end, power transformer, oval woofer and tweeter, tubes, high-voltage cage, yoke, etc.



The kit includes the preassembled and prealigned IF strip (left) and a prealigned Standard Coil front-end with special low-noise tube and circuitry (center photo). The front end will take up to three of the new UHF channel strips. At right is one of the plastic boxes with the components for a wiring stage. This type of packaging simplifies construction procedure. In fact, wiring time on this kit (16 to 20 hours) is shorter than on the usual stereo integrated amplifier.

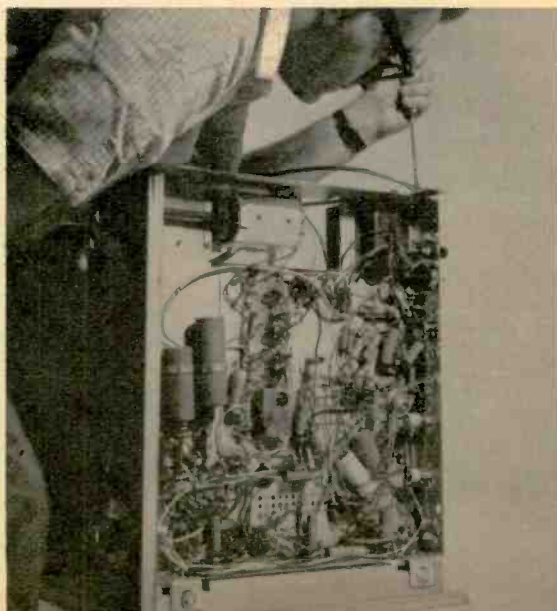
The final stages of construction are seen below left. The chassis is more open and easier to work on than is apparent from its slightly cramped appearance. The author chose to have vertical mounting of the controls, so the chassis itself is mounted vertically also. At right is shown the mounting of the picture tube and the rigidizing assembly board and brace to the rear of the front panel. The picture tube has built-in safety glass and special mounting ears which simplify the installation of the front panel. The set may now be slid into any desired mounting area.



The set worked the first time it was plugged in (photo at right shows hookup of antenna). In fact, the picture in our lead photo was taken immediately after minor positioning adjustments were made. Alignment can be done without instruments. Such features as a 4-mc bandwidth, complete complement of vertical and horizontal adjustments and a DC restoration circuit, all contribute to the quality of this receiver.

Transvision guarantees are liberal. The company has a \$10 service charge to put things right if there is a construction error. If a faulty component is the trouble, there is no charge. All parts—not just the picture tube—are guaranteed for a year.

Transvision TV kits are high-quality custom jobs that perform with the best . . . and teach you some electronics, too.





During their free periods teachers in Nunda, N. Y., talk personally to home-bound students, using CB, but most instruction is directly from classroom lectures. Teacher here discusses point in book.

CB for SHUT-INS

NEW USES for Citizens Band radio are being discovered almost daily. One of the most interesting new applications comes from a little farming community in northwest New York State. In the town of Nunda, with a population of barely 1,200 souls, the education system was faced with a difficult problem when several pupils were stricken with polio. The youngsters, confined to their homes, had to discontinue their study.

Ideas about what to do were not long in coming. Nunda has a high percentage of hams and Cbers, and Citizens Band radio was seen as the solution. The school purchased Johnson transceivers,

put a Hy-Gain antenna on the roof and ran coaxial cables to the classrooms. AM whip antennas designed for cars were put up at the homes of ill pupils and hooked to transceivers.

Volunteer students carried the school's base-station rigs from one classroom to another, connecting to the coax outlet in each room. The open mike, pointed toward the teacher, picked up class lectures and transmitted them to students in their homes. To recite, the home-bound students merely pressed their push-to-talk mike buttons.

So far, seven Nunda pupils have received schooling at home via CB.

Citizens Band equipment was found well suited to school-at-home since sets are easily installed.

Students hear class lectures, push mike button to recite; call letters are given as required.





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DXing UP TOP

Tune 152-174 mc, just above the 2-meter ham band, for a new glimpse of plane crashes and big fires.

By Kenneth Greenberg

AT 2 O'CLOCK one morning a few months ago I was drowsing in front of the VHF receiver at my home in Chicago after a long night of listening. I decided to turn in, but first I made a final sweep across the band that runs from 152 to 174 mc.

I never did get to sleep that night. When I hit 159 mc I heard the Chicago police dispatcher come on with a message about a plane crash in Clarendon Hills, a southwest suburb. It turned out to be a TWA Constellation that had taken off from Midway Airport. All 78 persons on board were killed.

As I waited and listened the grim tragedy unfolded. The band came alive with emergency messages. Scores of police vehicles were sent to the scene. Around 154 mc the Chicago

and suburban fire stations were sending equipment. There were calls for ambulances. At 155 mc I got on-the-scene reports from police cars.

Later, the VHF station operated by the local news service began talking to reporters and photographers, and on 152 mc I picked up eyewitness accounts related by newsmen via mobile phones. As dawn came, there were reports from helicopters hovering over the wreckage.

It was a night I will not soon forget. All the tragic information came to me first-hand, long before the public was aware of the crash. Though no one wants accidents like this to happen, they do. And getting your facts directly is better than getting them second-hand. Just 17 days later I was to be a radio witness to yet another crash, a Northwest Orient Electra that cracked up taking off from O'Hare Field.



Author tuning 152-174 mc rig; note simplicity of equipment. Antenna above is 36 in. long.



A Chicago policeman transmits on VHF channel but receives on 450-mc UHF band.



Among Up Top band receivers is 10-tube Lafayette HE-52 with squelch and 3 IF's—\$52.50.

This is a sample of the kind of listening you get on the 152-174 mc band, which is just above (Up Top) the 2-meter amateur band and below TV channel 7. Filled with industrial, public safety, maritime mobile and government stations, it's a band always worth monitoring and during disasters, natural or otherwise, it furnishes hours of exciting listening. Virtually all signals are FM and, though skip is known, most communications are local.

Receivers run from about \$50 to \$150. We show only a small selection of the many available.

One of the attractive features of these frequencies is antenna size. A yard of wire will do. Or, if you want to mount a better skyhook at a fair height, you can make your own easily and cheaply or pick up a commercial model for \$5. A half-wave coaxial (see photo) is merely an 18-inch rod mounted on top of an 18-inch sleeve. Quarter-wave ground plane types have a driven element of the same length plus four 18-inch radials.

Besides police (in some, but not all cities), fire and press stations, as noted above, the Up Top band offers a variety of communications. Around 160 mc you will find signals from railroad switching yards, caboose-to-engine messages from speeding trains, and engineers talking to base stations along the right-of-way.

Emergency messages, sometimes about a sick person on a train, are found here.

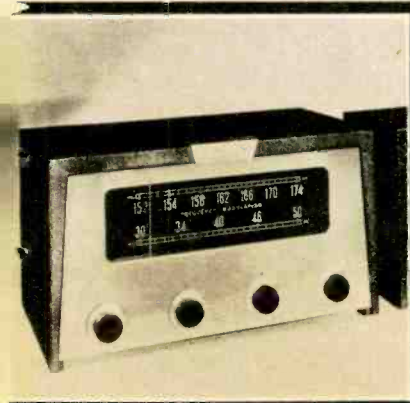
Taxicab base stations transmit around 152 mc, the cabs themselves at 157 mc. Among other inhabitants are trucking companies, gas and electric and water service trucks, forestry crews, garages and wreckers, land and marine mobiles and even motion picture production people carrying on intra-lot discussions.

You'll also find a spate of military signals which obviously are impossible to verify. In the Chicago area I listen sometimes to a net of stations at the Army's Nike missile sites that comes on during practice tracking missions.

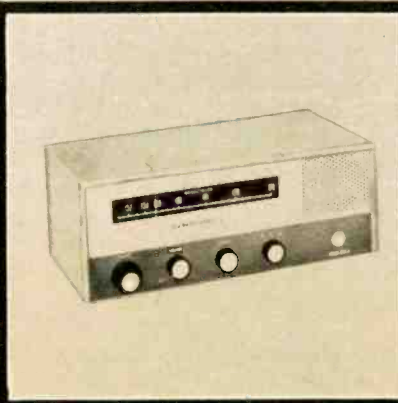
The Department of Commerce has some new VHF stations that broadcast weather information for small craft in harbor areas from May through October. Among them are KWO-35, New York, and KWO-39, Chicago, both on 162.55 mc. The Department also operates point-to-point VHF stations.

Identification is not difficult because call letters are given often. Four registries of these stations are published by Communication Engineering, Box 629, Mineola, N. Y.

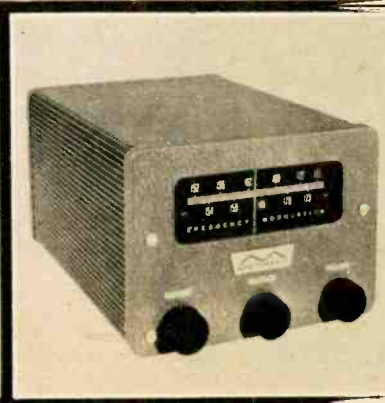
The receivers are simple and easily tuned, and most have squelch to keep them quiet. Being FM, the signals are static-free and never fade. There's nothing else in listening quite like the Up Top band. Try it!



Monitoradio's DR-200 offers 1 crystal-control channel and also covers 30-50 mc—\$149.95.



Hallicrafters CRX-2 receiver features crystal-control on 2 channels; the price is \$109.95.



A 12-volt receiver for mobile use is Monitoradio M-160. It has a 4-inch speaker—\$99.50.

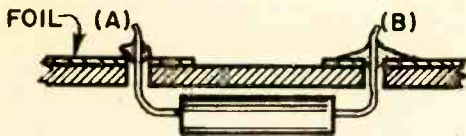


Printed Circuit Boards In Hi-Fi Kits

Several high-quality hi-fi amplifier and test equipment kits use printed circuit boards. I understand there is a certain amount of controversy about how good these boards are. How do you feel about the use of printed circuit boards in kits?

James Shaw, Newark, N. J.

Your choice of a kit should not depend solely on whether it includes printed circuit boards. Most of the printed circuit board problems you hear about are hold-overs from the old days when the boards were heat sensitive and would tend to crack, if not disintegrate, after an extended period of use. Certainly,



if the U. S. government uses printed circuit boards in satellites the home builder should not be afraid of them.

In general, there are several rules that both manufacturers and home constructors should follow when using circuit boards.

- Do not depend on them to support a great deal of weight. They are not designed to do so. Mount transformers and other heavy items on the metal chassis.
- Solder carefully. The illustration above shows a component mounted on a printed circuit board. The use of a printed circuit board does *not* insure good solder connections. In fact solder connections such as (A) are responsible for most difficulties experienced with printed circuit kits. A well made solder connection flows onto the foil surface as in (B).
- Although most manufacturers warn you about applying excessive heat to a printed circuit board, too little heat (which does not encourage the solder to flow onto the foil) can be equally troublesome.

- When soldering components to a board, be extra careful with the flux and where it flows. After soldering, it's a good idea to scrub the board, using solvent and an old toothbrush to remove all traces of flux.

Notes on the Duoflex

Among many letters on EI's Duoflex speaker system (July '62), were a number of questions on the cleats, amplifier power, frequency response, etc. These are answered below.


- All cleats are $\frac{3}{4}$ - or 1-inch stock. In the construction diagram, the front cleats should have been shown as $7\frac{3}{4}$ inches; the back, $10\frac{3}{4}$ inches.

- Any amplifier from 1 to 25 watts may be used.

- The Duoflex may be wired for 16 ohms by connecting the two 8-inch speakers in series. However, the 4-ohm connection is preferred because of the improved electrical damping obtained from parallel connection.

- We carefully avoided claims relative to the frequency response of the Duoflex since we regard most such claims as meaningless. If a manufacturer states, for example, that his speaker system covers from 40 to 18,000 cps he has not really told you anything about how the speaker will sound. Sure, it may reproduce the "full-frequency range," but perhaps with screechiness at the high end and muddiness at the low. Obviously, a tweeter manufactured to sell for \$2.95 won't sound quite as good as a \$75 electrostatic.

Manufacturers usually don't provide data on how many db down the response is at the ends of the audio spectrum, how smooth is the response curve, what percentage distortion the speaker has at the various frequencies, how well damped the system is (which influences the transient and bass response), etc.

Let's just say we've received letters stating that the Duoflex sounds better than systems three times its size and five times its cost. 



RICHARD S. CONWAY (CREI grad 1960) is Supervisor, Electronic Test Department Wilcox Electric Co., Kansas City, Mo.



ROBERT T. BLANKS (CREI grad 1960) is Engineer, Research & Study Div., Vitro Labs., Division of Vitro Corp. of America, Silver Spring, Md.



MEARL MARTIN, Jr. (CREI grad 1956) is a Senior Engineer and Field Support Manager, Tektronix, Inc., Portland, Oregon.

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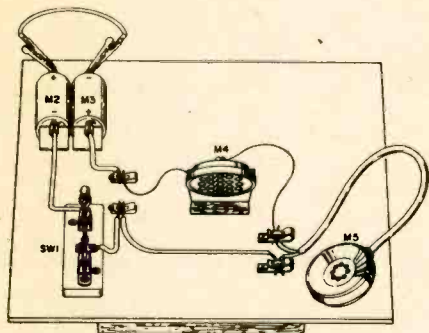
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29



GOOD READING

ELECTRONIC EXPERIMENTS AND PROJECTS. By Len Buckwalter. Howard W. Sams & The Bobbs-Merrill Co., New York & Indianapolis. 127 pages. \$2.50



Out of each year's crop of books on basic electronics, perhaps a dozen or so are meant, like this one, to help the beginner learn by doing. Their objective is to make the reader's initial acquaintance with electronics as direct and enjoyable as possible. And their success, particularly on the latter count, is hard to predict.

Which is why I gave this book to a neighbor, an intelligent and inquisitive 14-year-old who qualifies as a willing novice in electronics. His verdict is entirely favorable. Having finished about half the book's 27 experiments and projects, he reports that he has learned a good deal and had fun in the process.

Mr. Buckwalter, who is one of EI's Contributing Editors, has done an exceptional job of organization and planning. For one thing, his parts lists contain a minimum of store-bought hardware. For another, the judicious use of Fahnestock and alligator clips makes for a minimum of soldering. (Both these factors were much appreciated by my young neighbor.) The experiments themselves, from the making of a resistor to the rigging of a simple computer, flow in logical order. And, most important, each project demonstrates something that is worth demon-

strating. All in all, this is a useful volume, and my neighbor recommends it to novices of all ages. The drawing we show here is a typical how-to illustration from the book.

MY FATHER, MARCONI. By Degna Marconi. McGraw-Hill, New York. 321 pages. \$7.50

To most of us interested in hobby electronics, the name of Guglielmo Marconi stands for a great scientist who, in general, invented radio. But we know little about Marconi as a man.

This readable volume by Marconi's daughter gives us the other half of the picture. Although the author shows a marked appreciation and knowledge of the technical matters that concerned her father, it is the image of him as a man beset by personal problems—a marriage that failed, troubles with friends and associates—which gives the book its unique value.

REPAIRING HOME AUDIO SYSTEMS. By E. Eugene Ecklund. McGraw-Hill, New York. 320 pages. \$6.95

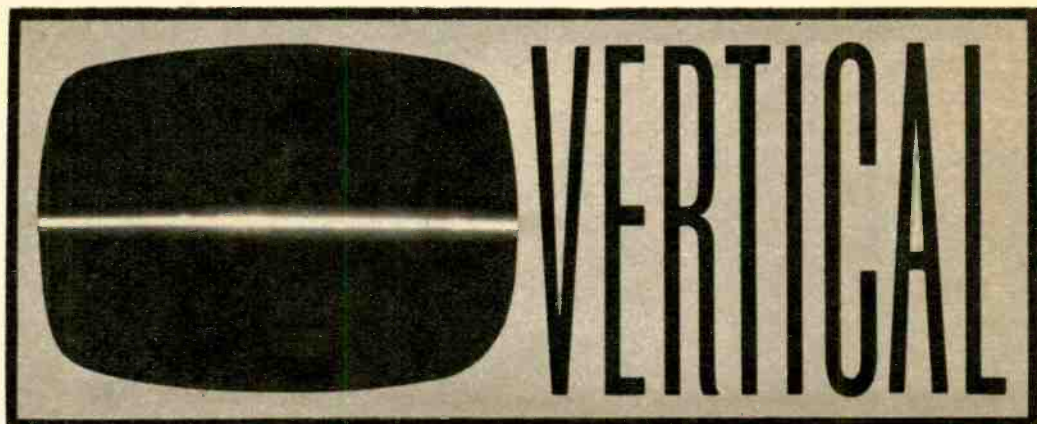
Although hi-fi components have been an important part of the electronics market for almost 15 years, there still is a dearth of qualified audio repairmen, especially outside the metropolises. And audiophiles have long complained that the mercies of the average radio-TV serviceman toward hi-fi equipment are anything but tender. The book at hand is obviously intended to cope with this complaint, and it might pay for small-town audio buffs to band together and buy copies for their local repairmen. While it has limitations, the book covers the main areas of hi-fi malfunctions in a straightforward, practical style. More than half its pages are devoted to record-playing equipment, but there is reasonable coverage of amplifier and tuner problems as well. On the whole, the material provides a good basic education for the average serviceman

Does your TV picture have that narrow, squashed appearance?

Is it short, thin and unable to fill the screen?

Tired electrons aren't the trouble and pills won't help.

Try EI's quick and easy repair course on . . .



PROBLEMS IN YOUR TV

By Art Margolis

AMONG the many troubles that plague television receivers, vertical oscillator problems are among the most common. You probably are familiar with vertical collapse. Its hallmark is a bright white horizontal line across the face of the picture tube. The voltages normally responsible for sweeping the picture vertically are somehow failing to get through to the yoke around the neck of the picture tube.

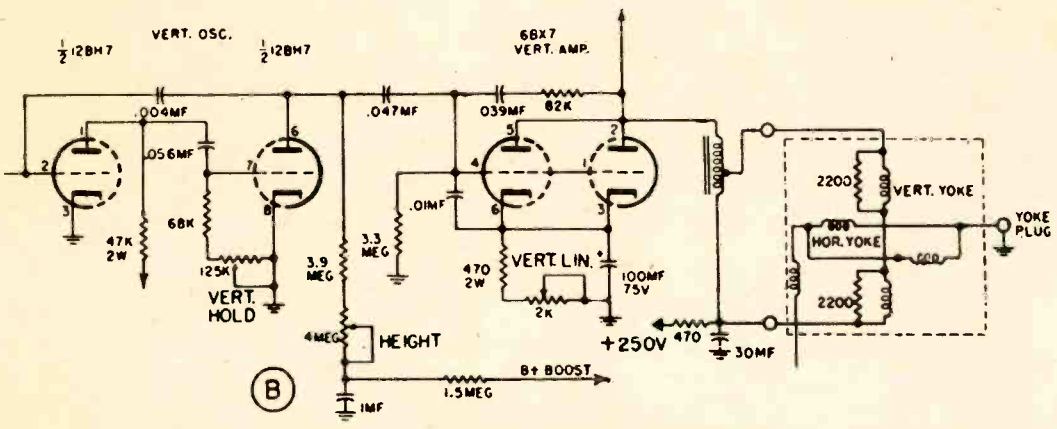
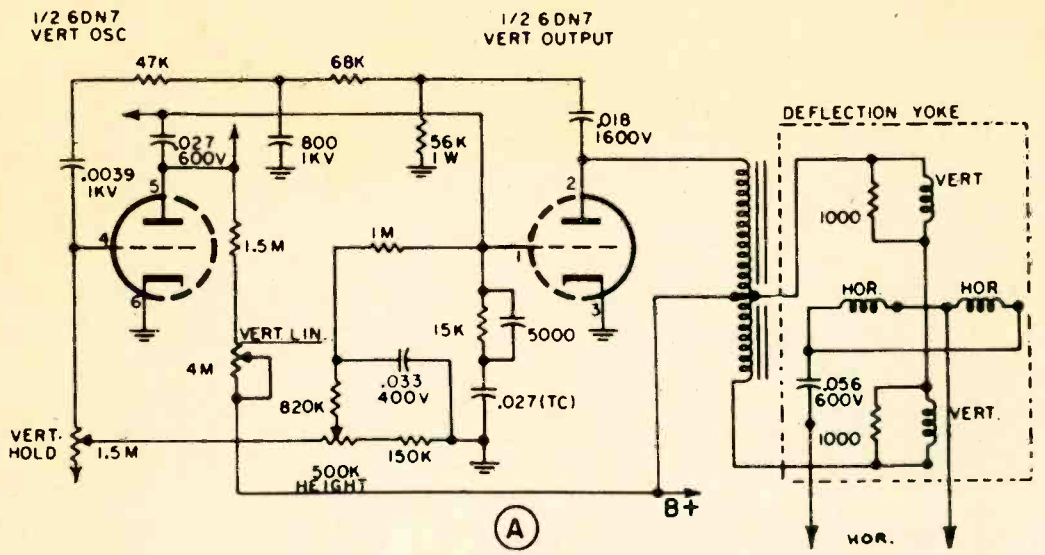
Troubleshooting Techniques. Since the electrons which normally light up the entire face of the CRT are now beating on the same narrow area of phosphor, keep the brightness control turned down during the following tests. Otherwise, your picture tube may have a line burnt permanently across the center of its screen.

Locate the set's vertical oscillator and vertical output tubes. They may be separate tubes or both in the same envelope. In any case, try replacements. Luck will be with you about 50% of the time, and your vertical sweep will be restored. In the other 50%, tubes won't help.

Preparing for Surgery. It's a good idea to leave the new tubes in the set until you've completed the repair. This way, you'll avoid additional problems that the old tubes might introduce. Secondly, get a schematic of your set from the manufacturer or one of the standard reference volumes.

With the chassis out of the cabinet, the dust removed and the innards of the set exposed, plug in your cheater cord. The subdued bright horizontal line should reappear.

The Signal Source. The basic troubleshooting tool we will



Typical manufacturer's schematics of TV vertical sections. Note differences in the tube lineup.

use is a 6-volt AC signal. If your set is a transformer-operated type, turn it off and solder a flexible wire about a foot long to a hot filament pin (you can use a voltmeter to check which filament pin is hot and which grounded). Connect a .05-mf, 600-volt (or higher) capacitor to the wire. This capacitor serves two purposes. It gives you a probe to hold and it prevents any DC in the circuits under test from feeding back into your 6-volt AC source.

If the TV is a transformerless type, it's safest to use an external 6.3- or 12-volt filament transformer as the signal source. Connect one side of the secondary to the chassis ground and the

other side through a lead to a .05-mf capacitor as before. Wrap all exposed connections with plastic tape.

Safety Precautions. Remember you're working on a live chassis with extra-high voltages lurking in it. It's good practice to keep one hand behind your back or in your pocket when you're probing. Don't use an un-insulated steel workbench and don't work in a basement with a damp floor. Avoid contact with plumbing and conduits.

Prop up the chassis securely, because you're looking for trouble if you grab a chassis to steady it while testing in a high-voltage area.

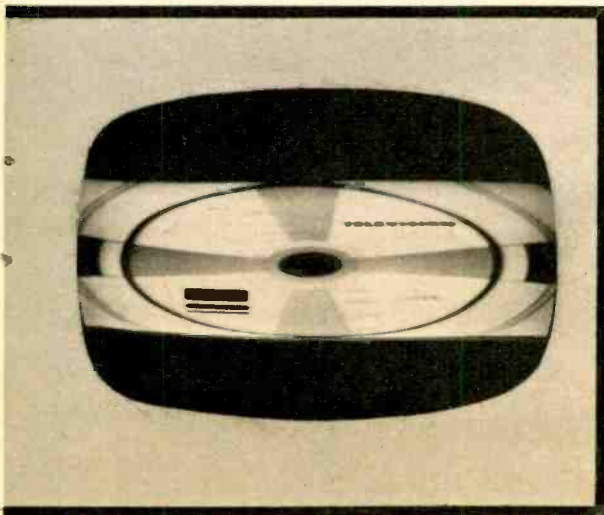
Now let's return to the 60-cycle test

signal we are going to inject into the vertical circuit for signal tracing purposes. Conveniently, the vertical oscillator in all American TV receivers operates at a frequency of 60 cps. The output of the oscillator is coupled to the vertical output circuit, where it is amplified and fed to the vertical output transformer. It is the job of this component to match the output tube to the vertical windings of the deflection yoke. The magnetic field developed in the yoke swings the electron beam up and down to provide the vertical component of the TV picture. Obviously, if the 60-cps pulse doesn't get to the yoke—because of a fault anywhere in the circuit between the vertical oscillator and the yoke there isn't going to be any vertical sweep—just a bright horizontal line.

What we will do is replace the missing vertical sweep signal with the 60-cps signal from our test probe. We don't have an exact replacement. The voltage isn't high enough and the vertical pulse produced by the oscillator normally is a sawtooth, whereas our signal is a sine wave. However, for testing purposes it doesn't matter since we're not trying to get the picture back right now. We're trying to locate the fault.

Touch the .05 capacitor to the control

If total picture collapse isn't the problem, check the B+ voltage in addition to the other tests.



grid (pin 1) of the vertical amplifier-output tube (see Fig. 1A). The horizontal line either will spread vertically or won't budge.

If spread occurs, it means the trouble is in the stage preceding the output tube. Something in the vertical oscillator section is at fault. If the picture doesn't spread, it indicates trouble in the vertical output circuit.

Note that the amount of spread varies from stage to stage. The amount of spread depends on the number of stages of gain coming after the signal injection point.

If troubles in the vertical oscillator are indicated, the next step is to touch the signal capacitor to the plate (pin 5) of the oscillator tube. If the image spreads, your trouble is before this point. If it doesn't spread your trouble is between the plate of the oscillator tube and the control grid (pin 1) of the output tube.

Your third test point is the grid (pin 4) of the oscillator tube. If the circuit under test has several tubes, as shown in schematic B, simply keep going back from stage to stage, following the schematic. As soon as your injected signal fails to produce a vertical sweep, that's where your component testing begins.

Checking the Components. In the suspected circuit area you'll find capacitors, resistors, coils and possibly transformers. One of them probably is the culprit. Check the voltages at the tube socket and see how they compare with the voltages given on the schematic.

A shorted or leaky capacitor can pull down plate voltage and upset grid bias. Capacitors (except filters) can be tested by a resistance check. With one lead unsoldered, capacitors should read infinite resistance on an ohmmeter. If resistance is indicated replacement is in order.

Filter capacitors also can be checked with an ohmmeter. With a can type, remove all wires from each terminal tested. Using a jumper wire, momentarily short the filter from plus to minus. Next, set your ohmmeter to the highest scale and apply its probes to the filter terminals. Make sure you have the plus

[Continued on page 121]

WEATHER WAVE CONVERTER

Simple transistor device pulls in authoritative, up-to-the-minute reports on your home or car radio.

By I. C. Chapel



Interior of converter. Note PC board between coils L1 seen at left and L2 (right).

WEATHER information used by private pilots and commercial airlines can be tuned in on your home or car radio using EI's miniature one-transistor converter. It picks up the low-frequency range-station broadcasts and converts them to a higher frequency that can be received on any radio.

Construction. The three series-connected penlight cells (which supply 4.5 volts at only 200 microamps) are mounted inside the box. Loopsticks L1 and L2 are transistor receiver types with additional turns of #38 enameled wire wound over their coils. Modify L1 by winding 300 turns over the coil. Connect the start of the new coil to the outer layer end of loopstick coil and then wind the new coil in the same direction as the loopstick coil was wound. This is important because the coils have to be connected in a "series-aiding" way. Should you experience trouble in getting the converter to work, it may be due to wrong-direction winding.

L2 is wound in the same way except that a tap (B) is brought out at the point where the two windings join. Terminals A and B represent the new winding. Capacitor C5 is connected across original winding B-C. The adjustable slugs serve to peak the received signal. Insulate tuning capacitor C5 if a metal case is used. With L1 and L2 in position, wire the printed-circuit

board between them as shown in photo.

Tuning. The converter is installed between your antenna and the receiver which is tuned to 700 kc (no ground wire is required between the units). Adjust L2 until a hush is heard in the receiver, then set the receiver to 1000 kc. Adjust input loopstick L1 to the frequency of the wanted range station (about 300 kc). Its tuning will be quite broad. When you cross the radio-range frequency, a continuous tone will be heard. This tone may be dash-dot, dot-dash or just a long dash, determined by the location of your equipment in relation to the transmitters.

FAA radio stations give weather reports within a 400-mile radius of a station. Any receiver capable of tuning 250-350 kc can get reception. Airman's Guide, published by the Government Printing Office, Wash., D. C., gives frequency and locations of all stations.

PARTS LIST

Resistors: 1/2-watt, 10% R1—1 megohm
R2—10,000 ohm

Capacitors:
C1—470 mmf C4—.001 mf
C2—57 mmf C5—365 mmf miniature variable
C3—20 mmf

S1—SPST toggle or slide switch

L1, L2—540-1,500 kc Transistor loopstick antenna (see text)

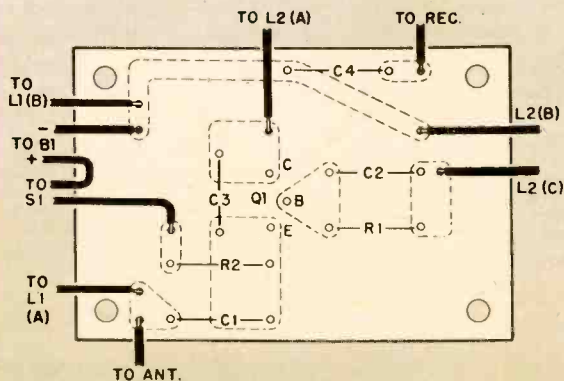
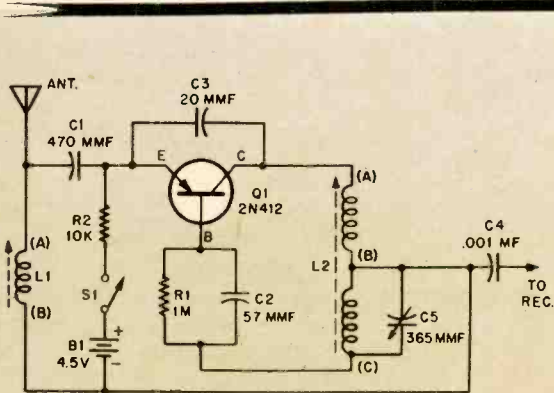
B1—3 series-connected penlight cells (4.5-v total)

Q1—2N411 or 2N412 transistor

Misc.—4"x2 1/8"x1 1/2" Minibox

A printed circuit board etched and predrilled for the above unit is available at \$1.50 postpaid from Detroit Electronic Corp., 13000 Capital Ave., Oak Park, Mich.

No ground to case is used. If shielding is needed to kill noise in mobile use, it should not be grounded to converter cabinet. Although not shown in pictorial, tuning capacitor C5 is connected across L2(B) and (C).



2 New DX Awards

Continued from page 92

How to qualify for awards: Our certificates are awarded strictly on the basis of the *number of countries* you have DXed. Each country may be counted only once. Clip out our EI DX Club Log and fill it in (we suggest using a ballpoint pen or pencil). List only countries from which you have verifications in the form of QSL cards or letters. Send the log to:

EI's DX Club
67 West 44th St.
New York 36, N. Y.

Do not send QSL's. Later, when we verify your log, we may ask you to send one or more QSL's for inspection.

Filling in the log: In the *Class Award Applied For* blank write the class name as it appears in our chart on the first page of this article (General-50, Special, etc.). Use the local date of reception and employ figures (such as 12-1-61, etc.). List local standard time, using the 24-hour clock (0000 to 2359 hours). Under *Station*, list call letters or other identification. Fill in *all* items for each entry, including checking one of the boxes under *Type of QSL*.

Additional log pages: For a DX Century Award application, make up one or more extra logs, using EI's format.

Classes of awards: See box on first page of article.

Cutoff date: Reception of DX signals must have taken place since Jan. 1, 1950.

Special notes: Applications for our awards are rejected most often for the following reasons: insufficient number of countries, duplications of same country, leaving blanks in an entry line, failure to list an exact-as-possible frequency. Merely listing the general band is not sufficiently accurate, except in the case of amateur radio QSL's.

Although intended primarily for short-wave listeners, our awards also are presented to hams who qualify. *Any* ham QSL from a country permits you to list that country in your log.

The names of EI DX Club award winners in our first Award Period appear at right.

EI DX AWARD WINNERS

GENERAL CLASS

100 Countries • DX Century Awards

Thomas C. Ashley, Nicholasville, Ky.
Bert Beyt, St. Martinville, La.
George R. Buchanan, Webster Groves, Mo.
Wendel Craighead, Kansas City, Kans.
Gerry L. Dexter, Waverly, Iowa
Franklin F. Fiore, Bethlehem, Pa.
Fred Hamer, Waterloo, Ont.
Donald N. Jensen, Racine, Wis.
Jeff Kadet, Needham, Mass.
Lavoyd Kuney, Detroit, Mich.
Joe Mauriello, Haskell, N. J.
Fred W. Noakes, Montreal, Que.
Giacomo Perolo, Sao Paulo, Brazil
Allan Roth, Bridgeport, Conn.
Joseph A. Stauhs, Belleville, N. J.

50 Countries

R. M. Abramowitz, Port Elizabeth, South Africa
Thomas Anderson, Union, N. J.
Fred K. Baines, New Glasgow, Nova Scotia
Sam Barto, Naugatuck, Conn.
Don W. Beebe, Seattle, Wash.
Edward D. Bowker, Keene, N. H.
Clifford Cardwell, Fort Worth, Tex.
Michael Chabak, Astoria, N. Y.
Richard E. Davis, Denver, Colo.
Robert Eddy, Newport, Ohio
Richard England, Columbus, Ohio
M. Franca, Antwerp, Belgium
Alex Garrison, Richmond, Va.
Paul Giuliani, Worcester, Mass.
Robert Gobrick, West Islip, N. Y.
Harry Gottshall, Brooklyn, N. Y.
Leroy Gruber, Deer Park, Ohio
Edward Hamill, Millbrae, Calif.
Richard Harris, El Dorado, Ark.
Dan Henderson, DeFuniak Springs, Fla.
Samuel Hevener, Sharon, Pa.
Charles Howard, Jr., Tampa, Fla.
James Howard, Kansas City, Mo.
Joseph Hueter, Philadelphia, Pa.
Francis Jacobs, Anson, Me.
Steve Jamour, Philadelphia, Pa.
Robert Lamkin, Revere, Mass.
Leigh Lerner, Highland Park, Ill.
David Listort, Elmont, N. Y.
William Lund, Manhattan Beach, Calif.
Michael Mandrick, Rochester, N. Y.
Anthony Manne, Port Elizabeth, South Africa
Gary McHugh, El Paso, Tex.
Ted Midlam, Fairborn, Ohio
Justin Mirkin, Port Elizabeth, South Africa
James Neff, Springville, N. Y.
Chris Pinn, Lockport, Ill.
Donald Scott Pratt, Hilton Park, Western Australia
Bernard Rachlin, Ottawa, Ont.
Paul Rhodes, Goshen, Ind.
John J. Riley, Glen Dale, W. Va.
Fred Rockman, North Burnaby, B. C.
John Rokita, Sharon, Pa.
Joseph Russo, Toms River, N. J.
Richard Schreiber, Wheatridge, Colo.
Stanley Schwartz, Bridgeport, Conn.
Michael Sealfon, Hillsdale, N. J.
John Shinn, Bowman, Manit.
Thomas Snow, East Point, Ga.
Leo Thibaudeau, St. Foy, Que.
David Truesdell, Wilmington, Ohio
Alvin Turetsky, Bridgeport, Conn.
Nick Vrettos, Ft. Leonard Wood, Mo.
Bill Wambach, Evansville, Ind.
James Young, Seattle, Wash.
James Zacher, Chicago, Ill.

MEDIUM-FREQUENCY CLASS

25 Countries

Maurice Ashby, Wichita, Kans.
Desmond Frampton, Invercargill, New Zealand

LOW-FREQUENCY CLASS

10 Countries

Hank Holbrook, Bethesda, Md.

The power: 50 watts The price: \$129.50 The builder: You



(It could only be a Fisher StrataKit.)

The new KX-100 stereo control-amplifier kit would be an astonishing value under any label — 50 clean watts for less than \$130 plus a few evenings of highly entertaining work. But the fact that it is a Fisher amplifier, with all the built-in quality that the name implies, makes it the most remarkable buy of the entire stereo era.

The KX-100 is an authentic StrataKit. The StrataKit method of kit construction is the exclusive Fisher development that enables a totally unskilled and inexperienced person to achieve the same result as a professional laboratory technician. You can't help ending up with a faultless Fisher product when you build a StrataKit.

In addition to more watts per dollar than any other top-quality amplifier, the KX-100 features all the standard control and switching facilities, plus a few remarkable extras: A front-panel headphone jack with speaker silencing switch... full tape monitoring facilities with the famous Fisher Tape-Play System... a High Filter switch... and a revolutionary new circuit that permits direct connection of a center-channel speaker without using an additional amplifier! Yes. All for \$129.50*. **THE FISHER**

*Walnut or mahogany cabinet, \$24.95. Metal cabinet, \$15.95. Prices slightly higher in the Far West. Export: Fisher Radio International, Inc., Long Island City 1, N.Y. Canada: Tri-Tel Associates, Ltd., Willowdale, Ont.

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Fisher Radio Corporation
21-55 44th Drive
Long Island City 1, N.Y.

Please send me without charge The Kit Builder's Manual, complete with detailed information on all Fisher StrataKits.

Name

Address

City Zone State

21 11 11

Ultrasonic Cleaner

Continued from page 49

surface with epoxy. Place the insulating sleeve (not shown) around the tank stud and lower the transducer, epoxy side down, centered around the tank stud. Place the soldering ring on the transducer so it is also centered around the stud. Apply a coating of epoxy to one side of the insulating clamp plate and lower the plate, epoxy down, on the soldering ring. Apply a flat washer, a lock washer and the nut. Tighten firmly. Allow 24 hours for the epoxy to set. Then place a solder lug on the stud held in place by a second nut.

The tank housing can be fabricated from sheet metal, but a rubber rim must be placed between the housing and the tank's rim to prevent spilled solvent from getting to the transducer. A housing complete with rubber rim is available for \$3.50 (see Parts List).

Strip three inches of the outer insulation from one end of the coaxial cable and pull the center conductor through the shield at the insulation. Solder the shield, as near as possible to the insulation, to the soldering lug on the tank's stud. Strip 1½ inches of insulation from the center conductor and tin the exposed strands. Force the center conductor against the transducer's silvered surface and, using a low-wattage iron, solder the wire to the soldering ring and transducer. Pass the free end of the coaxial cable through the tank housing and install coaxial connector PL1. If desired, the free end of the cable can be connected directly to the generator's output terminal and ground. If a direct connection is made, use a cable clamp at the generator to secure the cable.

Before connecting the tank to the generator, check it out with an ohmmeter. The cable shield should have continuity to the tank and open circuit to the center conductor. The center conductor should read continuity to the transducer's exposed silver surface. Pass the excess cable through the housing and force the tank into the housing, pulling the cable through.

WARNING: NEVER OPERATE

WITHOUT FLUID IN THE TANK.

For your protection, ground the generator by connecting a wire (#18 or #16) between the generator chassis and an external ground.

For check-out, pour a mixture of water and liquid detergent into the tank (10 oz. water, .5 oz. detergent). Turning on the power will result in the 826's filament glowing a bright white-yellow. In a few seconds the fluid will cavitate (cold boiling). Adjust the tuning rod for maximum activity as evidenced by vigorous boiling. Boiling may occur at several settings of the tuning rod but one or two settings will provide maximum action.

Remember: never put your hand in the solution while the unit is on.

The proper cleaning solution depends on what you're trying to clean. Plain detergent and water is good for some applications. A dash of ammonia helps. The kit of parts for EI's unit includes a Cleaning Solution Data Chart. There are several precautions to be observed:

- Do not use highly inflammable solutions since cavitation causes heat.

- Do not use toxic or low-flash-point solvents. Under ultrasonic agitation, carbon tetrachloride will form phosgene, a deadly gas. Low-flash-point solvents like benzene and naphtha develop vapors which are easily ignited.

Hi-Fi Record Guide

Continued from page 37

trovert versions of seven Metropole favorites.

Records discussed in this column, with monaural discs listed first and stereo versions just below:

Flute Concertos (45 rpm)	Connoisseur CS-362 (stereo only)	\$6.98
Verdi: Rigoletto	Sutherland, MacNeil, Cioni London A-4360	14.94
	OSA-1332	17.94
Twentieth Century Minstrel	Richard Dyer-Bennett Decca DL-9102	4.98
	DL-79102	5.98
Weavers' Gold	The Weavers Decca DL-4277	3.98
	DL-74277	4.98
Sounds Unheard Of!	Shelly Manne, Jack Marshall Contemporary S-9006 (stereo only)	5.98
Jazz at the Metropole	Yaged, Hawkins, Erwin Philips PHM 200-022	3.98
	PHS 600-022	4.98



Air Force Recruiter to Howard Adcock, Gadsden, Alabama:

“Let’s talk about your next important step.”

Today the Air Force plays a key role in the defense of the free world. Its members must work with increasingly complex techniques and equipment. There is little place for the untrained, unskilled. Such are the facts of life of the Aerospace Age.

A young man who chooses to put on Air Force blue will be classified into one of more than 40 career fields during his first few weeks of active duty. His classification will depend upon the

results of aptitude tests, his own desires, and the needs of the service.

This means he will be serving his country in a job he has the ability to do well, one that he likes, one where he is needed.

Is there a better step to take in beginning a successful career and preparing for the demands that face you?

*For America’s future, and your own,
join the Aerospace Team*

U. S. Air Force



Howard Adcock who is shown above is now an Airman 3C. He is with a Fighter Wing stationed at Myrtle Beach Air Force Base, S. C. As aptitude tests had predicted, he is doing well in his job as an Organizational Supply Specialist.



*Clip and mail this coupon today!
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City _____ County _____ State _____

WANT TO EXCHANGE CB CLUB PAPERS?

Well over 50 Citizens Band clubs publish some type of newspaper or newsletter. By reading these publications from other groups, CB club members can get ideas for improving their own paper, and they also can learn about the activities of other clubs.

The 42 clubs listed below are willing to exchange publications with other clubs on a one-for-one, postage-paid basis. If your CB organization wants to exchange, write directly to these clubs. Names of the publications are shown in italics in our list; the term *bulletin* means the paper has no formal name. All are published monthly, except as noted.

Elsewhere in this issue is an article which gives some tips on how to publish a good Citizens Band club paper. As that article says, to be successful, a club publication must have one chief goal: to assist the club in carrying out its activities. When you examine publications from other groups you should judge them on whether they meet this criterion.

If you want your club's exchange offer listed in EI, tell us the name of your paper, how often it is published and the address. Send this information to EI's CB Editor at 67 West 44th St., New York 36, N.Y.

Norwalk CB Radio Assn.
Norwalk CB News
Box 693
Norwalk, Conn.

Citizens Radio League
CB News & Views
Box 28
Northlake, Ill.

Wabash Valley CB Club
The Modulator
c/o Fred Rowe
Monroe City, Ind.

Cedar Rapids Citizens Radio Club
QRM
c/o Duayne C. Wolcott
Route 1
Cedar Rapids, Iowa

Citizens Radio Club of Wichita
Newsletter
Box 2638, Munsey Station
Wichita 8, Kans.

5 Watt Club
Call Book (annual)
c/o Paul Jolly
Glasgow, Ky.

Ohio Valley CB Club
Ohio Valley Citizen
1221 Loeb St.
Henderson, Ky.

Kentucky-Indiana CB Radio League
bulletin
212 Bolivar St.
Owensboro, Ky.

Emergency Communications Organization
East Baton Rouge Sheriff's Dept.
bulletin (occasionally)
Box 533
Baton Rouge 1, La.

Greater New Orleans CB Radio Assn.
The Carrier
Box 4195
New Orleans 18, La.

M.C.R.A.
S-9 (semi-annual)
Box 235
Cohasset, Mass.

Pioneer Valley Five Watters
Pioneer Valley Carrier
Box 989
Holyoke, Mass.

Cape Cod CB Radio Club
Whip Wave
Box 131
Kingston, Mass.

Channel Jammers
Channel Jammers News
47 Pine St.
Swampscott, Mass.

C-BAGS
C-BAGS News
21 Starrett Rd.
West Lynn, Mass.

Citizen's Radiophone Assn.
Gridleak (bi-monthly)
3306 Kanter
Detroit 11, Mich.

Tri-County Emergency Communications Net
Tri-County Bulletin
Box 102
Dover, N. H.

5 Watt Whips of Lowell
The Band Scanner
c/o Eloise E. Elden
Anders Lane
Nashua, N. H.

CB Socialites
Chatterbox
c/o Karl Moulton
Main St.
Plaistow, N. H.

Blair House Communicators
The CB Snooper
1116 St. George Ave.
Avenel, N. J.

Cape May County CB Club
bulletin (occasionally)
Box 121
Wildwood 1, N. J.

Albuquerque Citizens Radio Assn.
Five Minute Times
Box 7495
Albuquerque, N. M.

Capital District CB Radio Club
The Carrier
46 Continental Ave.
Cohoes, N. Y.

Sullivan Trail CB
Sullivan Trail CB News
92 Oakwood Ave.
Elmira Heights, N. Y.

LaGuardia Communications Club
Skip
c/o Peggy Daly
987 Amsterdam Ave.
New York 25, N. Y.

Nassau CB Club
The Carrier
539 Heathcliff Dr.
Seaford, L. I., N. Y.

Niagara Frontier CB Club
Newsletter
209 Fletcher St.
Tonawanda, N. Y.

Durham CB Radio Club
CB News Letter
Box 8124, N. Durham Station
Durham, N. C.

Central Ohio CB Assn.
CO CB Newsletter
Box 92
Columbus 16, Ohio

II O-M Club
Heterodyne Gazette
Box 111
Toledo 1, Ohio

Oregon Grapevine, Inc.
Oregon Grapevine CB News
Box 4261
Portland 8, Ore.

Johnstown CB's
bulletin
Box 852
Johnstown, Pa.

Lycoming CB Radio Club
Lycy CB News
Box 247
Montoursville, Pa.

5-11 Radio Club of Pittsburgh
The Modulator
868 Glass Run Rd.
Pittsburgh 36, Pa.

Mason-Dixon CB Club
bulletin
c/o Grace L. Dubbs
Route 3
Shippensburg, Pa.

Tri-County Citizens Radio Assn.
Band-Spread
167 Acorn Dr.
Warminster, Pa.

CBers of Lower East Tennessee
Ten-Five (bi-monthly)
520 First St.
Athens, Tenn.

Johnson City CB Club
Q-W
Box 3191, Carroll Reece Branch
Johnson City, Tenn.

Virginia Citizens Radio Assn.
VCRA CB News
Box 471
Annandale, Va.

Greater Dallas CB Radio Club
CB Broadcaster
1318 Michigan Ave.
Dallas 16, Tex.

CB Radio Club of Fort Worth
CB Buzzer
Box 9697
Fort Worth 7, Tex.

Evergreen Area CB Assn.
Evergreen CB News
9220 Holly Dr.
Everett, Wash.

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The Monitor Meter

Continued from page 81

indication representing per cent modulation. Full scale (1 ma) equals 100% modulation; .9 ma equals 90% modulation, etc.

If you don't get a 1-ma reading when S1 is on *calibrate*, reverse the twinlead connector at the Monitor Meter or RF pickup unit. Leave it plugged in the way that provides the highest reading.

Now adjust C6 in the RF pickup box. You will find a setting where the meter reading suddenly peaks.

To check audio quality, plug a set of headphones into J1 and set S1 to *modulation*. Signal volume can be adjusted with C1. The meter is cut out when phones are used.

In amateur stations, running higher power than CB rigs, Monitor Meter coupling is simplified. You probably won't need the RF pickup unit and the MM can be located farther from the transmitter.

Connect a short length of hookup wire to J2's ungrounded terminal and wrap the free end five or six times around the transmission line. Connect J2's ground terminal to transmitter ground. If you get too little pickup, increase the number of turns or try moving the wrap-around coil to another spot.

If you have a low-power transmitter that won't get up enough drive to go through the transmission line, use the pickup unit.

Electro-Shock

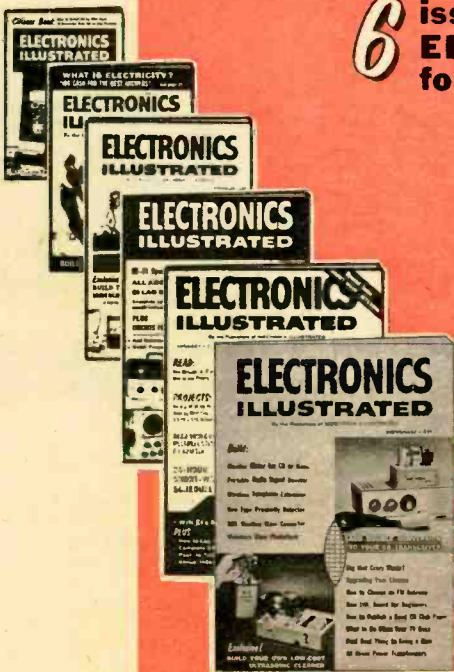
Continued from page 33

age preset; in others, the doctor adjusts it. In preset machines, the only variable is time; the doctor simply holds down the activating button until convulsions are produced. In a typical machine, the voltage ranges from 80 to 120 volts, depending on the temple-to-temple resistance of the patient's head.

Electro-shock is not the final answer but is a true ally to mental health.

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Circulation Department
Fawcett Bldg., Greenwich, Conn.

Double-Conversion Adaptor

Continued from page 65

adjust top and bottom slugs of T1 and T2 for maximum speaker volume. Repeat the procedure at least once to insure peak alignment. Then peak the top and bottom slugs of the receiver's last IF transformer. The crystal-control feature insures that the original receiver calibration will not be changed.

Receivers with a 455-kc IF must be aligned with a modulated signal generator. First, remove the DCA crystal and set the signal generator to maximum output at 274 kc. Connect the generator's ground lead to the DCA chassis and the hot lead in series with a 100-mmf disc capacitor to pin 1 of the 6BA6. Using a K-Tran tool, adjust the bottom slug of T2 for maximum volume. As the volume increases, reduce the output of the signal generator for the lowest usable volume. Similarly, adjust T2's top slug. Repeat the procedure once. Now connect the generator to pin 7 of the 6BE6 and set its output for a usable signal. Adjust the bottom slug of T1 for maximum output, then T1's top slug. Always remember to reduce the generator output to the minimum usable level as you peak T1, T2.

Disconnect the generator, plug in the crystal and connect an antenna to the receiver. Tune in a weak signal. If you have aligned the DCA properly there will be no shift in dial calibration. Using the proper alignment tool, peak the receiver's last IF transformer. Always use a weak signal; if the signal is strong the receiver's AVC action prevents you from making a peak alignment.

Receivers with 1,500-1,800 kc IF. The output of the receiver's last IF stage is fed into the signal grid of the 6BE6 converter tube V1. Simultaneously, V1 functions as a crystal-controlled oscillator whose frequency is 262 above the incoming IF signal. The receiver's IF and the crystal oscillator signals beat together in V1. One of the beat frequencies appearing at the plate of V1 is the difference between the IF and crystal frequencies: 262 kc.

T1 passes only the 262-kc signal to the grid of V2, the 6BA6 amplifier tuned

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to 262 kc by T2. The output of T2 is rectified (detected) by D1, which separates the audio signal and the AVC voltage from the 262-kc signal. The audio and AVC voltages are then fed back to the receiver.

Receivers with 455-kc IF. The DCA operates as above except that its IF frequency is shifted to 274 kc to permit the use of a low-cost crystal. The difference frequency is 274 kc, to which T1 and T2 must be retuned.

Meet the Power Transformer

Continued from page 61

transformer, but *not* delivered to the load, is radiated in the form of heat.

To minimize losses, the manufacturer uses more (or better) core material and larger wire for the windings. The design is dictated by the load currents to be encountered. Thus, the power transformer for a ten-watt amplifier will be much smaller than the one used in a 25-watt unit. In either amplifier, if the transformer is too small for the application its internal temperature may rise high enough to melt the insulation. This, in turn, shorts the windings and causes the transformer to draw excessive current from the power line. Unless its primary circuit is fused, the transformer will burn up.

Wire must be selected carefully. If the wire is too large, the transformer itself will be oversize. If the wire is too small, heat will go beyond safe levels.

For the purpose of calculations, transformer wire is gauged in circular mils (a mil is .001 inches). For each ampere of current in the transformer winding, the wire should have 700 circular mils (although any figure between 500 and 1,000 can be used). Consulting a copper wire table, we find that #22 wire has a thickness of 810.1 circular mils. Based on the 700-circular mils/ampere figure, the wire can carry 1.16 amperes without overheating.

You can see that a transformer with wire carrying 500 circular mils per ampere will run warmer than one with 1,000 circular mils per ampere. In cases where additional heat won't cause

any trouble, the use of the smaller wire results in a more compact transformer. In cases where transformer reliability is a prime consideration, the 1,000-circular-mil-per-ampere figure would be used.

To test a transformer, run it for an hour or two at full load and then check the temperature. However, this system doesn't tell you much about the heat conditions deep inside the transformer. It is possible to measure the exact temperature of each winding, however. Since any copper wire of a certain gauge has a specific resistance per foot at various temperatures, all you have to do is measure the resistance of the winding when cold, and then check it after a couple of hours of operation.

From the preceding you can see that anything done to reduce the winding resistance will increase transformer efficiency. In addition, if you can limit the flux leakage by better steel or larger cores you will gain efficiency. If the transformer were 100% efficient (all the primary current was converted to flux lines which were all absorbed by the secondary), then a one-turn primary would be sufficient. Practically, however, the primary turns are determined from the *flux density* produced with a given core material.

First the turns *ratio* for the required step up or down in voltage is established, then the number of primary turns is determined. The important considerations are the type and size of core, and the operating frequency. As a rule-of-thumb, a core having one square inch of cross section and a magnetic path one foot long will require about eight turns per primary volt. If any of the above factors is changed, the number of primary turns will have to be adjusted in proportion. If the frequency of operation is fixed (say for the 60-cycle power lines), the number of primary turns required is inversely proportional to the cross-section of the core.

The most popular method of constructing transformers is the E and I lamination system. The core is made of thin slices of high-grade steel in the shape of an E. Long I's close the ends. This manufacturing method allows the

coils to be machine-wound, six or more side-by-side on a long fiber tube. The tube is then cut into sections (each with one coil) and the tube trimmed flush to the coil. Next, the core is *stacked*; that is, the E laminations are inserted into the coil. To reduce losses, the E laminations are stacked from alternate sides of the coil, and the I laminations are interleaved.

High-grade silicon steel serves as the core material in power transformers built to operate over a narrow band of power-line frequencies. Audio transformers, and others designed to handle a wide frequency range, employ a material called *audio C*. —

The Listener

Continued from page 31

the Azores, Angola, Mozambique and (political realities to the contrary) Goa as integral parts of Portugal. So a country-hungry DXer is no better off after bagging difficult CSB-81 in the Azores

(see QSL card) than if he'd merely copied a few program notes from powerful Emissora Nacional at Lisbon. He still has just one country—Portugal.

To cope with this situation, radio hobbyists mixed a distance ingredient into the formula. If a territory or island is separated from the motherland by so much water or foreign territory, it becomes a separate country. The magic distance, hashed out over Mexico's Revilla Gigedo Islands (a separate DX country), is 100 miles.

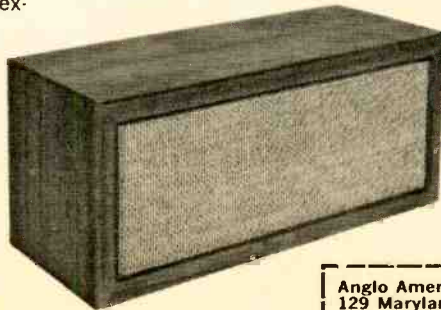
Two-thirds of the earth's surface doesn't count in *anybody's* list. I'm referring, of course, to international waters. This used to affect only that rare breed known as utility DXers. Since most hobbyists are SW broadcast fans, nobody worried. But now we have *broadcasters* on the high seas, such as Holland's SS Veronica, a transmitter-bearing ship afloat in the North Sea (see QSL card). Veronica puts out a signal on 1563 kc and is heard occasionally on the East Coast; does it represent a separate country? [Continued on page 121]

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One solution might be to count the oceans and seas as countries. Maybe you have some views on this subject. If so, drop me a line c/o EI.

Miniature Slave Flash

Continued from page 75

on the back of the box if desired so the slave may be attached to some nearby object. After the slave is correctly positioned its flash bulb is inserted, and from this moment until the picture is taken there must be no change in the light intensity on the photocell or the bulb will flash prematurely.

The flash of light at the camera is followed so closely by the flash from the slave that no synchronization changes are necessary. This added light source vastly improves your work's quality.

The slave flash has been designed with great sensitivity. It responds to relatively small variations in light intensity. If such high sensitivity is not needed, construction costs can be reduced. Only one photocell will operate the unit, or the first transistor may be eliminated. With only two transistors, C1 and R1 will be connected to the base of Q2 and the polarity of both C1 and the photocell will be reversed to correctly operate Q2, an NPN transistor. It should be noted that good sensitivity is necessary if the slave is used under conditions of high ambient light levels. This is because the pulse of light from the camera is relatively weaker if the scene is already well lighted.

The light-sensing component is a B2M selenium photocell (or two in parallel for greater sensitivity) feeding two audio transistors. The third transistor is a low-priced power type which replaces the relay found in conventional slaves and fires the flash bulb. These transistors are connected in a complementary-symmetry amplifier circuit with the resistor in Q1's base circuit biasing them all almost to cut-off.

A negative pulse from the photocell via C1 triggers them all to momentary conduction and fires the bulb. It is capacitor C1 which causes the slave to ignore the steady ambient light level and

respond only to an abrupt increase in light intensity. Capacitor C2, connected across the battery, is an energy storage reservoir which supplies the pulse of current needed to fire the bulb long after the small battery can no longer provide this surge.

Vertical Problems In Your TV

Continued from page 107

lead of the meter on the positive terminal of the filter capacitor. The meter needle will flick toward zero, then return slowly toward the high end of the scale as the capacitor charges from the ohmmeter's battery. If it doesn't, the filter probably is bad. A more positive test is to solder in an equivalent-value capacitor of the same or higher voltage rating. If the new one cures the problem, then the old capacitor is a dud.

Transformers and coils should have continuity. A reading anywhere from zero to a few hundred ohms is all right. If you get a high-resistance reading, the coil probably is open. After each replacement turn on the TV. When the picture returns, the villain is found.

Testing the Output Stage. If your picture didn't spread when you put a signal into the control grid of the output-amplifier tube it means checking in the direction of the yoke. Inject the 60-cps signal at the plate (pin 2) of the output tube (diagram A). If your picture spreads at all, it means your trouble lies in one of the components serving the output tube. Test them. If you get no reaction at the plate, check the vertical output transformer, the components around it and the yoke. The absence or presence of B⁺ in and around the yoke will indicate what's happening.

Once the defective component has been replaced and the picture size is close to normal, you probably will have to reset the vertical adjustment controls. The *height* tends to spread out the bottom of the picture while the *linearity* tends to spread the top area.

When you're satisfied with the picture you can try reinstalling your old tubes. If no major readjustment of the vertical controls is needed they can be left in.

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—	1DN5	.55	—	6AV6	.41	—	6L6	1.06	—	12CX6	.54
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—	2BN4	.64	—	6BF5	.90	—	6T8	.85	—	12ED5	.62
—	3AL5	.46	—	6BF6	.44	—	6U8	.83	—	12EG6	.62
—	3AU6	.54	—	6BG6	1.70	—	6V6GT	.54	—	12EK6	.62
—	3AV6	.42	—	6BH6	.68	—	6W4	.61	—	12EL6	.50
—	3BA6	.51	—	6BH8	.98	—	6W6	.71	—	12EZ6	.57
—	3BC5	.63	—	6BJ6	.65	—	6X4	.41	—	12F8	.66
—	3BE6	.56	—	6BJ7	.79	—	6X5GT	.53	—	12FA6	.79
—	3BN6	.75	—	6BK7	.85	—	6X8	.80	—	12FM6	.50
—	3BU8	.78	—	6BL7	1.09	—	7A8	.68	—	12FR8	.97
—	3BY6	.58	—	6BN4	.62	—	7AU7	.65	—	12FX8	.90
—	3BZ6	.56	—	6BN6	.74	—	7B6	.69	—	12GC6	1.06
—	3CB6	.56	—	6BQ6	1.12	—	7E6	.75	—	12J8	.84
—	3CE6	.58	—	6BQ7	1.00	—	7F8	.90	—	12K5	.75
—	3DG4	.85	—	6BS8	.95	—	7F9	.90	—	12L6	.73
—	3DK6	.60	—	6BU8	.70	—	7S7	1.00	—	12SA7	.99
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—	5AN8	.90	—	6CK4	.70	—	12A4	.60	—	17BQ6	1.16
—	5AQ5	.54	—	6CL8	.79	—	12AB5	.60	—	17DQ6	1.06
—	5AT8	.83	—	6CM7	.69	—	12AC6	.55	—	17W6	.70
—	5BC8	.79	—	6CN7	.70	—	12AD6	.57	—	18FW6	.49
—	5BE8	.83	—	6CQ8	.92	—	12AE6	.50	—	18FX6	.53
—	5BK7	.86	—	6CR6	.60	—	12AE7	.94	—	18FY6	.50
—	5BQ7	1.01	—	6CS6	.57	—	12AF3	.73	—	19AU4	.87
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—	5U4	.60	—	6DJ8	1.21	—	12AV6	.61	—	25C06	1.52
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—	5V3	.90	—	6DN6	1.55	—	12AX4	.67	—	25DN6	1.42
—	5V6	.56	—	6DQ6	1.10	—	12AX7	.63	—	25EH5	.55
—	5X8	.82	—	6DT5	.81	—	12AY7	1.44	—	25L6	.57
—	5Y3	.46	—	6DT6	.53	—	12AZ7	.86	—	25W4	.68
—	6AR6	1.20	—	6DT8	.94	—	12B4	.88	—	32ET5	.55
—	6AB4	.46	—	6EA8	.79	—	12BA7	.94	—	32L7	.90
—	6AC7	.96	—	6EB5	.73	—	12BD6	.50	—	35C5	.51
—	6AF3	.73	—	6EB8	.94	—	12BE6	.53	—	35L6	.60
—	6AF4	1.01	—	6EM5	.77	—	12BF6	.60	—	35W4	.42
—	6AG5	.70	—	6EM7	.82	—	12BG7	.77	—	35Z5	.60
—	6AH4	.81	—	6EUB	.79	—	12BK5	1.00	—	36AM3	.36
—	6AH6	1.10	—	6EV5	.75	—	12BL6	.56	—	50B5	.69
—	6AK5	.95	—	6EW6	.57	—	12BQ6	1.16	—	50C5	.53
—	6AL5	.47	—	6EY6	.75	—	12BR7	.74	—	50EH5	.55
—	6AM8	.78	—	6F5GT	.39	—	12BV7	.76	—	50L6	.61
—	6AQ5	.53	—	6F67	.69	—	12BY7	.77	—	70L7	.97
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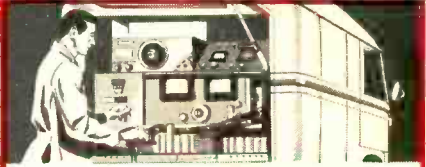
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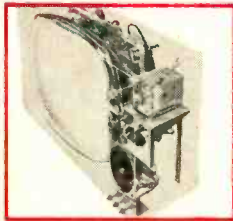
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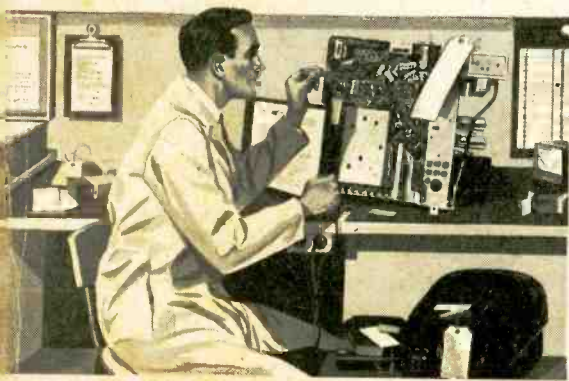
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