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A Message from
J. Morrison Smith
President
National Radio Institute

"Nothing is farther from the truth—than the idea that *only* engineers, with college degrees, are needed in Electronics. Authorities point out: For every *one* engineer required, Electronics needs *four* to *seven* Technicians. NRI trains you for technical careers in many different Electronics fields."

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Has shop in basement—gets "more and more work all along"

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—JOHN D. PETTIS,
172 N. Fulton, Bradley, Illinois

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- ☐ **EARN $3 TO $5 PER HOUR.** Fixing appliances is a high-paying skill because the demand for trained men is so great.
- ☐ **ENJOY SEMI-RETIREMENT ON A GOOD INCOME.** When you're ready to retire, you can devote a few hours a day to this work. Live and work anywhere you please.
- ☐ **NO PREVIOUS EXPERIENCE OR TRAINING NEEDED.** We tell you and show you everything you need to know, in plain English and clear pictures.

IF YOU'RE like so many men today, you've been "hankering" to start "a little home business of your own." In spare time at first, then maybe full-time later on. Something you'd enjoy – and that pays well. Something that fills an existing need in your neighborhood or town – that "sells itself," without any high pressure arguments – that doesn't take a big investment or elaborate equipment.

This is it—Servicing Electrical Appliances! Now is the perfect time to get into it. Sales of electrical appliances have skyrocketed. Look how YEARLY SALES have risen since 1950: Coffee Makers – from 900,000 to 4,750,000. Room Air Conditioners—from 200,000 to 1,800,000. Clothes Dryers—from 318,000 to 1,425,000. Floor Polishers – from 240,000 to 1,090,000. No wonder that men who know how to service appliances properly are making $3 to $5 an hour—in spare time or full time!

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FEEDBACK from our readers

Write to: Letters Editor, Electronics Illustrated, 67 West 44th St., New York 36, N. Y.

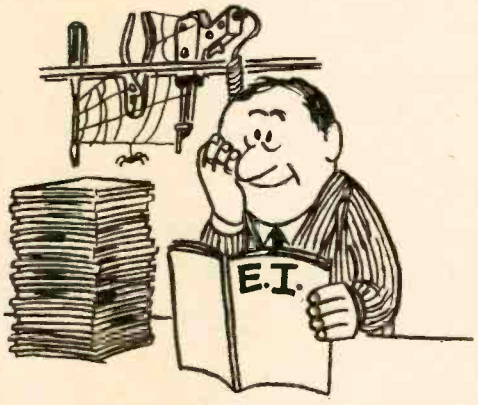
● *Alaskan Antennas*

Having read your article on new TV antennas in the March EI, I thought I'd tell you about our troubles in trying to bring television to our community from a 100-watt station (AFRTS) that is 35 miles away on the other side of a mountain range.

We've packed six different antennas up three mountains so far. The sound is perfect but the picture could be better. A 30-element yagi is next.

John C. Ingram
Cooper Landing, Alaska

● *Lone Star Report*



I was very interested in the article HOW TO USE RADIO PROPAGATION REPORTS (Jan. '62 EI). I enjoy EI but my problem is that I read so much I haven't time to build anything.

Jerry Green
Ralls, Tex.

● *The Take*

Of most interest to me in your March issue was your report on XERF, the Mexican border station, in THE LISTENER. Years ago when I was program director of KFBI in Wichita, Kans., I taped a one-hour all-talk show that was broadcast on XERF at about 5 a.m. Commercials were spliced in. I quit when I was asked to sell arthritis cures.

The point is, that station's selling power was enormous. They got more than 15,000 letters a week, each with a buck inside. Why, for practically nothing you could get an *autographed* picture of John the Baptist. I'm not commenting on the quality of programs or customers, but the mail draw was spectacular.

Bud Sunkel
President, WPBI-FM
Danville, Ill.

We'll add a PS for you, Bud: In recent weeks some of the border-station advertisers have been indicted for fraud.

● *Radiating Priest*

Being a bug for gadgets, I built your Wireless Mike (March '61 EI) for our parish priest at his request. I mounted the whole thing in a plastic toothbrush case, which he wears under his vestments. I hooked a tuner to the speaker system in the church, so now the whole congregation can hear everything.

Tony Pilon
Strathmore, Que.

[*Continued on page* 6]

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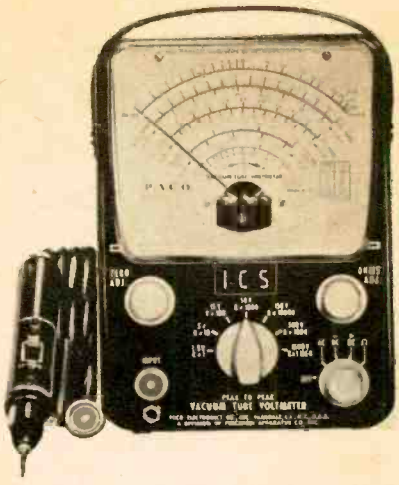

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FEEDBACK

Continued from page 4

● ***Oops!***

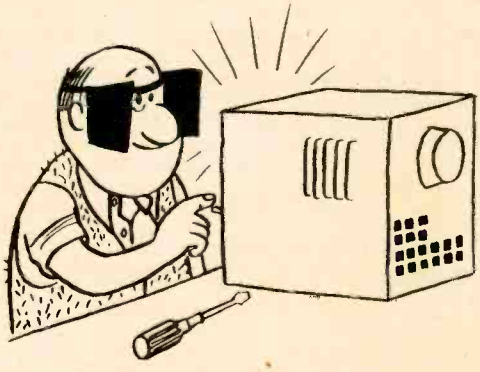
I represent Fisher Radio Corp., which owns the trademark Stereo Beacon as applied to radio and high fidelity reproducing systems. In your March issue there appears an article entitled STEREO FM BEACON and repeated in the article is the word Beacon.

. . . I am sure you will agree that an acknowledgment is required in your magazine that Stereo Beacon is the trademark property of Fisher.

Henry L. Burkitt
Lawyer
New York, N. Y

EI acknowledges.

● ***Scope Shade***



For some time I've tested and adjusted my hi-fi system with an oscilloscope but I've been bothered with ambient glare on the trace. I've finally found an ideal device to hold a light metal or cardboard shade on the bezel securely. It's a cable clamp with a screwdriver adjustment from 3 to over 6 inches. The clamp, stock No. 5688, is sold by The Ideal Corp., 435 Liberty Ave., Brooklyn 7, N. Y.

Milton Hollander
Brooklyn, N. Y.

Thanks for the tip, Milt. The clamp-and-shade should work fine. If it doesn't, the alert hobbyist can always try the blinders designed by our cartoonist.

[*Continued on page* 107]

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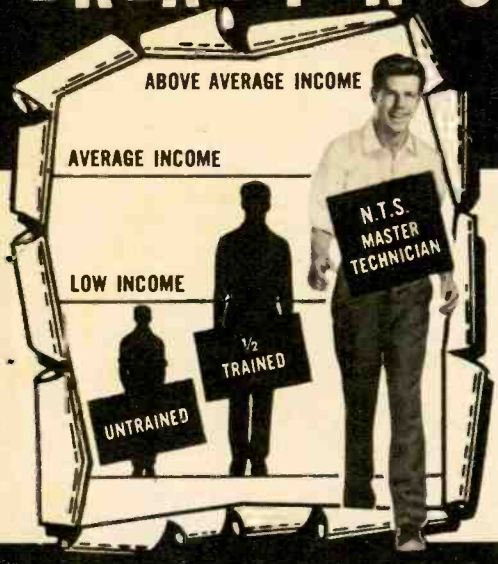

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. . . electronics in the news

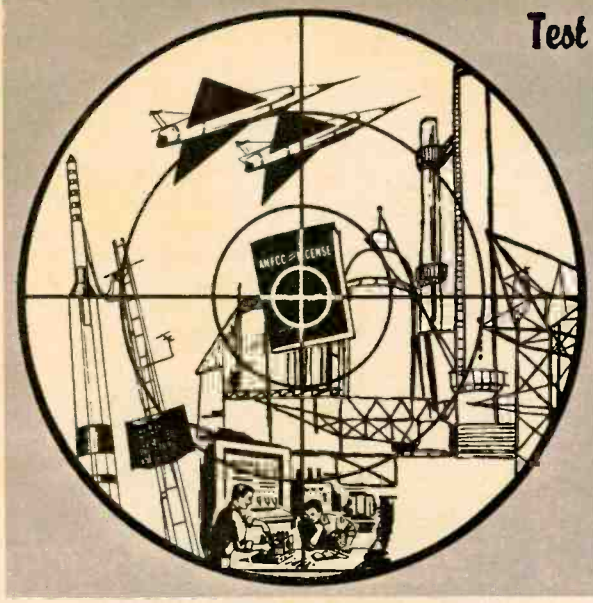
Personal Radar . . . The world's smallest combat radar set is what the Army Signal Corps at Ft. Monmouth, N. J., calls its lightweight enemy-finder. The flashlight-like rig was developed by 42-year-old engineer Harold Tate, who in the photo at left is showing off his brainchild for the big brass in Washington. The soldier in the other picture demonstrates how it may be used in the field. Weighing just 10 pounds, the set can be carried on the battlefield by one GI and is sufficiently sensitive to detect enemy movements a mile away. The production model will have the squarish parabolic reflector shown on the unit held by Mr. Tate. The round reflector was an earlier model. Two tiny dipoles are mounted on the end of the metal post. One is the active antenna element; the other is a parasitic element. The rig operates in the X band, is powered by 12-volt silver-zinc batteries carried in a belt pack. An audio signal is fed to the headphones and there also is a visual trace on a scope (faintly visible under the jack in the upper left corner of the set's back panel). The cathode ray tube has a 1″ x 3″ screen.

New World of Sound . . . An average person can hear sounds up to about 15,000 cycles per second, and some women and children go to 20,000 cps. But now all of us can eavesdrop on the unknown world of ultrasound around 40,000 cps with an Ultrasonic Translator made by the Delcon Corp. of Palo Alto, Calif. You can't listen directly, of course. The Translator reduces ultrasound to the audio range so your ear can pick it up. So sensitive is the gadget that a burning match sounds like a forest fire and a minute air leak becomes a hurricane. Operated by flashlight batteries, the Translator is designed to detect tiny leaks in pneumatic and hydraulic systems and to find worn bearings in delicate machinery—all of which generate high-frequency sounds but little that's audible. The Translator itself does not respond to sounds in the audio range. The instrument will aid industry, space work and science.

The Spring's the Thing . . . Bell Telephone Labs now has an electrical connector that will replace the age-old screw-type binding post. It is for use with plastic-insulated wire in telephone installations. The new one is a tightly wound coil spring made of square wire and mounted on the end of a small pole. To make a connection, you pull the end of a lead wire between two of the spring's coils. The sharp corners cut through the insulation and make contact at four points. To disconnect, just pull out the wire.

ARE YOU "ON TARGET?"

Test Yourself.....



ANSWER THESE QUESTIONS:

- DO YOU want to get into ELECTRONICS?
- Do you have a SPECIFIC OBJECTIVE in mind ... Are you shooting at a particular target (such as an FCC License)?
- Do you want the kind of training that will take you straight to this objective QUICKLY... without wasting valuable time on non-essentials?

The Grantham Communications Electronics Course prepares you for your first class commercial

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QUICKLY!

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☐ Grantham teaches the *theory* of electronics. Every basic concept of electronics fundamentals is covered in the Grantham course... whether you take it in resident classes or by home study. Grantham training *"makes electronics yours."*

☐ You can get your First Class FCC license IN ONLY 12 WEEKS in Grantham resident classes (or, in a correspondingly short time in the Grantham home-study program). THINK OF IT! A *commercial* U.S. Government license... PROOF OF YOUR qualifications in meeting these U.S. Government requirements as an electronics communications technician... a nationally recognized certificate. By preparing you for this license in only 12 WEEKS, Grantham conserves YOUR TIME!

☐ Mature men select Grantham Schools for electronics training. (The average age of Grantham Students is 28.8 years.) MATURE MEN want a definite objective (not a pot of gold at the end of the rainbow). Grantham training has this specific objective: To prepare you for your First Class FCC license and greater earning capability. The Grantham Course is for mature men *who know what they want.*

☐ Grantham Schools' tuition rates are low, yet the instructional service is not equalled by many of the *most expensive schools!* Grantham can do this because of highly efficient instructional methods and because Grantham has a sincere desire to out-do all others in service rendered per tuition-dollar. Grantham has established *reasonable* tuition rates. And, the percentage of students who successfully complete the Grantham course—and who get their FCC licenses—is one of the highest in the nation.

☐ YOU GAIN RESPECT by showing your Grantham diploma, once you earn it. YOU GAIN RESPECT by showing and posting your First Class FCC License—a nationally recognized certification of your electronics knowledge. Many companies which employ industrial electronics technicians require them to have this license. YOU CAN GET IT IN ONLY 12 WEEKS. Let Grantham show you how!

HERE'S PROOF: Here is a list of a few of our recent graduates, the class of license they got, and how long it took them:

	License	Weeks
James C. Bailey, 217 Behrends Ave., Juneau, Alaska	1st	12
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

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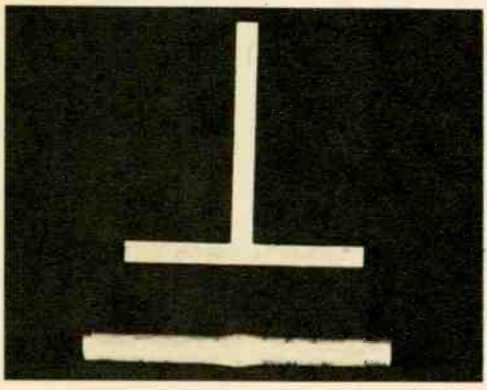
...electronics in the news

Digging Deeper . . . Not content to rest on his laurels, Dr. Leo Esaki, inventor of the tunnel diode, has unearthed a new electrical characteristic in bismuth, one of a group of substances known as semi-metals (arsenic and antimony are others). These materials, classed somewhere between semi-conductors and metals, are of special interest because electrons can move in them at speeds close to vacuum-tube velocity. Scientists have been seeking a formula to control this movement. Dr. Esaki may

have found it when he cooled a crystal of pure bismuth close to absolute zero (minus 459 degrees F) and subjected it to electrostatic and electromagnetic fields. He found that at a critical point the semi-metal disobeyed Ohm's Law. Its current-voltage curve became non-linear. This kink in performance may be useful in amplifiers, switches and other electronic applications. Dr. Esaki's work was done in the IBM laboratory at Yorktown, N. Y. (see photo). Stepped-up research on the theory is underway.

...electronics in the news

The Solution . . . Although hailed for its versatility, aluminum's aversion to bonding techniques and solder (without a flux) has restricted its electrical applications. The Aluminum Company of America has expended a load of money in search of a cure, which they now say they've found. It's a rapid, fluxless



bonding process designated R-260, which produces joints that are strong, ductile, corrosion resistant and possessed of good electrical conductivity. A patent application is holding up release of details of the process.

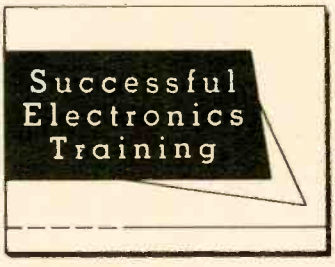
One immediate use of R-260 is for connections in aluminum-wound transformers. Our photo shows R-260 joints of square magnet wire (top) and two aluminum rods.

Sound via Ultrasound . . . If you've been keeping track of those experiments concerned with transmitting the sound of the human voice (or other information) via super-high-frequency radio waves, infrared, optical light, etc., you can now make another mark on your media scoreboard. The Ling-Temco-Vought people are using yet another medium—ultrasound—for getting data from here to there. LTV's transmitter is a 2-inch electrostatic speaker facing into a 30-inch dish reflector (see cut). The reflector concentrates the speaker's audio output into a narrow beam that, in effect, is amplitude-modulated. The beam's frequency is 30 kc. The human ear cuts out at 15 to 20 kc; a dog can

How To Get an FCC License (Commercial)

An FCC License Or Your Money Back!

Completion of the Master Course (both Sections) will prepare you for a First Class Commercial Radio Telephone License with a Radar Endorsement. Should you fail to pass the FCC examination for this license after successfully completing the Master Course, you will receive a full refund of all tuition payments. This guarantee is valid for the entire period of your enrollment agreement.



find out how . . .

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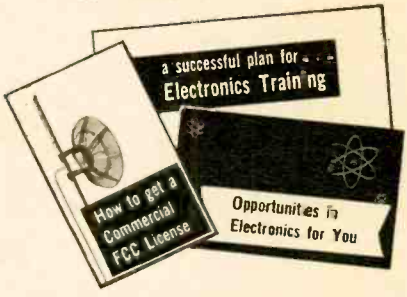

Sorry—Not For Beginners

Please inquire only if you really want to get ahead and to add to what you have already learned in school, in the service, or on the job. Some previous schooling or experience in electronics, electricity, or related fields is necessary for success in Cleveland Institute programs.

Cleveland Institute of Electronics

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Please send me Free Career Information Material prepared to help me get ahead in Electronics. I have had training or experience in Electronics as indicated below.

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- ☐ Radio-TV Servicing
- ☐ Manufacturing
- ☐ Amateur Radio
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- ☐ Home Experimenting
- ☐ Telephone Company
- ☐ Other .....

In what kind of work are you now engaged? .....

In what branch of Electronics are you interested? .....

Name ..... Age.....

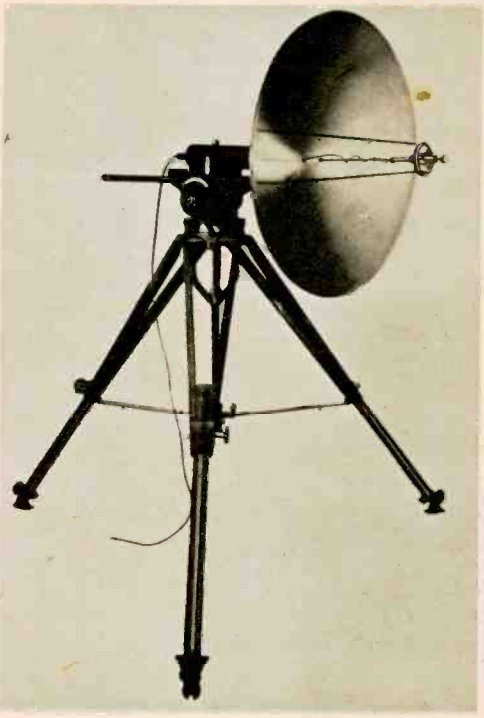
Address .....

City ..... Zone..... State .....

EI-40

...electronics in the news

hear up to 25 kc. The receiver looks just like the transmitter, except it has a sensitive microphone in place of the



speaker. LTV claims the mike can pick up anything from 2 cps to 250,000 cps, including the sound made by the aurora borealis and a bat's ultrasonic "radar" signals.

Un-tender Trap . . . The nuisance phone-caller may not get off so easy in the future. General Dynamics/Telecommunication of Rochester, N. Y., has patented an electronic trap that permits tracing and identification of the once-anonymous caller who dials your number, says nothing, and hangs up. Already being used in many Mid-Western cities, the arrangement is comprised of a simple circuit plate at the phone company's central office, minor changes in switching equipment and a button attached to the subscriber's set. When a nuisance call comes through, the subscriber pushes the button. This holds

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

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

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

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

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

THE KIT FOR EVERYONE

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

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

PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

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

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

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- **SET OF TOOLS**
- **SOLDERING IRON**
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- PRINTED CIRCUITRY

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

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

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

Choose From These Popular "Edu-Kit" Models

#10A: 10 Circuits $14.95

#15A: 15 Circuits $19.95

#16A: 16 Circuits (includes Printed Circuitry) $22.95

#20A: 20 Circuits (includes Printed Circuitry and 4 Advanced Circuits) $26.95

#25A: 25 Circuits (includes Printed Circuitry and 9 Advanced Circuits) $30.95

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MODEL desired _____ Price _____

- ☐ Send "Edu-Kit" postpaid. I enclose remittance in full.
- ☐ Send "Edu-Kit" C.O.D. I will pay postage.
- ☐ Send me FREE additional information describing "Edu-Kits."

Name _____

Address _____

_____

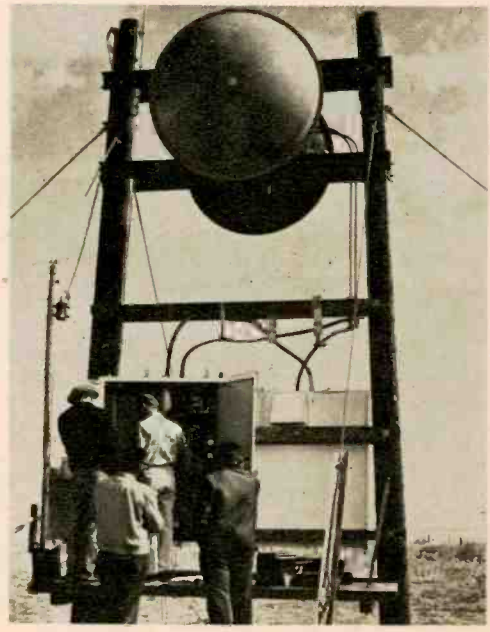
PROGRESSIVE "EDU-KITS" INC.

1186 Broadway, Dept. 542AE, Hewlett, N. Y.

. . . electronics in the news

the incoming call, preventing the caller from disconnecting, and at the same time sets off a signal at the telephone switching office. The phone company then can trace the call. The rest is left to police. The service is available only to subscribers constantly subjected to this type of calls.

Higher and Higher . . . Yesterday's "high-frequency" radio services are now becoming low frequencies. A routine press release from Bell Telephone Laboratories describes a new microwave system for telephone service (see cut) and casually mentions that it operates in the 11,000-*megacycle* range. This is way above the 4,000 or 6,000 mc bands which carry a major share of the



country's telephone and TV traffic—and which are approaching the limit of their capacity. At 11,000 mc, radio signals can be described as having quasi-optical qualities, but it might be more meaningful to drop the modifier and think of the radiation almost in terms of light waves. Radio-frequency signals have been generated experimentally to almost 100,000 mc. [*Continued on page* 115]

comparison invited

Browse Through This Free 1962 Heathkit Catalog

It's the world's largest electronic kit catalog . . . 100 pages describing, illustrating, and specifying over 250 different kits you need for more fun in your leisure hours or to make your job easier. There are Marine, Test and Lab instruments . . . Stereo/Hi-Fi . . . Amateur Radio equipment . . . Educational Kits . . . and many more such as garage door openers, radios and intercoms for your home. No matter what it is, you'll find it in the 1962 Heathkit Catalog . . . and we guarantee you can build it or your money back. Prove to yourself that Heathkit can save you up to 50%!

Kit GR-91 SWL Receiver, 550kc to 30mc 5 tubes; easy to build. $5 mo. **$39.95**

Kit IO-20 Ignition Analyzer, big 5" scope shows trouble spots. Easy to use. $9 mo. **$89.95**

Kit MI-11 Depth Sounder, indicates 200' on hard bottom, battery powered. $7 mo. **$69.95**

Kit GD-71 Telephone Amplifier, use your phone hands free! Transistor circuit. **$19.95**

Kit AA-100 Stereo Combination Amplifier, 25 watts per channel, 5 stereo inputs. $9 mo. **$84.95**

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ITEM	MODEL NO.	PRICE

☐ Yes, please send me, my free 1962 Heathkit catalog

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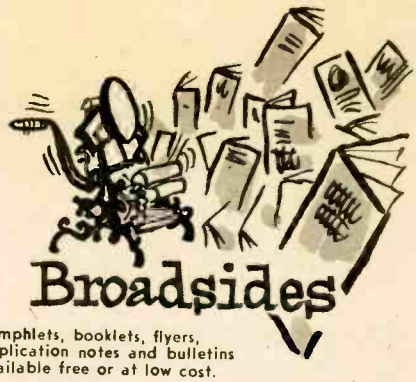

Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

Is There a Future Scientist or Engineer in Your Home? A new booklet bearing that name and put out by the Battelle Memorial Institute will help you find out. Directed to parents and youth leaders, it discusses preparatory courses, where to seek counsel and more. Single copies may be had upon written request from the Institute's Public Service Office, Columbus, Ohio.

Here's your chance for a painless—in fact, entertaining—way to bone up on math. **Problematic Recreations** is a 31-page booklet of not-too-easy riddles and puzzles that challenge the inquiring mind. Third in a series, the booklet is available free from Litton Industries, Beverly Hills, Calif.

Two hi-fi guides for do-it-yourselfers have been put out by H. H. Scott (111 Powdermill Rd., Maynard, Mass.) and Allied Radio (100 N. Western Ave., Chicago 80, Ill.). Scott's is a free kit-builders' brochure that features their tuners and amplifiers, with specs to help you choose your kit. Allied's booklet (10¢) deals with the interior decorating angle and tips on component placement.

Semitronics Corp. has issued a three-in-one catalog that includes their line of **semiconductors**, a replacement guide and application notes. You can get the booklet or its companion wall chart free from the company at 370 Broadway, New York, N. Y.

If you're in the market for **Ruggedized Yagi** antennas for TV or FM, write to Taco, Sherburne, N. Y., for their free catalog.

A revised and enlarged edition of the **Eletronics Data Handbook** contains all the tables and formulas needed by the experimenter. 35 cents. Allied Radio, Chicago 80, Ill.

How to test a stereo kit for top performance:

Simply look for this name.

You don't even have to open the box. If it's a Fisher StrataKit, you already have better proof of performance than if you had built any other manufacturer's kit and tested it in one of the world's most elaborately equipped audio laboratories.

How can Fisher make this claim? Very logically. Fisher has one of the world's most elaborately equipped audio laboratories. Fisher did build and test everyone else's kits before the StrataKit engineering program was finalized. The task then set for Fisher engineers was to outclass in every way what they had found in other designs. Which they did. They drew on all the knowledge accumulated in the course of 24 years in high fidelity and the results are in the box. StrataKits are easier to build than others, the StrataKit instruction manuals are clearer than others, the completed StrataKits have more advanced features and perform better than others. And we have yet to hear of someone who could not complete his StrataKit successfully and with the greatest of ease.

The Fisher StrataKits now at your dealer are the KX-200 80-watt stereo control-amplifier and the KM-60 FM Stereo Multiplex wide-band tuner. Both sell for $169.50. Both are the world's finest in their class. The proof is simply in their name.

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Please send me without charge the complete Fisher StrataKit catalogue.

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City_____ Zone____ State_____

EI711

Electronic Marketplace

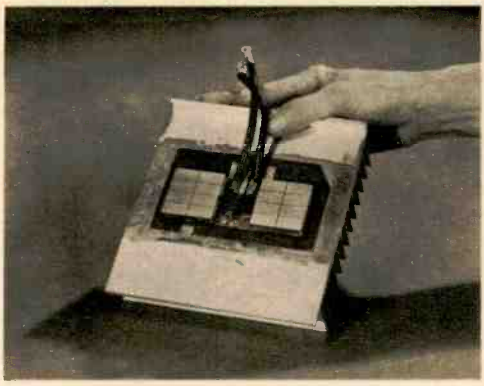
Hot . . . A line of commercial thermoelectric generators that convert heat directly into electricity has been announced by the Minnesota Mining & Mfg. Co. Fueled by LP or natural gas, the generators have no moving parts. They are expected to be useful for operating offshore lights, unmanned weather stations and other remote and

emergency systems, either as a direct power source or (more likely) to trickle-charge a small nickel-cadmium storage battery. Our photo shows one of the units (right) used in a forest lookout tower to power a two-way radio. Available in four output sizes from 2 to 15 watts, the generators cost about $30 a watt.

Cold . . . At the other end of the thermometer (see above) and with opposite electrical action is the first commercial thermoelectric ice-cube maker, offered by the York Division of Borg-Warner, York, Pa. Gone are the compressor, evaporator and noisy motor of the conventional freezer or refrigerator. In their place are simple, no-moving-parts thermocouples which create low tem-

peratures (by removing heat) when electricity is passed through them. The machine can produce 30 pounds of cubes a day—or a tray of 14 cubes every 38 minutes.

Direct refrigeration by electricity has



been a laboratory plaything ever since the effect was observed in 1834 by French scientist Jean Peltier. However, the concept did not become practical until a new family of semiconductors grew out of the same research that produced the transistor. The favorable thermoelectric properties of some exotic semiconductors turned out to be a happy and unexpected bonus. The ice-maker is intended for commercial use, and its price probably will range in the high three-figure bracket. Our photo shows two square cooling plates that are mounted on top of thermocouples. Printed circuitry is used. Note heat sink fins on the underside of the plates.

Small Economy Size . . . A smallish two-band transistor radio and a smaller stereo phonograph have been joined to form the Mini Sterephone—a cigar-box entertainment center. Four flash-light cells spin 33⅓ or 45 rpm records while the midget lies down. The unit has a 3-inch speaker and jacks for ear-phones or a second speaker.

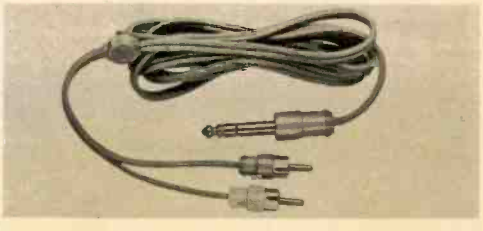
In an upright position (right in photo), the Sterephone (that's the way they spell it) becomes an AM receiver covering the broadcast band and short wave

Marketplace

from 3.9 to 12 mc. There's both a built-in ferrite antenna or a collapsible rod. An additional feature is a socket for a

117-VAC adaptor. About $80. Hoffman Electronics, Los Angeles 7, Calif.

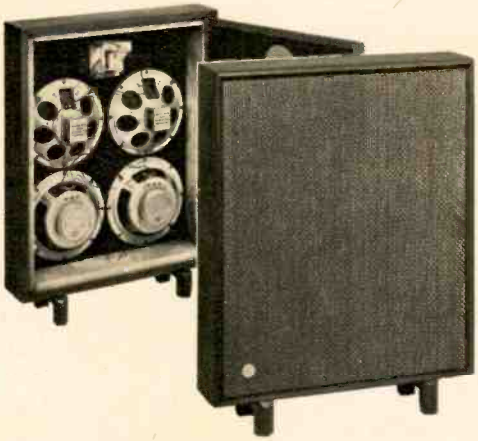
Stereo Lash-Up . . . Now there's an easier way to inter-connect a stereo mixer to any three-conductor dual input recorder—stereo or mono. It's with a molded cable assembly (see photo) that



has a 3-conductor phone plug on one end and two color-coded phono plugs on the other. The leads are shielded and have a clamp which prevents them from pulling apart. The price is $4. Switchcraft, Inc., 5555 N. Elston Ave., Chicago 30, Ill.

Marketplace

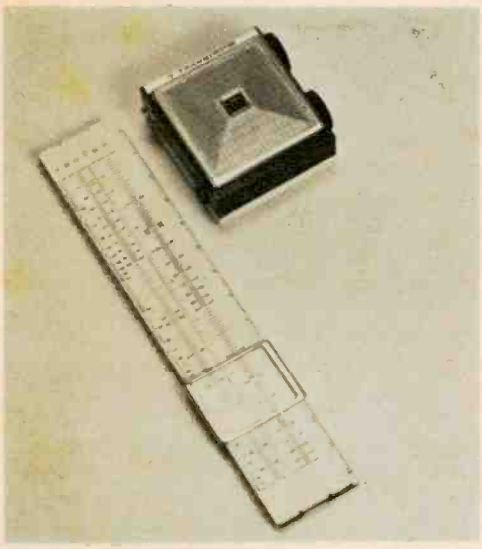
The Quints . . . Five speakers do the work in the slim Sound Panel by Olson. Five inches deep, the system contains two 8-inch free-cone speakers, two 8-inch mid-ranges and a 3½-inch tweeter. The unit can be used as part of a room divider (two would make a stereo divider, we suppose). The finish is walnut. About $50. Olson Electronics, Akron 8, Ohio.



Signal Source . . . The Conar 280 is a kit that makes receiver checking and alignment routine jobs. It's a signal generator that furnishes modulated or unmodulated RF from 170 kc through 60 mc on six bands, and a 400-cycle signal for audio testing. Big, easy-to-read dials cover the front panel. Kit price is $22; wired price, $30. Conar Div., National Radio Institute, 3939 Wisconsin Ave., Washington 16, D. C.

Marketplace

A Radio for Alice . . . Like Alice, transistor radios are very nearly shrinking out of sight. The line about their being as small as a pack of cigarettes needs modification. The Micronic Ruby, a new Japanese job, is more the size of a lighter. Although it contains seven transistors, a loudspeaker and two batteries, the set is less than 2 inches long, about 1¾ inches wide and a shade under an inch thick. It weighs three ounces. The manufacturer is Standard Radio Corp. of Tokyo. It's not yet on the market in this country.



More XTL's . . . Interference on the Citizens Band getting you down? If your transceiver is a one- or two-channel rig, you can add the Regency CS-6 Crystal Switcher. The outboard unit contains six pushbutton-selected crystals to give you crystal control on that many channels. The switcher attaches to the bottom of mobile transceivers or to the top of fixed-station equipment. No changes are required in transceiver circuitry; it's just a plug-in operation. The unit also is adaptable to ham transmitters. The unit has a plastic tape above the selector buttons for marking channel numbers in crayon. The tape can be wiped clean when changing crystals. Less crystals, the price is about $20. Regency Electronics, Inc., 7900 Pendleton Pike, Indianapolis 26, Ind.

Unfair to Fish . . . but great for small-boat owners. The Aqua-Probe is a transistorized depth- and fish-finder that's priced just under $100. The heart of the unit is a bronze-encased transducer and an air-cushioned crystal enclosed in a rubberized coating. Extensive filtering and shielding eliminates much interference from the boat's engine. Our photo shows the hooded indicator head, which is easy to read even in bright sunlight. Columbia Hydrosonics Corp., Freeport, N. Y.

Pocketful of Pep . . . A 1½-watt (1,500 milliwatt) handi-talkie has appeared on the CB scene, bearing the name Ross 400. Fifteen times more powerful than the usual 100-mw CB and license-free handi-talkie, the Ross 400 offers reliable communication up to about 5 miles. The set uses 15 transistors and one diode, and can be powered by either rechargeable nickel-cadmium batteries or penlight cells. A regular CB license is re-

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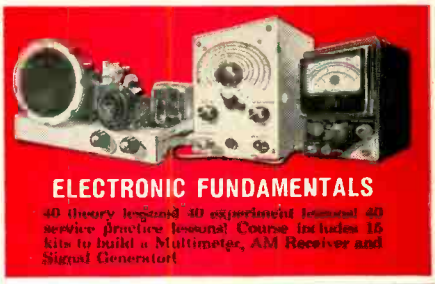

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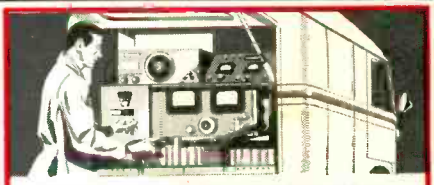

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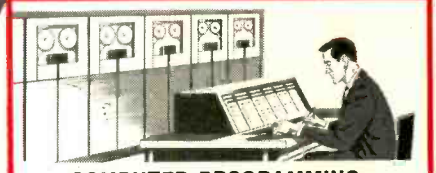

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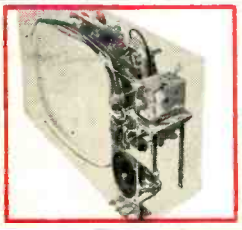

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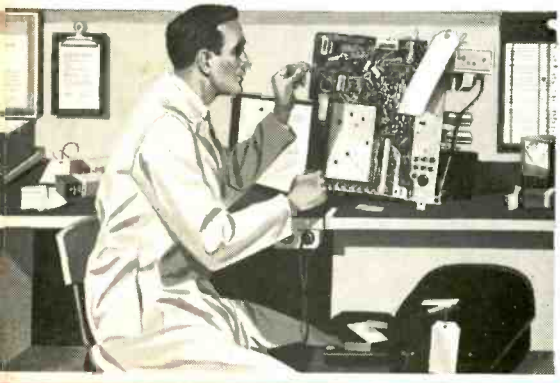

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B	Television and General Electronics (V-7)	2 yrs. High School, with Algebra, Physics or Science	Day 1½ yrs. Eve. 4½ yrs. (N.Y.) 3 yrs. (L.A.)
C	Radio and Television Servicing (V-3)	2 yrs. High School, with Algebra, Physics or Science	Day 9 mos. Eve. 2¼ yrs. (N.Y.) 1½ yrs. (L.A.)
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E	Electronic Drafting (V-11 V-12)	2 yrs. High School, with Algebra, Physics or Science	Eve. Basic: 1 yr Advanced: 2 yrs.
F	Color Television	Television background	Eve. 3 mos.
G	Radio Telegraph Operating (V-5)	2 yrs. High School, with Algebra, Physics or Science	Day 9 mos. Eve. 2¼ yrs. (N.Y.) 1½ yrs. (L.A.)
H	Computer Programming (C-1)	College Graduate or Industry sponsored	Eve. 24 weeks Sat. 30 weeks
I	Technical Writing (V-10)	High School Graduate	Day 9 mos. (L.A.) Eve. 2¼ yrs. (L.A.) 3 mos. (N.Y.)
J	Automation Electronics (V-14)	Background in Radio Receivers and Transistors	Eve. 9 mos. (N.Y.) Sat. 44 weeks (N.Y.)
K	Digital Computers	Electronics background	Eve. 3 mos. (L.A.)
L	Preparatory Math & Physics (P-0)	1 yr. High School	Day 3 mos. or 6 mos.
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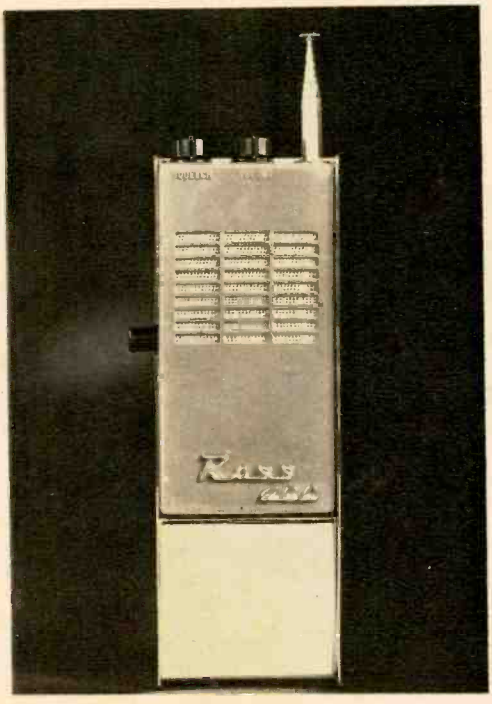
quired. The price (less batteries) is



about $165. Ross Labs, 124 Lakeside Ave., Seattle 22, Wash.

The Combo . . . If you put a Japanese girl, a radio and a camera together, what do you have? A Japanese girl and a Ramera, that's what. And it's just what our photo shows. The Japanese-made

Ramera has a six-transistor radio with 2¼-inch speaker at one end and a 16mm still camera at the other. Now you can charm your subjects with music while you shoot them. $49.95. Silver Bells Limited, Box 982, Carmel, Calif.

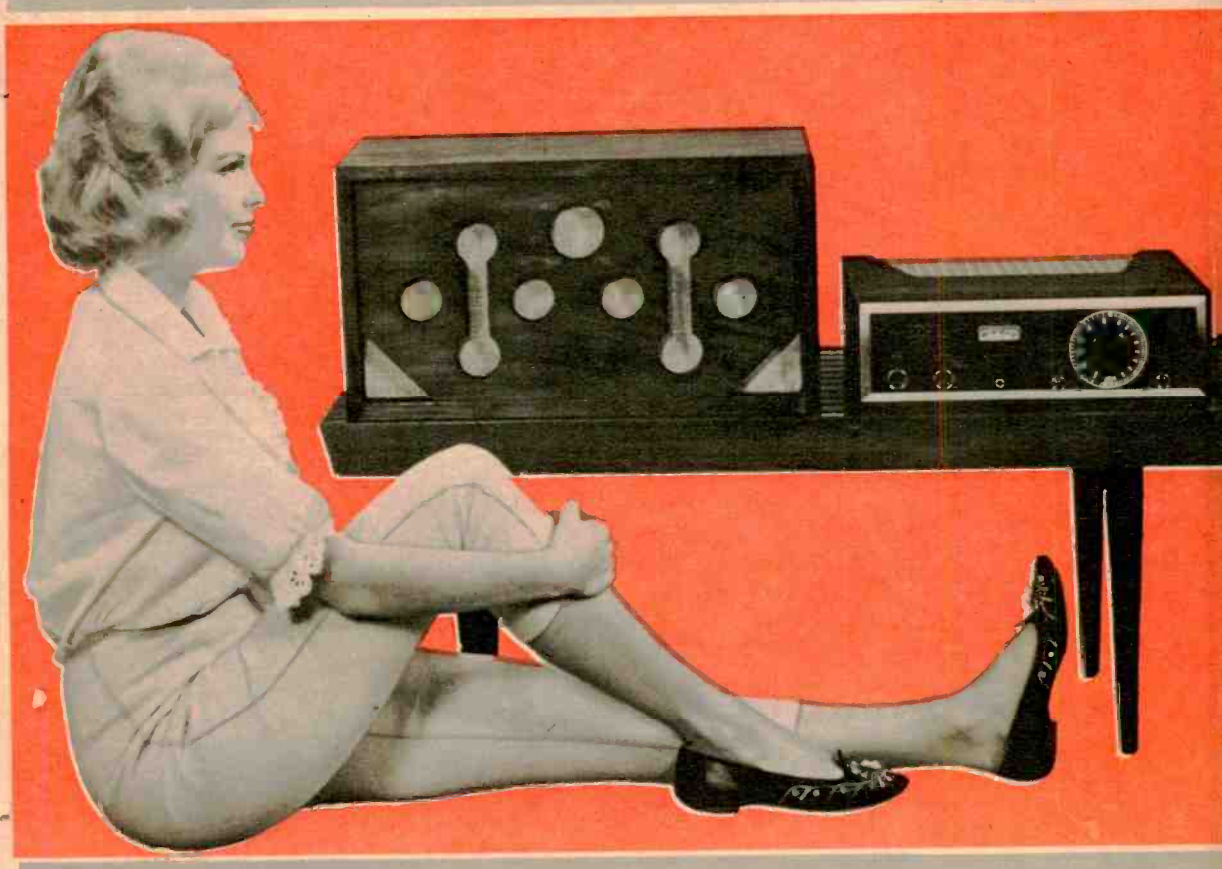
[*Continued on page* 103]

ELECTRONICS ILLUSTRATED
JULY 1962

THE DUOFLEX

Complete plans for a bookshelf hi-fi speaker system that you can build for under $15.

By Larry Klein, Technical Editor



THE sound quality of the Duoflex speaker system belies its simple construction and modest cost. A striking cabinet design enables the speaker to fit harmoniously into the decor of any living room or den—either as a solo unit or a stereo pair. And its small size means the Duoflex can sit conveniently on a bookshelf, which is not the case with many units bearing the bookshelf label.

Though the acoustic design of the Duoflex is complex, only the components, some basic woodworking tools and a few hours of your spare time are required to duplicate the superb results achieved by our prototype. Any extended-range 8-inch speakers with a free-air resonance around 65 cps will produce good results in the system; however, the specific speakers installed in the prototype (see Parts List), gave excellent results at a cost of

A rotary saw hole-cutter—or similar tool—is used to make the front panel cutout sections.

only $9 a pair. This leaves you some $6 for lumber and miscellaneous items in order to bring in the basic system for $15.

If you want to add an extra shimmer to the highs, you can install a tweeter. They are available as cheaply as $2. We chose an excellent miniature unit that sells for $3.60 (see Parts List). The crossover network—capacitor and hand-wound coil—will run you less than $1. Warning: don't use a standard crossover as it will not match the speaker impedances.

For a full discussion of the system's acoustic design, see the Tech Editor's Test Bench in this issue.

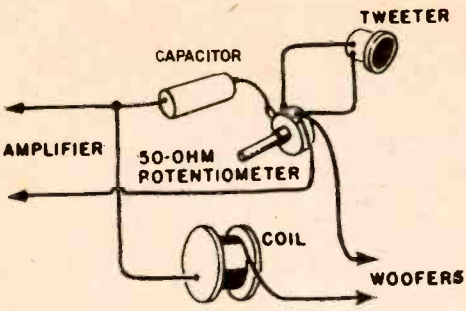
Constructing the cabinet is a simple job. The exploded view of the cabinet is self-explanatory. Only a few notes are required. You can use ¾" plywood or Novoply and finish as desired but the dimensions must not be varied from those shown. All joints should be secured with *both* glue and screws to make them as rigid and airtight as possible (the back panel is an exception, being held in place with wood screws only). If you go in for fancy woodworking, you can make miter rather than butt joints. The bottom of the baffle board and back panel are secured with screws brought up through the bottom panel.

Before installing the speakers, rub your finger vigorously around the speaker cones' corrugated rim.

The speakers, before installation, require a simple treatment to lower their resonance. As sold, they have a free-air resonance of about 75 cps. You can bring this down substantially by running your finger around the outer edge suspension of the cone (see photo). Use moderate pressure, but avoid tearing the cone. Two minutes of rubbing will reduce the resonance to around 65 cps, which provides an improved bass response.

The grille cloth may be any acoustically transparent material mounted with tacks or staples. After the grille cloth is in place, use ½" or ¾" wood screws to mount the speakers, taking care to center them over the baffle cutouts.

The tweeter may not be required by your ear since the 8-inch speakers specified have a fairly extended treble response and produce a nicely balanced sound in the Duoflex cabinet. If you don't add a tweeter, you naturally omit



Full L-C crossover with tweeter control is wired as above. The woofers are connected in parallel.

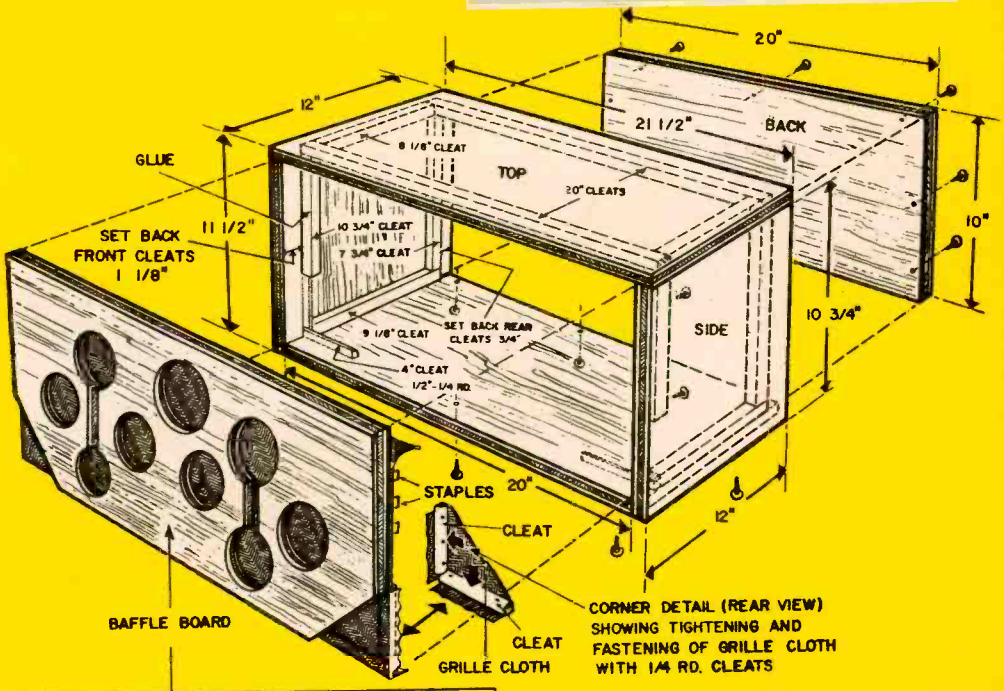
PARTS LIST

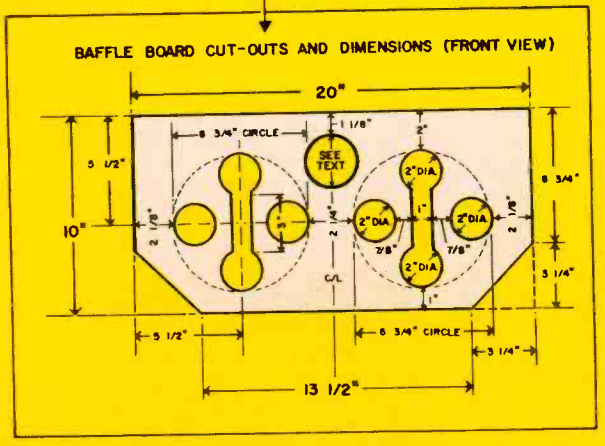
Lumber—Approx. 10 square feet of ¾" plywood or Novoply. Finish as desired

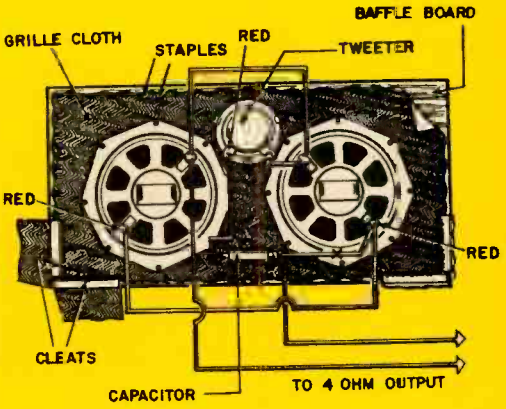
Speakers—Two 8" Norelco speakers (AD-3800) available from Olson Electronics, Stock #S-278 (2 for $9)

Optional—2" tweeter (Olson, S-345; $3.60); 4 mf non-polarized capacitor (Olson, C-958; 39¢); Coil, if used, ¼ lb. spool of #18 enameled solid copper wire

The wiring diagram below shows the speakers and a tweeter wired with a capacitor only. If a coil is added, insert it at the point marked X between the capacitor and the right-hand speaker. The size of the tweeter cutout depends upon the tweeter that is selected. The suggested tweeter (see above) takes a 1¾" diameter hole. If a tweeter is not used, do not cut the tweeter mounting hole shown in the front panel cutout plans.







The author's prototype had front panel removable. Here the cabinet is being lined with a layer of glass wool.

the tweeter opening in the front panel. However, if you do like extended highs almost any type and impedance tweeter may be used. Horn types and 4-ohm tweeters may require an attenuator, such as the 50-ohm pot shown in the diagram. If the control action is too abrupt, try a 25-ohm pot instead. The recommended tweeter does not need a potentiometer.

A sealed-back tweeter may be mounted inside the cabinet, using the manufacturer's recommended opening, but a tweeter with the rear of the cone exposed should go on top of, or alongside the speaker cabinet to avoid interaction with the 8-inchers.

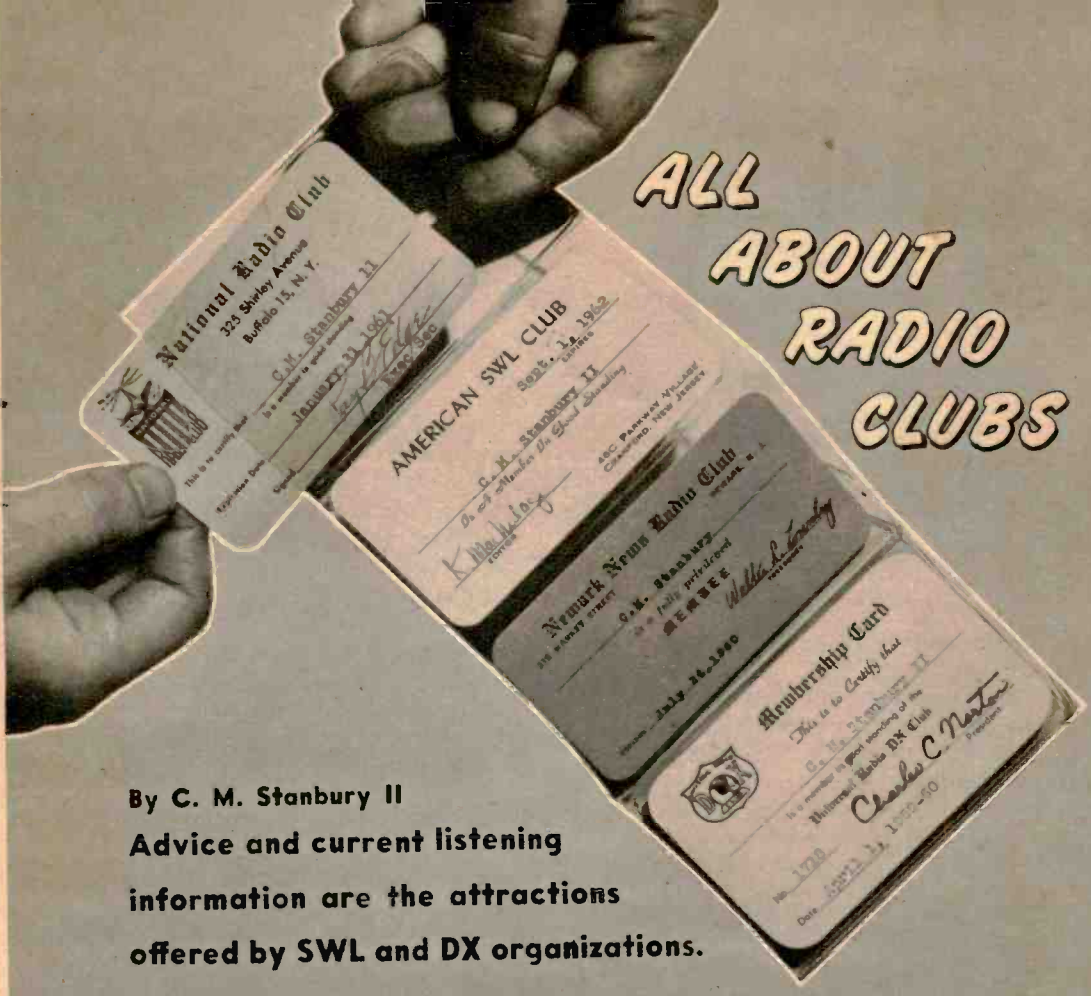
The crossover should be about 5 kc, even though the tweeter manufacturer may recommend a lower figure. A single non-polarized paper or oil capacitor hooked up as shown in the cabinet diagram provides a high-pass filter. This means that only highs are allowed to pass through to the tweeter, while the 8-inch speakers get both the highs and lows. A 4-ohm tweeter requires an 8 or 10 mf capacitor, an 8-ohm tweeter a 4 mf capacitor. A 16-ohm tweeter uses a 2 mf capacitor.

A full inductance-capacitance crossover provides improved performance in the mid-frequencies. The L-C crossover not only keeps the lows out of the tweeter but in addition prevents the highs from reaching the 8-inchers. The capacitor values for the L-C crossover are the same as given above and depend on tweeter impedance.

The .13 millihenry coil which is connected in series with the woofers is made by tightly winding about 100 turns of #18 enameled wire on a 1½″ length of 1″ wooden dowel. The end pieces of the coil form are made of 2″ discs of Masonite or any other flat nonmetallic material. You can cut out the discs with the same hole cutter used for the cabinet's baffle openings. Do not screw or nail on the disc end pieces; use glue.

After the speakers are wired, it's a good idea to check their phasing. Do this by connecting a flashlight battery across the speaker leads. Both cones should move either in or out at the moment of contact. If the cones move in opposite directions, switch the leads going to one of the speakers.

The coil may be held in place by looping a length of tape around its middle and stapling the tape to the cabinet wall. After the speakers are mounted, line the inside of the enclosure and the back panel with a 1-inch layer of glass wool (fiberglass). Ordinary lamp cord is fed through a ¼″ hole drilled in the back panel for connection to the 4-ohm taps on your amplifier.



ALL ABOUT RADIO CLUBS

By C. M. Stanbury II

Advice and current listening information are the attractions offered by SWL and DX organizations.

A FAMILIAR landmark for many years in the short-wave listening and DX picture has been the radio club. Ever since the 1920's we have had at least a few, and sometimes more than a few, organizations made up of members with the common interest of radio listening. They've played an important role in the development of the hobby to which they're dedicated, and the future looks promising to them.

The single factor that makes radio clubs truly useful and holds them together for long periods is the mimeographed bulletin which carries the latest listening information—new stations to be DXed, frequencies, time schedules. Though a common interest in radio in general, and listening in particular, might pull a group of enthusiasts together (as it did in the early days of broadcast radio), the club thus formed has to make some useful contribution to its members to remain long in existence. That useful contribution is what comes out of the mimeograph machine, a piece of equipment that could be called the cornerstone of radio clubs.

Oftentimes, an experienced and active DXer discovers his own listening information is a step ahead of what he gets from his clubs, but the general listener and the novice find the bulletins (along with articles in such publications as EI) of great value. And most listeners fall in the latter categories.

In a way, radio clubs are unique. Their members may be scattered all over the country or the world, and few of them ever see each other. The fraternal bond is cemented together by postage stamps.

Which club should you join, and what happens when you do become a member? To make your decision, you should first determine your own interests. Do you like to specialize in certain bands, or are you an all-band man? Some clubs

Typical dedicated club editor is multi-lingual Bob Newhart of the American SW Listeners Club.

specialize in one or more bands (the broadcast band, for instance), while others attempt to cover the whole listening range. The chart we present with this article indicates which clubs specialize in what bands, if any. Choose the one with interests matching your own.

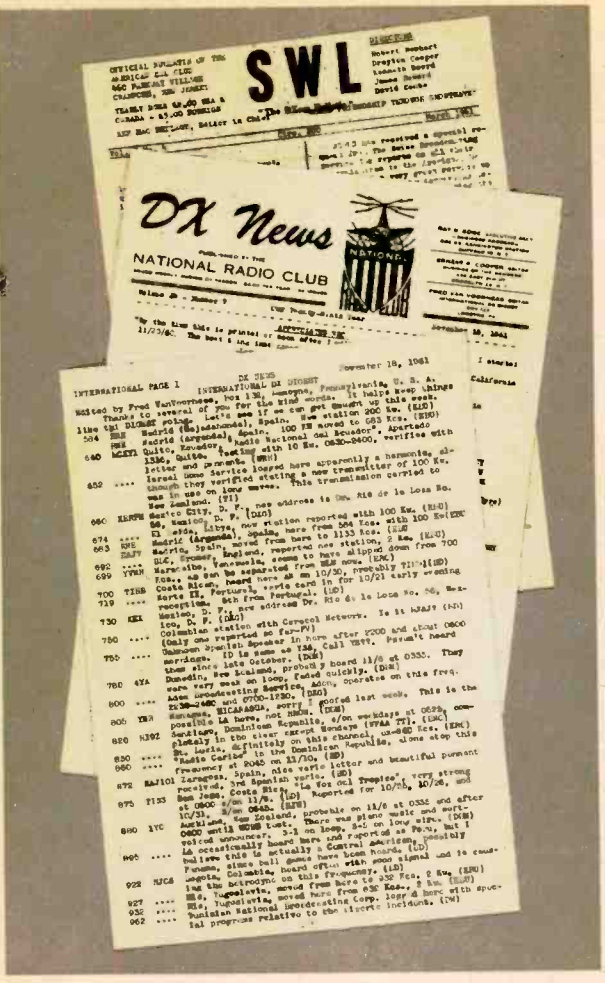
A sample copy of a club's bulletin traditionally serves as kind of a prospectus for the group. Any of the clubs will send you a sample for a small fee—15 to 25 cents.

After you send in your dues you are likely to receive a membership card, some fact sheets about the club, possibly some general how-to-DX hints, an offer to sell you stationery engraved with the club's letterhead for your own correspondence, and the current issue of the club's bulletin, which you will continue to get every month. (The exception here is the National Radio Club, which publishes its DX News on a weekly schedule in fall and winter.) Besides the previously mentioned station, frequency and time information, the bulletin probably will carry some better-than-average loggings by other members and some views on the state of the world of radio, usually expressed by the bulletin's editor.

From time to time you may be asked to take part in club elections (by mail) and some clubs have annual conventions to which you will be invited. Only a fraction of the membership normally attends these get-togethers because of geographic distances.

If the club and your hobby are important to you, of course, you'll want to take a more active part in its affairs. There is one important way to do this: submit reports on your listening activities and DX catches. The editor of your club bulletins will be overjoyed to receive your dispatches because this is how he gets *his* news, other than from

Some clubs offer their members stationery with engraved letterhead for personal use.



Club success usually hinges on rapid dispatch of mimeographed sheets carrying listening news.

his own listening activities. The fact that far-off Radio Umlang is now being received in your area makes a nice item for the club bulletin.

For the average member, the operations of a radio club may seem relatively simple. But from the standpoint of those who are trying to keep a club together and operating, life is not so serene. As a veteran listener and after having served as an editor for four clubs, I've seen both sides of the picture.

The key man in any radio club is a gent who may have any one of several titles—Editor, Publisher, President or perhaps Executive Secretary. His job is to put together and send out the club's key product—its bulletin. While quality and quantity of the news is important, the speed with which it is put in the hands of members is what will make or break the club, and perhaps the Publisher's back. The factors he has to wrestle with include how fast his members send in their individual reports, how close or far away his sub-editors are and how fast *they* send in their material, time consumed in typing and running off stencils and, finally, the proper assembly of bulletins, folding and stuffing them in envelopes and mailing them. All these tasks have to be worried with and performed in this individual's spare time. It's no wonder that a mere description of the job sends many interested applicants scurrying for cover, and that a few months of doing the work eliminates most others.

This leaves only a few individuals who have the time and the required devotion to the hobby to carry out the job. As a result, most clubs follow a general pattern. One is formed. If the Editor-Publisher is efficient and really interested, it survives.

Some clubs have a constitution and a board of directors who work with (and sometimes against) the Publisher. Con-

[*Continued on page* 108]

RADIO CLUBS OF NORTH AMERICA

Club	*Bands Covered*	*Annual Dues*	*Sample Bulletin*
American Short Wave Listeners Club 46C Parkway Village Cranford, N. J.	SW, BCB, FM, TV, hams	$2	.15
Canadian DX Club 24 Briscoe St., West London, Ont.	all	$3.50	.15
Midwest DX-SW Radio Club 2100 W. William St. Decatur, Ill.	SW	$2.50	—
National Radio Club Box 63 Kensington Station Buffalo 15, N. Y.	BCB	$4	.25
Newark News Radio Club 215 Market St. Newark, N. J.	all	$5	.25
Universal Radio DX Club 109 Mesa Vallejo, Calif.	currently inactive		

how HEART PACERS work

By S. David Pursglove

THE MAGIC WAND of modern medical electronics is, by any accounting, the heart pacer. This device, simulating the action of a natural bundle of fibers that makes the heart beat, has given new hope and additional years of life to hundreds of heart patients. Men and women, and children, too, with defective hearts have been relieved of the ever-present fear that the next minute might be their last.

Yet when you examine a heart pacer in detail you realize not only that it contains no magic; there isn't even anything new in its circuitry. There are two general types of pacers. One operates outside the chest cavity, the other inside.

Our lead photo shows an external pacer made by Westinghouse. It consists of a small metal box with carrying case and two output leads that terminate in disc electrodes positioned on a patient's chest. Alternatively, the leads can be tough Teflon-coated wires which are passed through the patient's chest wall and attached directly to the heart.

The second type of pacer is a miniature unit which is placed permanently inside the chest cavity with its leads sewn to the heart.

That bundle of fibers we spoke of is the heart's natural pacemaker. Located in the upper right portion of the heart, it triggers your heartbeat by sending forth a series of electrical signals. The electrical properties of the body have been known a long while. As a biology student, you may have made a frog's leg twitch by shocking it. It is when the natural pacemaker can't get its signal

through or falters that the electronic pacemaker comes to the rescue.

The basic pacer circuit (see schematic) is less complicated than a one-tube radio. A typical unit employs a transistorized blocking oscillator powered by a 10-volt battery and having a maximum output of 27 volts at 270 milliamps. The pulses produced by the circuit can be varied in width from 2 to 6 milliseconds and pulse rate is adjustable from 25 beats a minute through the adult norm of 55-70 up to 250 bpm used in animal experiments. Potentiometer R2 is the variable element in the circuit, although beat rate is determined also by the fixed values of resistor R1, capacitor C1 and the inductance of transformer T1's secondary. Potentiometer R3 varies the voltage applied in relation to the resistance of the patient's chest and heart. Diode D1 clips the top off voltage peaks and prevents dangerous surges. T1 produces the "high" voltage but not in usual transformer fashion. Each pulse of current creates a magnetic field around T1's primary. When the field collapses self-induction creates a pulse of "high" voltage.

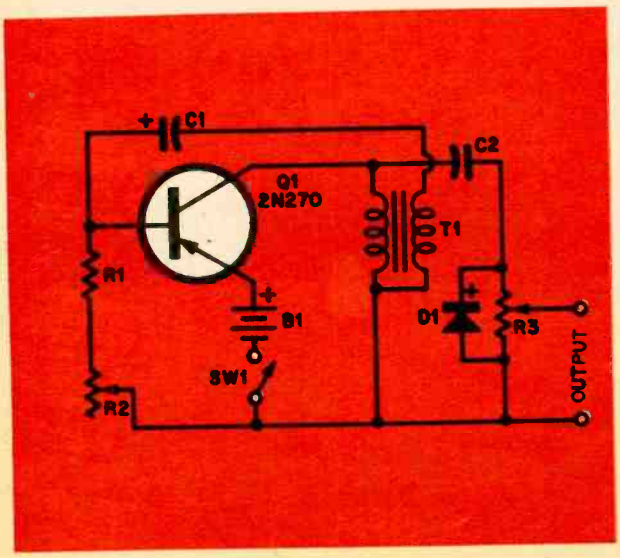
When the heart falters during open-chest surgery, steel needles attached to the ends of the output leads can be inserted directly into the organ to pace its beating. The external disc electrodes, coated with conductive paste, are used most often in the treatment of heart block (Stokes-Adams syndrome). The external application means that victims of occasional but severe cardiac arrest can have the benefit of an electronic pacer without surgery. The heartblock victim usually receives enough warning to cry for help or even to place the electrodes on his own chest before blacking out.

Because of the increased resistance between the output leads in external applications, higher voltages (up to 250 v.) and different circuit components are used.

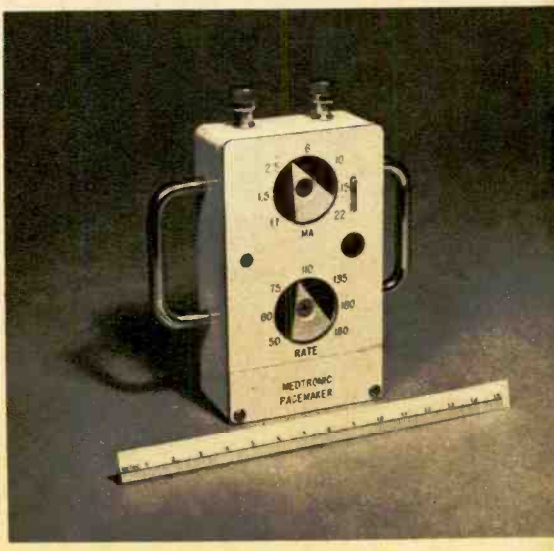
A companion unit to some pacers is an electronic monitor which automatically activates the pacer to start a stopped heart or speed up a slowed one and sounds a high-pitched alarm or flashes a light on a hospital monitoring panel. Some models transmit a radio signal to the patient's physician.

If you contemplate the construction of an experimental pacer . . . *don't*. In unskilled hands, pacers are deadly because they can arrest a healthy heart. But in skilled hands they can work miracles.

Pacer circuit employing transistorized blocking oscillator with controls for pulse and voltage.



External Medtronic Pacemaker weighs 2 lbs. and measures 3x5x2½ inches; that's a metric ruler.



MARINE LIGHTNING ARRESTER

for CB or radiotelephone.

By Elbert Robberson, W2FRQ

TO A PERSON in a boat with his radiotelephone or CB antenna the highest point for miles around, lightning becomes more than a natural phenomenon; it turns into a hair-raising threat. Boat antennas have been hit, and will be hit again. Fortunately, the danger can be minimized by a lightning arrester.

At present there are no commercially available lightning arresters for marine radiotelephone antennas. The kinds used for broadcast and TV receivers on shore are unsuitable because of the likelihood of their breaking down from transmitter output voltage and corrosion. However, there is no need for boatmen to cower in the bilge when a squall hits, for a radiotelephone lightning arrester is easy to build.

As shown in the illustra-

tions, the spark gap has sufficient separation so it will not break down and conduct during voltage peaks from the transmitter. The inductor, L1, is small enough that it will not seriously detune the transmitter antenna-tuning circuit. The choke is made of eight turns of No. 14 solid copper wire wound on a 1″ form. The turns are spaced evenly for a winding length of 1 inch. After winding, the form is removed and the coil supports itself.

If lightning strikes the antenna, L1 holds the surge away from the equipment and the lightning arcs over the gap to ground. After the lightning strike, the gap returns to its normal non-conducting state.

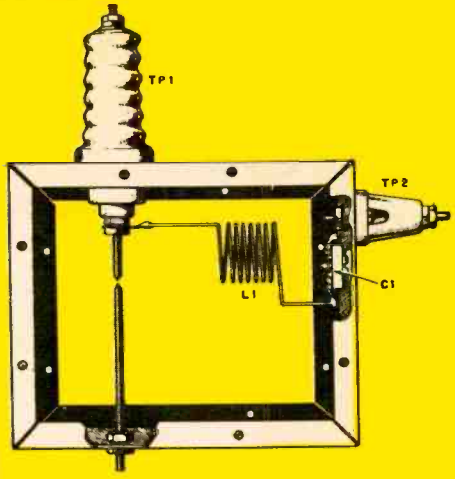
The arrester is housed in a metal box. Porcelain feed-through insulators (TP1, TP2) serve as the antenna and radiotelephone connections and support the choke coil. A length of ¼″ threaded rod through the bottom of the cabinet provides the ground path. The upper end of this stud and the lower end of the antenna lead-in insulator rod form an adjustable spark gap. The gap ends of these rods are filed to a point.

On Citizens Band frequencies, from 26.965 to 27.255 mc, the inductance of choke L1 throws the antenna circuit out of resonance. However, a 50 mmf trimmer capacitor (C1) in series with L1 allows the antenna to be retuned to frequency. C1 can be mounted in the lightning arrester enclosure and should be insulated from the case. Use an insulated screwdriver to tune C1 for maximum RF output.

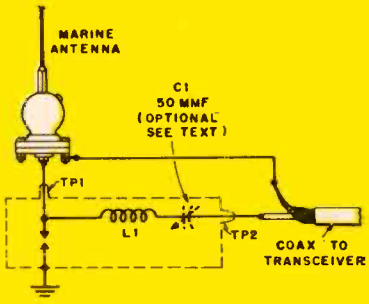
The cover can be sealed to the box by swabbing the joint with liquid gasket compound, such as Permatex. Acrylic spray can be used on the box to retard corrosion.

The best location for the lightning arrester is at the base of the antenna, either inside or outside the boat. The ground cable from the arrester's cabinet should be heavy tinned-copper braid or strap or copper cable (No. 8 or larger) run as directly as possible to the boat's ground-plate terminal or engine block. Sharp bends in the

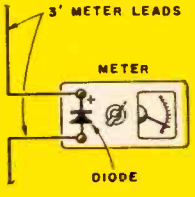
[*Continued on page* 104]



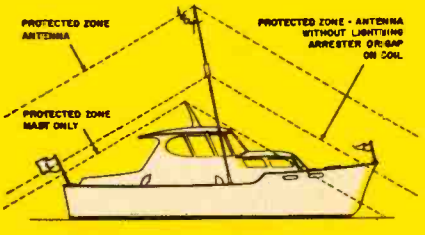
Simple construction of arrester is shown. If trimmer C1 is used, hole is drilled opposite it to permit tuning to the antenna.



Note that the only grounded element in the arrester assembly is the bottom gap stud. Any type of high-voltage standoff will serve.



Diode across meter set to 1 ma or lower current range indicates antenna tuning.



Antenna serves as safeguard, not a hazard if it is fitted with a lightning arrester.

the beacon that TALKS

FOR more than two years the Coast Guard has been testing a new marine navigation system that promises to make the pleasure boat owner's life both safer and easier.

Normally when you're out of sight of land in a small craft, you depend on lights, a radio direction-finder or marine radio beacons (and your compass) to steer you back to shore. But there are drawbacks here. Distance or heavy weather obscure lights; RDF's, giving bearings on any radio station, do not have pinpoint accuracy, and the dots and dashes of marine beacons are meaningless to the average Sunday sailor (who couldn't care less until he suddenly finds himself in a tight situation).

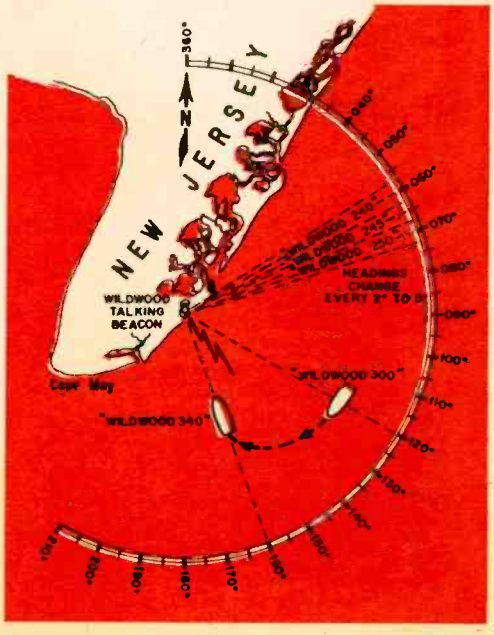
What the Coast Guard, working with IT&T, has devised is a radio beacon that talks . . . and talks and talks and talks, in English. During the past couple of seasons, a talking beacon has been operating experimentally at Wildwood, on the Atlantic shore near New Jersey's Cape May. Beacons are now being tried out at other locations. Although the CG hasn't made up its mind yet about widespread installation of talking beacons, the tests have been encouraging.

The idea is also encouraging to boat owners because picking up talking beacon information requires only a small and relatively inexpensive receiver. The frequency used in the tests is high enough to reduce the receiving antenna to a few inches in length. Our photo shows a model holding one of the sets, with the talking beacon transmitter in the background.

The talking beacon is nothing more than a high-frequency radio transmitter with an extremely directional signal that gives spoken rather than coded bearings. Operating at 9,310 mc, in the microwave frequencies, it uses an antenna with a parabolic reflector to achieve a beamwidth of 2 to 5 degrees. (The higher the frequency and the larger the reflector, the narrower the beam.) There was another reason for choosing microwave frequencies: this band is not crowded and full of interference, as are the lower frequency marine bands.

What makes the talking beacon different is the fact that it rotates and, as it does so, the signal transmitted changes according to the way it points.

[*Continued on page* 110]



BEGINNERS PAGE

Basic Batteries

A VITAL ingredient in any electrical or electronic circuit is the power source. So it is fitting that we begin this new series on basic electricity and electronics for our beginning readers with an article on batteries.

Would you like to make the world's simplest battery? Tear off a small piece of "tinfoil" (it isn't really tin) from the inside of a cigarette pack. Fold it in half so that the white paper is on the inside and place it between your back teeth. Bite down gently so the metal surfaces touch your uppers and lowers. When you touch the foil with your tongue there should be a slight tingle or salty taste. Notice how the battery action goes on and off as your teeth make and break contact with the foil.

The "mouth battery" won't work if you are one of those rare persons who has no fillings in his teeth. For the fillings contribute one of the essential ingredients to the battery. They are: *two dissimilar metals* (in this case, the foil and tooth filling) and an *electrolyte* (your saliva). The tongue was merely a test instrument—its sensitive nerve endings can detect the tiny flow of electricity. It's a standing joke among radio-TV servicemen that one can tell the freshness of a battery by how salty it tastes.

A better look into how a battery operates is provided by setting up the simple experiment shown in Fig. 1. Based on the earliest known battery, constructed by Count Alessandro Volta more than 150 years ago, the basic principles are still used today. The materials you need are a drinking glass, some white vinegar, the top cut off a tin can and a sheet of copper about 1" x 2". If there isn't a copper object around the house, you can get a piece at most any building supply or hardware store.

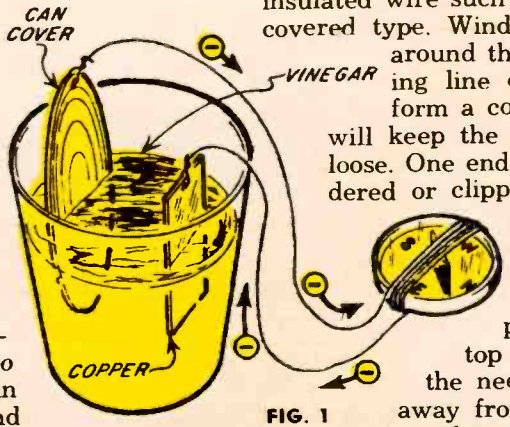


FIG. 1

This takes care of the battery, but a test instrument for showing the flow of current is necessary. You might want to invest in a 0-1 ma (milliameter) DC meter movement since we will be using it frequently as this series goes on. You can purchase a suitable meter for under $4 from any large parts supply house.

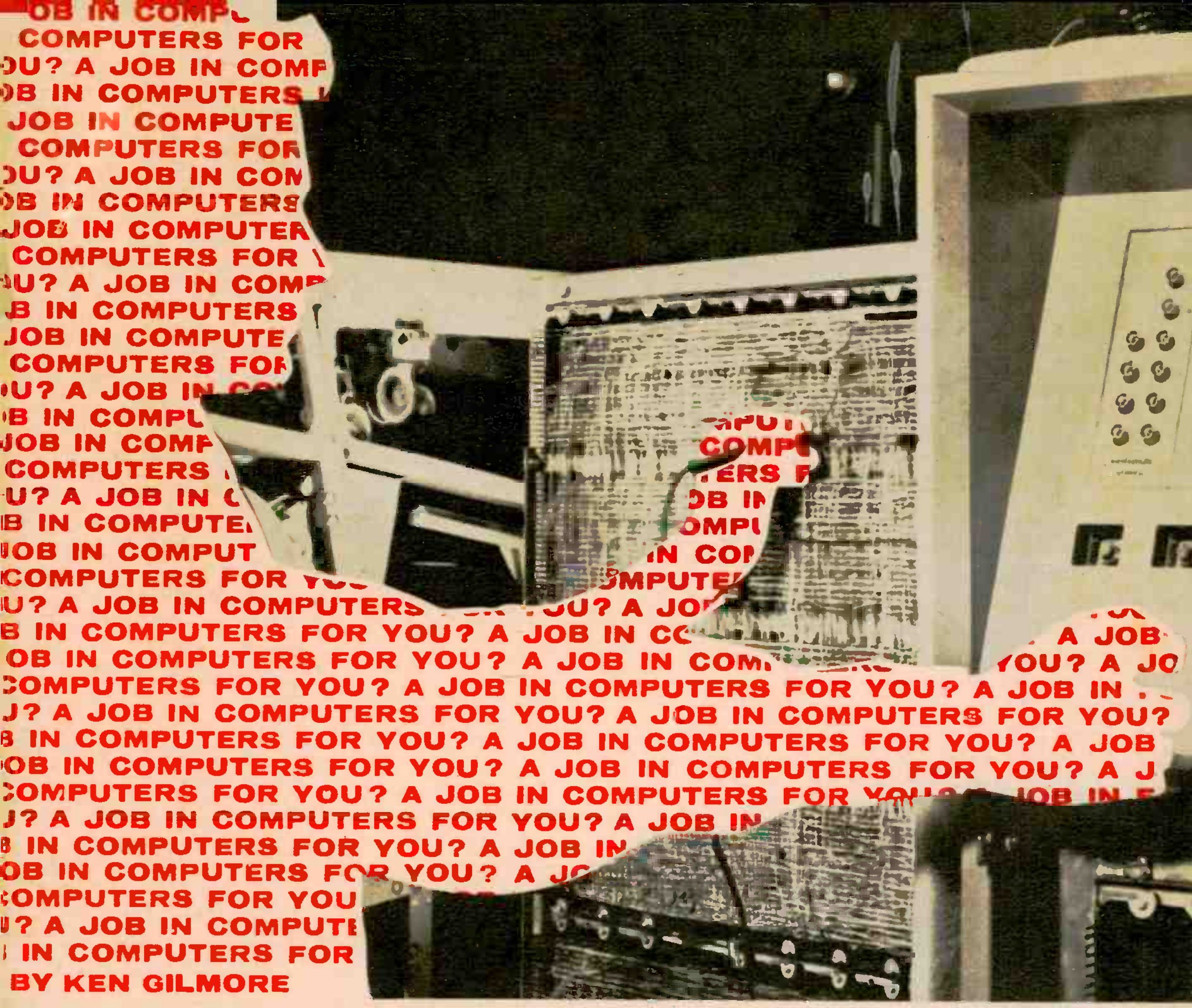
As an alternative, you can make a small current indicator using a dime-store compass and a few feet of thin insulated wire such as No. 28 enamel-covered type. Wind 30 turns of wire around the East-West marking line of the compass to form a coil. A piece of tape will keep the coil from working loose. One end of the wire is soldered or clipped to the piece of copper and the other to the can cover.

Rotate the compass on the table top so one end of the needle points slightly away from the West marking. This allows you to see whether the needle moves toward or away from the coil during the experiment. It is important to keep the compass flat as possible on the table so its needle can swing freely.

Battery action starts when the cover of the can is lowered into the vinegar. Watch the compass needle. It should line up with the coil or move at a greater angle to it. You can reverse the movement by exchanging the wires on the piece of copper and can cover.

Let's see where the current came

[*Continued on page* 112]



A JOB IN COMPUTERS FOR YOU?

BY KEN GILMORE

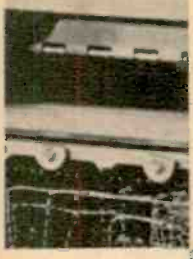
A YOUNG MAN in Chicago peers into an ailing computer, touches a probe to a few terminals and presses some buttons. Then he reaches inside, pulls out a circuit board and puts in a new one. The computer springs to life and begins earning its keep again.

In Los Angeles a dozen men and women spend their days writing strange symbols on sheets of paper. They are programmers and their symbols tell computers in their own language what to do and how to do it. With proper programs, a computer can run a factory payroll, add millions of figures or tell you when Col. Glenn is going to splash down.

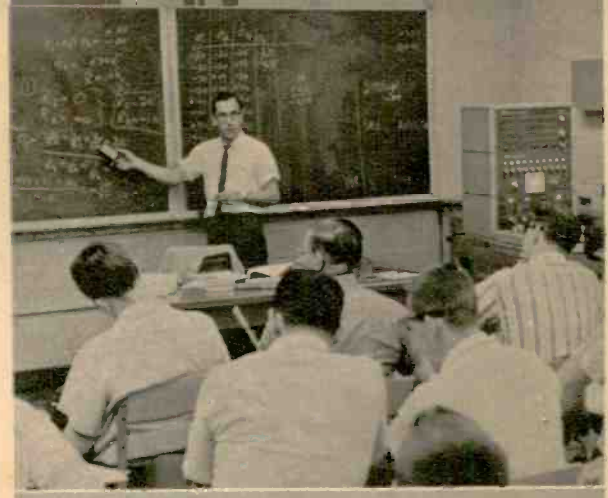
Technicians and programmers are members of one of America's fastest-growing specialized groups—the computer people. They're working in an exciting field that is full of opportunity. One company is hiring 1,000 new technicians every year. Another wants all the applicants it can get. Some 30,000 persons are now working in programming alone, and by 1970 the need is expected to run into the hundreds of thousands.

Would you like a crack at the booming computer field? Let's present some facts about employment with *computer manufacturers*, starting with technician-engineers. How do you become one?

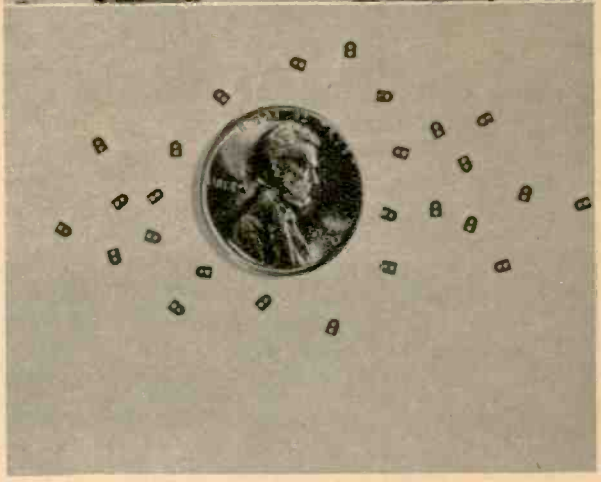
A top IBM personnel man says he looks for these qualities in a prospective technician: A good performance in high school, especially in math and science. If you've had physics and electronics, so much the better. "If a man is really interested in this field, his high school grades in math and physics will show it," says the IBM executive. "He doesn't



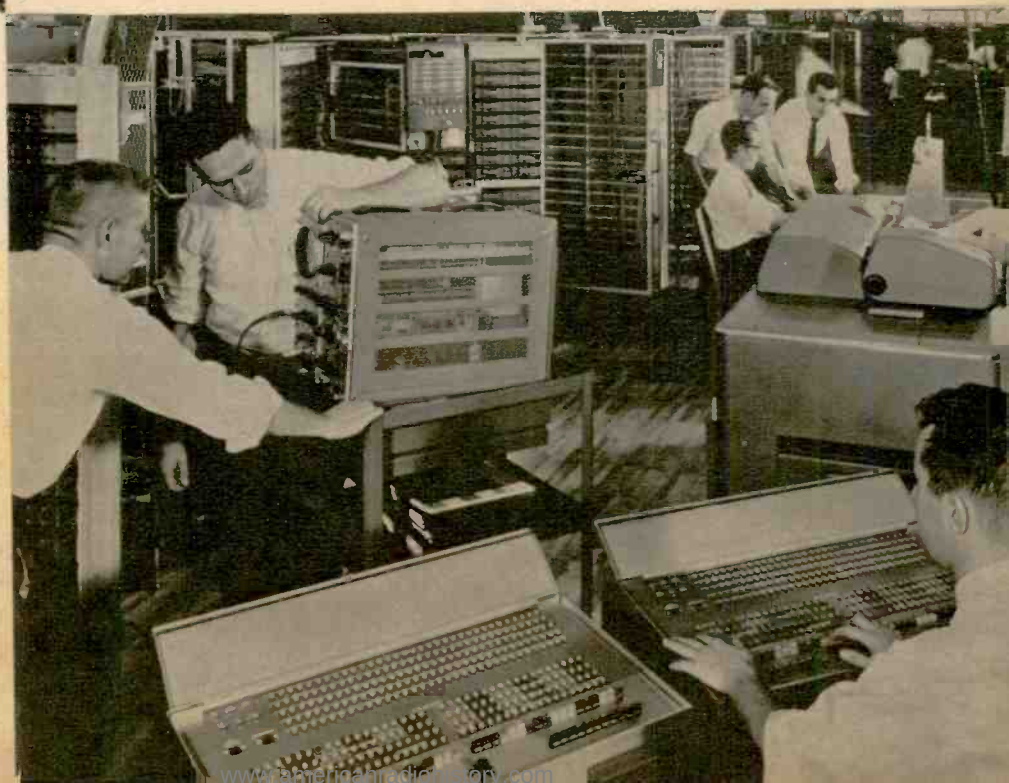
A lot of classroom work goes into the making of computer technicians. Class at right is at RCA Institutes. In photo opposite a technician checks out a freshly built computer at Burroughs Corporation factory.



A delicate touch sometimes is required of computermen, a fact made abundantly clear by the photo at right. Those tiny components lying beside a penny are ferrite memory cores for an IBM computer.



Every electronic brain that comes off an assembly line is put through its paces by technicians. In photo below elaborate data processing equipment is tested by crew of technicians at the factory.



have to be at the head of his class but we want his record to show he was a good student, learned quickly and is vitally interested."

Most companies also want a man who can get along with people because technicians must meet and work with customers. As a last requirement at IBM, you must be a graduate of a good technical school. In some cases, armed forces technical school or on-the-job training may qualify you.

As a new man on the job, your first assignment is likely to be—to go back to school. In company classrooms and at full pay, you'll spend several months learning about that company's specific equipment, practicing test procedures, getting acquainted with test instruments and learning machine operation.

After that you might be assigned to help a lab engineer on manufacturing or design problems, or you might check new equipment coming off the production lines. But it's more likely you'll be sent to a field office to work with a senior employee in taking care of customer computer installations . . . repair, maintenance, installation of new equipment, etc. After six months to a year, you might be assigned one or more electronic brains to take care of without help. They'll be all your responsibility.

To keep up, you'll need more and more education. Most companies have in-plant courses and some pay tuition at universities or technical schools. The more you know, the faster you advance. If you show promise you may be sent to school full time at company expense. After all this training and if your field work is top-notch, you may soon become manager of a field station with several men in your crew.

As a computer technician you may work in any part of the country or the world. Your territory may spread for hundreds of miles. In Southern Louisiana one IBM man makes his rounds through the bayou country by power boat. Another commutes by helicopter to a drilling rig in the Gulf of Mexico. Of course, you may be assigned to a single large plant or office in New York, Chicago or another of the country's big cities.

If you get a college degree in some phase of electronics you'll be able to step in as a computer engineer as soon as you graduate. But a degree is not a must.

Take the case of Jim H. He graduated from high school, spent three years as a radar technician in the Navy and became a TV repairman. He wanted to go to better jobs in electronics but the lack of an engineering degree held him back. Then he got a job with a large com-

Technicians must know how to operate computers as well as how to fix them when they break down.

Computer research sometimes requires surgical garb; this man checks memory drum at Sperry Co.

puter manufacturer, went through a training course and was assigned to a 20-man maintenance crew on a giant military computer. Three years later Jim was boss of the crew and enjoying the prestige and pay of a graduate engineer.

As a computer technician you can pretty much determine your own rate of advancement. If you're qualified, most companies will assign you the rank of engineer even if you have no degree. You get the same responsibility, job title and pay as graduate engineers.

It is possible to become a programmer also with only a high school or technical school education but your chances are better if you are a college graduate. Just as important, you need an analytical, orderly mind and an ability to pay attention to detail. A Remington Rand official put it this way: "The people we're looking for have an analytic mind. They use their intelligence as an athlete uses his muscles. They are curious. They develop a habit of asking themselves questions, taking nothing for granted, mentally taking everything apart to see how it fits together."

More than 100 colleges and universities offer courses in programming. Some of the better technical schools have set up similar courses lasting about six months. There also are private programming schools in some cities.

If you've got what it takes to be a programmer, you'll find it doesn't matter much what you studied in college. Math majors probably have a slight edge, but one computer firm made a survey and found its programmers had degrees in everything from Elizabethan literature to animal husbandry.

You could go to a programming school on your own without a degree but it isn't easy. When RCA Institutes started a programming course a few years ago anybody with a high school diploma was eligible. But the school found its graduates with only high school diplomas had a hard time getting jobs. Now it accepts only college graduates or those who pass special tests.

Probably the best way to get a programming job without a degree is to go to work for a company using computers or about to install them (rather than for a computer manufacturer). Some companies give aptitude tests periodically and then train those who do well as programmers.

What about pay in this field? A man just out of technical school usually gets a starting salary of $5,000 a year or more. A few men get as much as $6,000. With less extensive training starting pay may be as low as $350 a month. As you begin to be productive, your pay goes up. There's no salary ceiling. If you've got the right training, the desire to keep learning and the determination to get to the top, there's no stopping you. A high-level programmer may make more than $20,000 a year. A technician, if he keeps abreast of new developments, can get the rating and pay of a graduate engineer.

MAJOR COMPUTER COMPANIES

Scores of companies equipped with computers hire special personnel to operate and service them. But the largest employers of computer technicians are the companies which manufacture the equipment. Below are the names and addresses of the major computer manufacturers.

Computer Div.
Bendix Aviation Corp.
Arbor Vitae & Bellanca
Los Angeles, Calif.

Delco Radio Div.
General Motors Corp.
Kokomo, Ind.

Federal Telephone & Radio Co.
98 Kingsland Rd.
Clifton, N. J.

General Electric
Building 2, Rm. 153
1 River Rd.
Schenectady, N. Y.

Giannini Controls Corp.
1600 S. Mountain Ave.
Duarte, Calif.

International Business Machines Corp.
590 Madison Ave.
New York, N. Y.

Librascope Div.
General Precision, Inc.
810 Western Ave.
Glendale, Calif.

Litton Industries
336 N. Foothill Rd.
Beverly Hills, Calif.

Minneapolis-Honeywell Co.
Military Products Group
2953 Fourth Ave. S.
Minneapolis, Minn.

Radio Corp. of America
32 Rockefeller Plaza
New York, N. Y.

Raytheon Corp.
100 River
Waltham, Mass.

Remington Rand Div.
Sperry Rand Corp.
Park Ave. S. & 23rd St.
New York, N. Y.

Remington Rand Univac Div.
Sperry Rand Corp.
Park Ave. S. & 23rd St.
New York, N. Y.

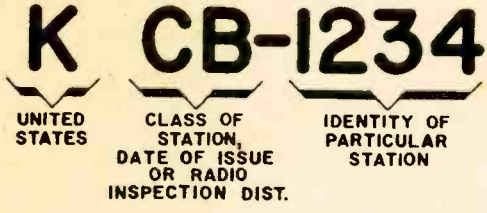
Sperry Gyroscope Co.
Great Neck, N. Y.

CB CORNER

By Len Buckwalter
1W5733

citizens band news and comments

THE FCC Goes Legal . . . CBers who have been given the pink-slip treatment by the Federal Communications



The new look: CB call signs now being issued begin with a K and have 3 letters and 4 numbers.

Commission should get at least a small chuckle out of the new call-sign system that has gone into effect for the CB service. Since the band opened the FCC has, in effect, been operating outside the law or, more specifically, outside an international agreement for the allocation of radio call signs. According to the agreement, U. S. call signs were to begin with A, K, N or W; Britain was to use G, M and 2A to 2Z; Japan got J, etc. So along came the FCC with *number* prefixes for the Citizens Band, a mistake now being corrected.

All classes of CB stations are affected by the new system, but your present call will not be changed unless you fill out a Form 505 for renewal of license, change of address or other reason. Then you will lose your number call and get a new one in the K series.

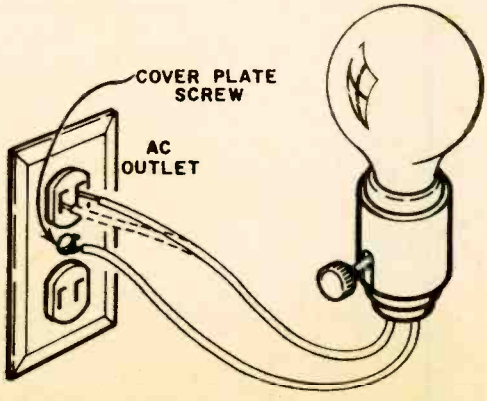
Our drawing shows the meaning behind the three letters and four numbers of the new calls. Exactly what the second and third letters mean is not yet definite; they may indicate any of the things shown, or something else the FCC decides on later. The station numbers will *not* necessarily be issued consecutively in given FCC districts.

The call sign shown in the drawing above is one we made up.

Look Down, Look Down . . . If you're having trouble with signal coverage, they say, look to your antenna. The electrical opposite of the antenna—the ground—gets ignored. But your grounding system can be almost as important as your skyhook. A poorly grounded rig can give you TVI; loss of transmitter power off the cabinet, mike lead and AC cord; increased danger from lightning, and general noise.

Begin laying out your ground system by locating a good building ground. Often the screw that holds the cover plate on the AC wall outlet contacts the building's electrical ground. One way to check is with a 117-volt bulb of any wattage (see cut). Connect one lead to the cover-plate screw and insert the other in the wall outlet's holes, one at a time. If the bulb lights, the screw is a usable ground.

A ground locator for shack is bulb with short leads; cover-plate screw often is good ground.



Another possible ground is a cold-water pipe. Avoid gas lines and hot-water pipes.

Run a heavy wire (No. 14 will do) from the ground to the rig. If no ground

[*Continued on page* 103]

make your own PRINTED CIRCUITS

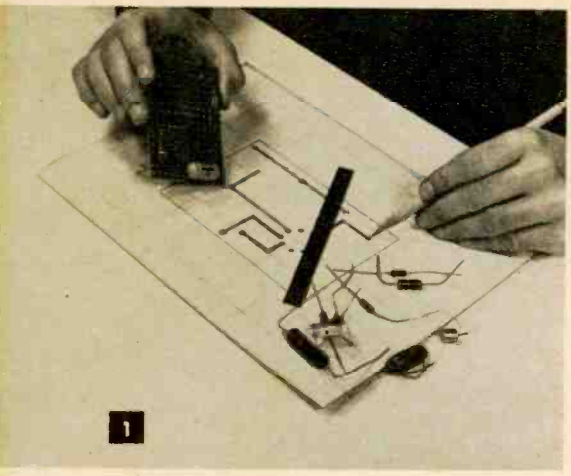
By Harry Kolbe, Contributing Editor

NEW, INEXPENSIVE techniques and materials have brought printed circuit projects within the reach of all. Hard to get materials and tedious drilling have been eliminated by a number of new developments. The introduction of *perforated* copper-clad boards, and a whole variety of resists take the work out of do-it-yourself printed circuit-board design and fabrication.

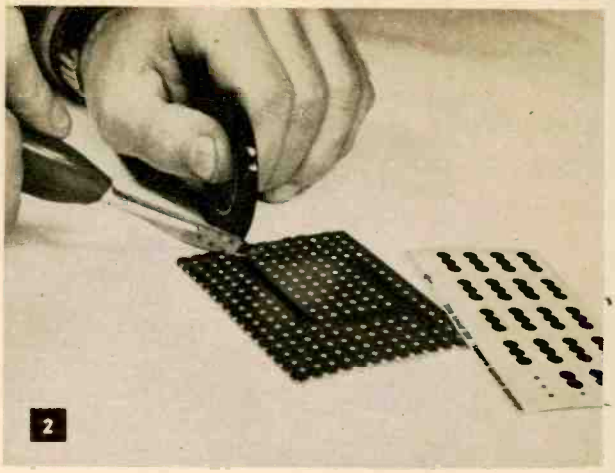
Let's look at the boards first. The holes in the board are $\frac{1}{16}$" in diameter with $\frac{3}{16}$" between hole centers. Four different board sizes are available, one of which should be about right for your latest project. Of course, the boards may be easily cut with a variety of tools to any desired size.

Circuit Layout and Design. Most of the same techniques used to lay out perforated chassis boards (see the March '62 EI) also apply to the copper clad boards. Without repeating the entire discussion, there are several points worth mentioning.

Graph paper is an excellent design aid for use with these boards.



1



2

Each intersection of vertical and horizontal lines represents a hole in the board and the layout sketch made on the graph paper need not be to scale. It's a good idea to have all the components on hand before starting for you can plan your layout by mounting the components temporarily on the board. Simply bend the component leads and push them through the board perforations. After the components are in their final position, sketch in the common buss lines such as ground and B+.

How to use Resist. After the circuit has been designed on paper, it must be transferred to the copper foil on the board. Here's where we depart from the non-copper clad perforated board techniques. First a resist is laid down on the copper foil in the areas that are to serve as the "wiring." The areas unprotected by resist are eaten away by the acid. Available to the do-it-yourselfer are tape resists, liquid resists and ballpoint tube resists. All are inexpensive, easy to use, and stocked by most large mail order radio supply houses.

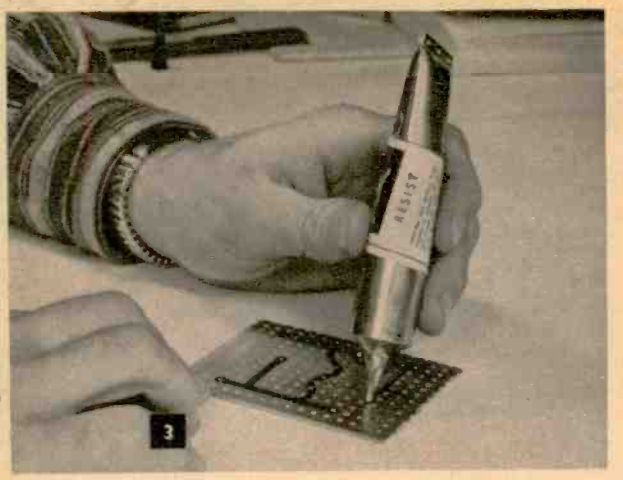
Tape resists are available in rolls of three widths (1/32", $\frac{1}{16}$" and ⅛"). To use tape resist, simply reproduce the conductor pattern in tape on the copper foil. Press the tape down firmly at conductor intersections and joints to prevent etchant leaking under the tape. Tape resist $\frac{3}{16}$" circles may be used at points where component leads are brought through and connected to the foil but are not really necessary with the perforated board. Remember to lay out the resist over the holes, not between the rows of holes.

Liquid resist is etchant resistant paint which can be applied to the foil with a small brush. Unlike tape resist, which is more or less limited to straight line conductor paths, liquid resist can follow the convolutions of any circuit pattern. When large areas of foil are to be covered, liquid resist is handiest to use. Its only disadvantage is that it must be removed from the foil before soldering. Fine steel wool will do the job easily.

The third, and perhaps most convenient to use, is a liquid resist dispensed in a $\frac{1}{16}$" stripe from a ballpoint tube. As with the other liquid resists, the resist must be removed later at points where the foil is to be soldered.

Etching the Board. It's important to realize that the chemicals used are highly corrosive and therefore dangerous. Keep the etchant in its tightly closed bottle and be careful not to splash it on your skin, clothes, or surrounding work areas. If an accident occurs, flood the etchant with water immediately and neutralize with sodium bicarbonate (baking soda). It might be a good idea to wear rubber gloves and work at the kitchen sink.

A recommended etchant manufactured by Techniques, Inc. is available in 6 ounce, pint, and quart sized unbreakable plastic bottles.



1 Graph paper ruled in ¼-inch squares is helpful in planning initial layout. 2 Tape resist may be used for straight lines and 3 ballpoint tube resist will serve for curves. Another type of resist 4 is a liquid which is applied with a small brush. This is suitable for covering large areas of foil. 5 After circuit is laid down in resist, the board is dipped in an acid bath. After etching is completed, the board is washed in water and is then ready to have the components installed.

Pour the etchant into a flat-bottomed glass dish, *never* a metal container. Carefuly check the resist on the circuit board in order to make sure that you have covered all of the copper foil that you wish to retain. Immerse the board in the etchant. Agitate the board in its bath every minute or so to encourage fresh acid to reach all areas of the exposed copper. Continue for 5 to 10 minutes until all the exposed copper has been eaten away. The time required cannot be stated exactly since it depends on temperature, thickness of copper, number of times etchant has been used, etc.

After the etching is complete, wash off the etchant under cold running water and then dry the board with a cloth. Strip off the tape resist, or if a liquid resist was used, remove it by rubbing lightly with fine steel wool. For ease of soldering, polish the copper with steel wool until it is shiny. Your etched circuit board is now complete. To use, simply place the components on the non-foil side of the board, push their leads through the perforations and solder them to the foil.

The total cost for the resist, boards, and etching materials is only about $3.00—and since there is enough material for seven or eight more projects, that figure comes down to about 37¢ a project. But your big pay-off is a professional-looking electronic device that is a snap to build.

printed circuit

POCKET RADIO

Combination regen and reflex circuit soup up simple two-transistor receiver.

THE POCKET RADIO receiver would win almost any construction project popularity poll. But the hobbyist contemplating the construction of one has a problem. What circuit should he use? Superheterodynes work well but are expensive, complex and require alignment. On the other hand, a one- or two-transistor receiver may require 10 to 20 feet of antenna to pull in anything.

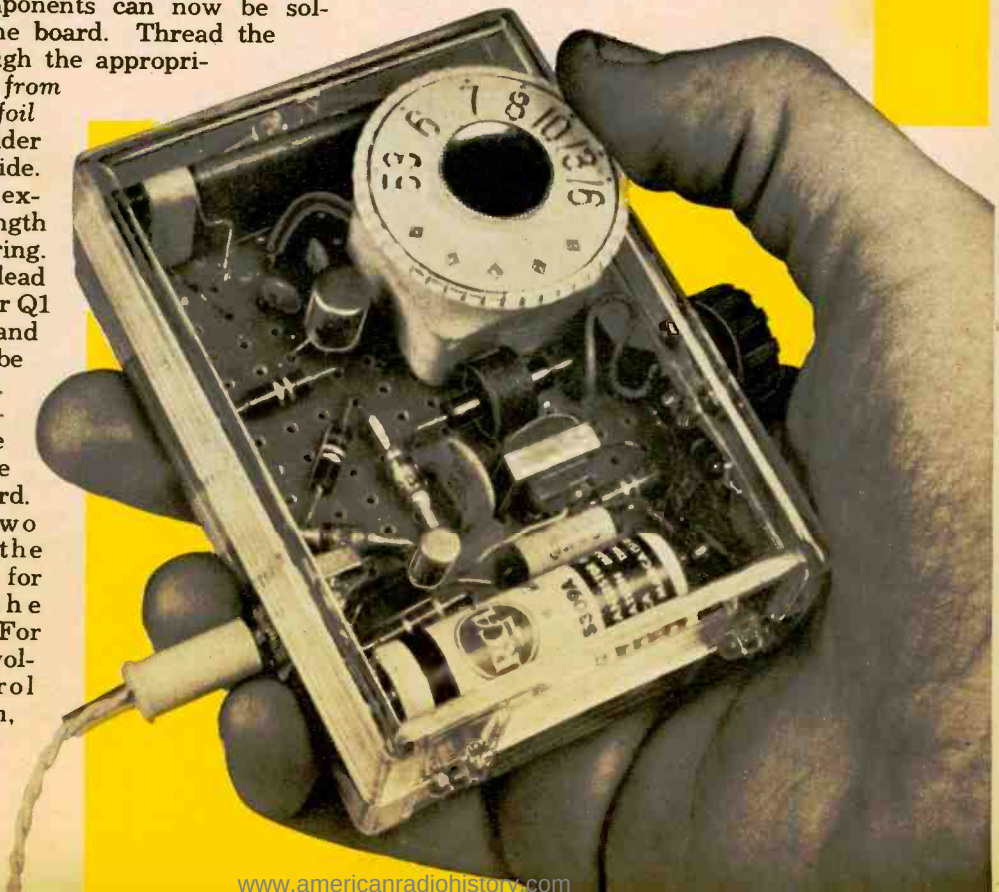
Here, then, is a little receiver that resolves the dilemma. Using two inexpensive transistors and a handful of other components, all major stations in an area can be received without an external antenna. The completed receiver fits into a small plastic case and all components (with the exception of control R3 and phone jack J1) are mounted on an etched circuit board.

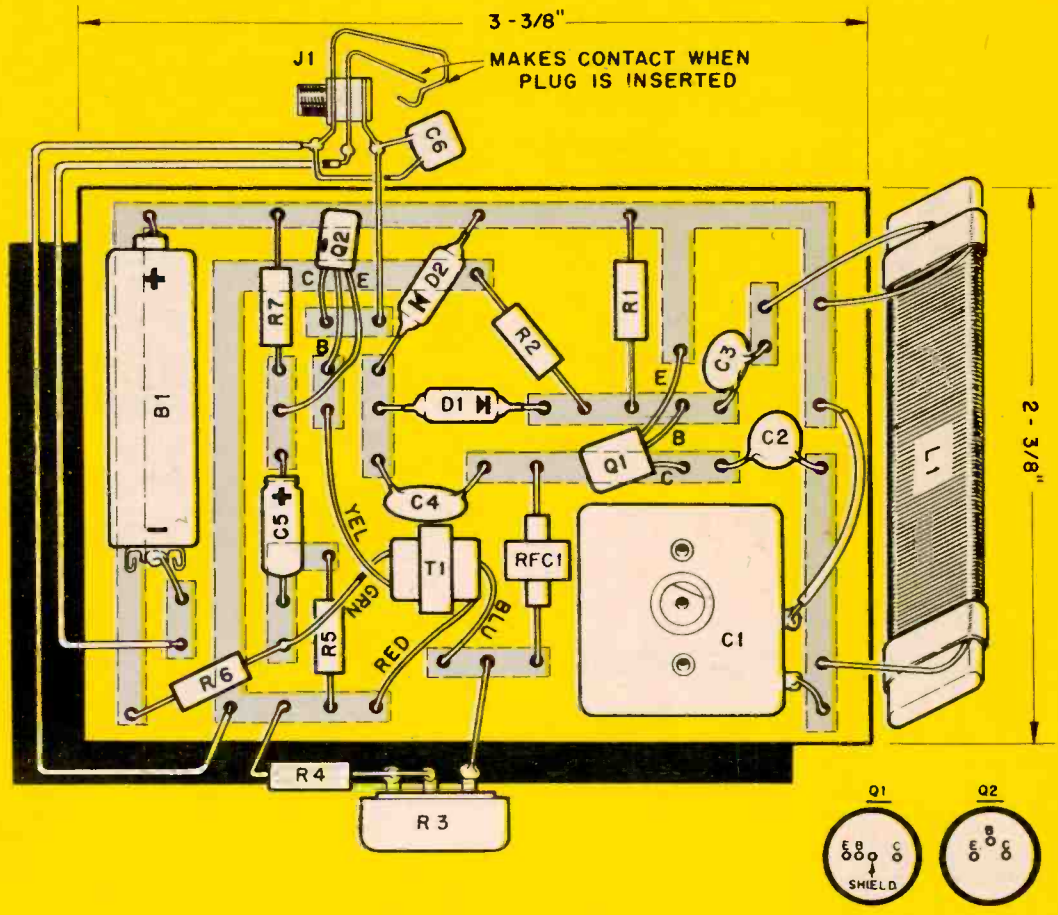
The etched circuit board is made first. Following the instructions in the preceding article and using the full-size template as a guide, lay out the circuit with ⅛" tape resist on the foil side of the board.

After etching the board, two small slots are cut for the mounting lugs of transformer T1. Push T1's lugs through the slots and bend them over tightly against the chassis. Tuning capacitor C1 is fixed to the board with Duco cement.

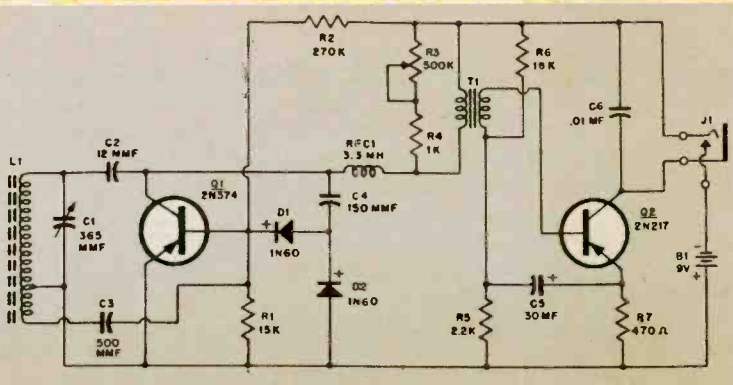
The components can now be soldered to the board. Thread the leads through the appropriate holes *from the non foil side* and solder to the foil side. Clip off the excess lead length after soldering. The shield lead on transistor Q1 is not used and and should be cut short. This completes the wiring of the circuit board.

Drill two holes in the plastic case for J1 and the shaft of C1. For the type of volume control (R3) shown,





In pictorial above, the foil side of the board is shown in an X-ray view. All components are mounted on the non-foil side of the board. Standard components are used throughout circuit.



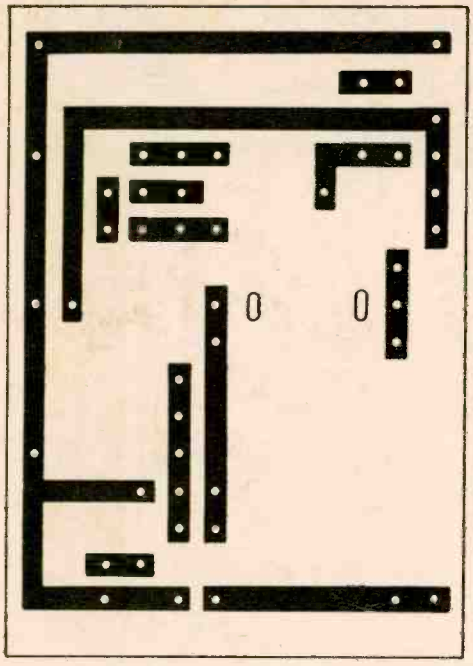
PARTS LIST

Resistors: ½ watt, 10%
R1—15,000 ohms
R2—270,000 ohms
R3—500,000 ohm miniature volume control
R4—1,000 ohms
R5—2,200 ohms
R6—18,000 ohms
R7—470 ohms

Capacitors: Low voltage disc ceramic, unless otherwise noted
C1—10-365 mmf miniature variable capacitor plus tuning dial (Lafayette MS-274 and KN-24)
C2—12 mmf
C3—500 mmf
C4—150 mmf
C5—30 mf @ 6-volt, miniature electrolytic
C6—.01 mf

T1—Transformer, 100,000 ohms to 1,000 ohms (Lafayette TR-97 or equiv.)
RFC1—3.3 millihenry choke (National R-40)
L1—flat transistor antenna coil (Lafayette MS-330)
Q1—2N374 transistor
Q2—2N217 transistor
D1,D2—1N60 diodes

B1—9-volt battery (RCA VS309A or equiv.)
Misc.—Earphone, 7,000 ohm (Lafayette MS-260) Other less expensive 3,000-ohm earphones may be used with some loss of sensitivity; plastic case, 3⅜"x2⅝"x1" (Lafayette MS-159 or equiv.); perforated copper-clad board, resist, etc.



Full-size template for laying down the tape resist is shown at right. Only those holes which take the component's leads are shown. Note that the resist tape goes over, not between, each row of holes.

two outside holes for the mounting bolts and one center hole must be drilled. The control is positioned on the top half of the case so its three lugs protrude over the cover edge. A small groove is filed to clear the control lugs.

If the type of control shown is not available to you in the 500,000-ohm size, any miniature pot of the correct resistance value may be substituted for the one shown. If the standard type of potentiometer is used, it may have to be located in a position other than that shown in the pictorial.

Rather than use a pot with a switch for turning on the radio, it was decided that the old trick of modifying the earphone jack as a switch would be employed. Battery life is conserved since a glance at the jack tells you if the set has been accidentally left on. Bend the center contact of J1 as shown in the pictorial so it will connect the battery when a phone plug is inserted.

Place the circuit board in the bottom half of the case. Connect R4 to volume control R3 and solder the appropriate wires from the circuit board to J1, R3 and R4. Close the case and attach the tuning dial to the shaft of C1. To turn on the receiver, simply plug in the earphone.

If the receiver whistles as you tune across the band, try using a smaller capacitance value for C2.

How it works. A combination of regenerative and reflex operation is the secret of this receiver's sensitivity and selectivity. The RF signal is picked up by ferrite antenna L1 and fed through C3 to the base of Q1, where it is amplified. The RF signal now appears at Q1's collector and is fed back into L1 (via C2) for further (regenerative) amplification. The souped-up RF signal is next fed from Q1's collector via C4 to detector diodes D1 and D2 (hooked up in a voltage-doubler circuit). The audio output of the diodes is reapplied to the base of Q1 (from the cathode of D1) and Q1 now functions also as an audio amplifier. From Q1 the amplified audio signal is coupled by T1 to output transistor Q2 for final amplification, and then fed to the earphone from the collector element of Q2.

THE ELECTRONIC BANKER

ELECTRONICS IN INDUSTRY

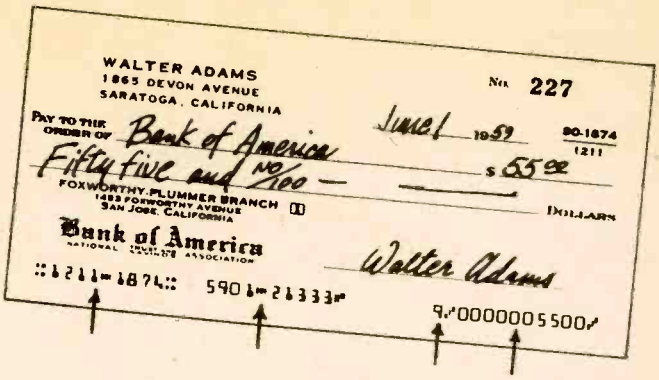
By A. D. Jackson

IF YOUR NAME happens to be on lists of people who receive press releases from computer manufacturers and related companies, you have been inundated in the past few months with news about big doings concerning banks. If you're also on banking-company lists you may still be digging out of a drift of mimeograph paper.

Boiled down to a few words, the releases tell all and sundry that automation has come to the counting-house. The big ledgers, roll-top desks, high stools and the quill pens have been gone a long time. Now the people who sat on and used them are gone, too.

Automated banking probably is not new to you. Magnetic Ink Character Recognition (MICR) checks, with their strangely shaped numbers along the bottom, have been scattered to the four winds by the movement to automation. Last year four checks out of every ten carried magnetic symbols.

Electronics did not take the citadel of banking by storm, it might be noted, although it has moved fast, once inside the door.



Those MICR numbers on checks have special meanings in common business language. Groups (see arrows) from left to right indicate "transit," account number, transaction and the dollar amount of check.

The role of match-maker in this marriage usually is credited to S. Clark Beise, who was vice-president (now president) of the Bank of America in 1949 when he got it into his head to do something about the mountains of paperwork in his business. He went to the Stanford Research Institute and told them his story. Five years and $2,000,000 later SRI and the B. of A. unveiled ERMA, their prototype electronics banker. The letters stood for Electronic Recording Method of Accounting.

After that, everybody who could do so got into the field. ERMA now has almost as many grandchildren as Eve.

To get an idea of what ERMA and her brood have done to banking, consider an efficient bookkeeper with a year's experience. She (invariably it's a girl) can sort and post around 245 checks an hour. Some of the new machines can sort and post upwards of 2,000 checks in *one minute*. In the counting-house (but, luckily, not elsewhere) one machine is worth something like 135 sweet-smelling bookkeepers.

The more complicated electronic bankers can do an amazing number of things. Let's start with the MICR numbers on your check. Each of those powdered-iron symbols, when brought close to an electromagnetic pickup head (like the one on your tape recorder), generates a characteristic waveform. By detecting and, in effect, reading these waveforms, electronic banking equipment can perform its miracles. So far, all MICR characters are numbers or special symbols. But in the future letters, such as those shown in the title

Check-sorter Joann Carley poses in Phoenix bank with less-shapely successor, a row of machines.

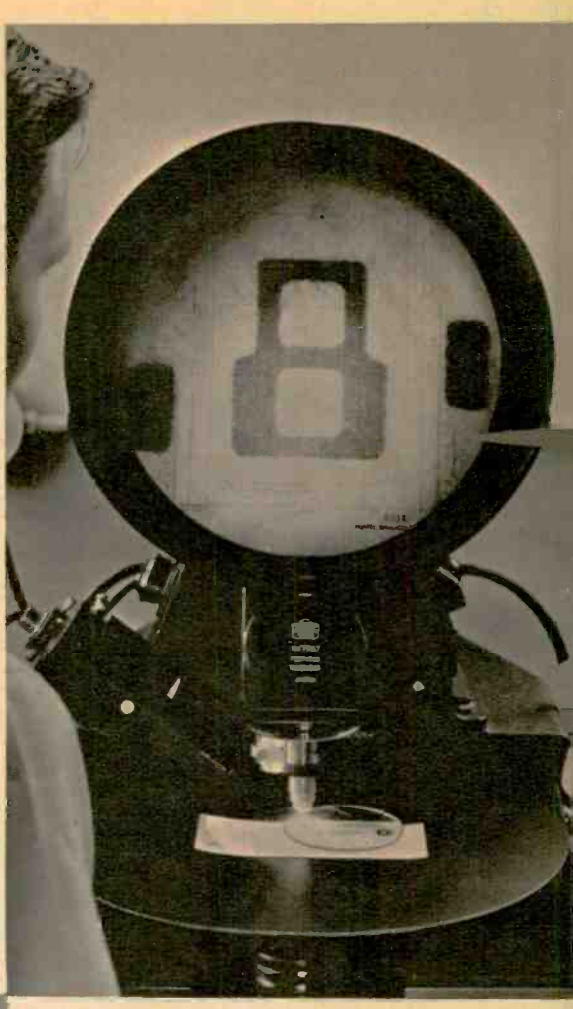
The newest look in unpeopled drive-in banks is this closed-circuit TV teller in Waukesha, Wis.

of this article, may come into use.

Blank MICR checks come with two groups of numbers on them. The first ("transit") group are routing numbers, telling how the check is to get back to the bank on which it is drawn. The second group identifies the bank or branch and your account. After a check returns to your bank two more MICR groups are printed on it. One gives the posting machine instructions as to priority of posting, tells whether the check is for deposit or a withdrawal, etc. The final numbers give the amount of the check.

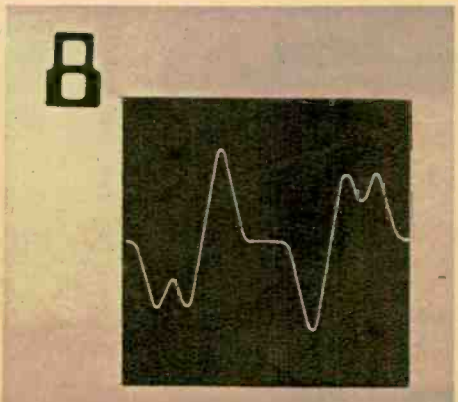
After checks have received their four MICR groups they go into big sorters, such as the one in our lead photograph. The sorters and related computer memory equipment look at your current balance, subtract the check and note your new balance. Reels of magnetic tape have become the standard memory device. In addition to keeping tabs on accounts, the tape prints a complete record of all a bank's transactions via a high-speed teletypewriter. It also can be told to look up new accounts, total active accounts, total deposits, etc. It can even do a bank's cost accounting.

Large electronic installations at some central banks now take care of accounts in all branches, even when they are half a continent away.



The 50X magnification of MICR number above shows peculiar style of digits officially adopted for bank automation. Electromagnetic pickup head reads numbers by detecting distinctive waveform of each digit such as the 8 below.

Prototype of truly automatic banker takes coins, bills and checks, gives validated deposit slip.



KIT
EI
REPORT

SCOTT LT-110
Stereo FM TUNER

THE WIDESPREAD popularity of stereophonic FM radio and its swift acceptance by high fidelity fans constitute an unusual tribute to the people who are manufacturing the equipment involved in transmitting and receiving multiplex broadcasts. If the first stereo FM products on the market had performed poorly and caused trouble, it might have taken years to recover from the setback and restore public confidence. It has happened in other fields. It did not happen in stereo FM (or FM stereo, if you prefer).

One of the companies which has earned public esteem because of the high-quality performance of its first stereo FM equipment is H. H. Scott, Inc., a firm of sufficient size to play a key role in creating an image for a new art like stereo FM. In this case, the image it helped create is a good one.

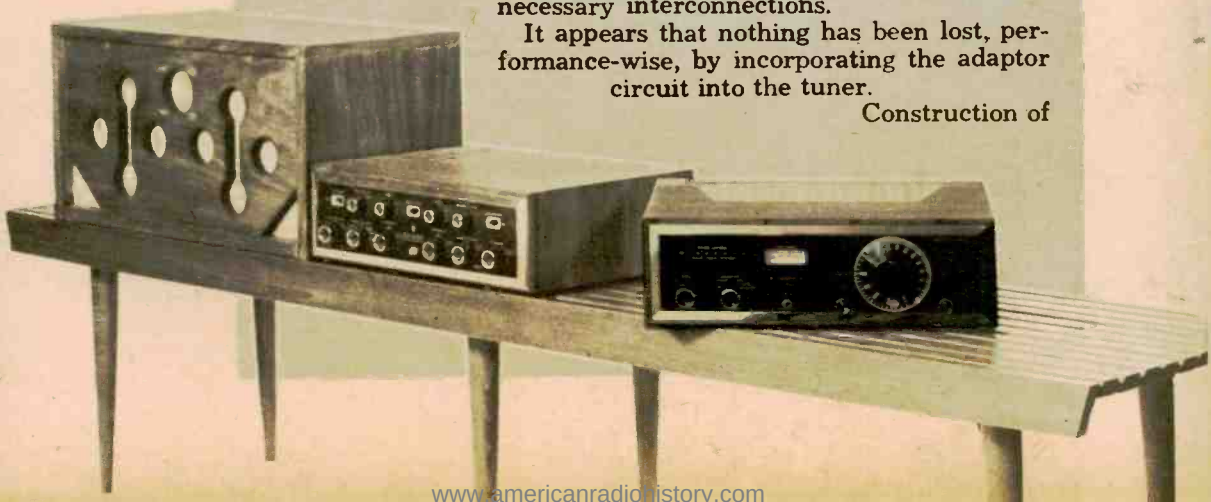
Scott's first, factory-wired multiplex equipment exhibited excellent performance figures and when the company became the first to market a stereo FM multiplex tuner in kit form, the LT-110, there was speculation about how the do-it-yourself line would measure up.

The basic LT-110 tuner is identical in all essentials to the LT-10 monophonic tuner kit which EI checked out in a special report on all tuner kits which appeared in the November '61 issue. The LT-10 showed exceptional performance and the monophonic part of the LT-110 matches those figures.

In building and testing the LT-110 we were specifically interested in the multiplex adaptor incorporated into the chassis to provide two-channel reception. The adaptor sub-assembly appears identical to the one Scott uses in its self-powered adaptor. In the case of the LT-110 kit, the adaptor comes factory-wired, aligned and already mounted on the chassis (the silver-plated front-end also is pre-wired and mounted). The builder merely assembles the rest of the tuner and makes the necessary interconnections.

It appears that nothing has been lost, performance-wise, by incorporating the adaptor circuit into the tuner.

Construction of



the LT-110 is simple and straightforward. Like virtually all electronic kit manufacturers, Scott knows how to produce excellent instruction manuals. This is one of them. The wiring job should take about nine or ten hours to complete. Our builder, a novice, took ten and a half hours.

Although there are no tricky operations in the assembly, normal care must be exercised in making connections in the multiplex section so as not to foul up what is already done for you by the manufacturer.

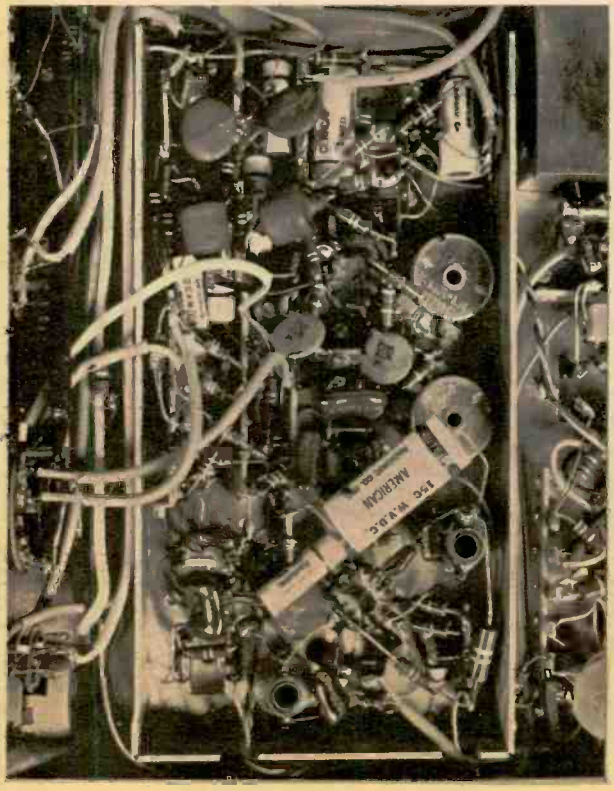
Probably the leading question in tuner kit construction has to do with alignment. Can I align the rig without special instruments after I get it together? The answer is yes. In the case of the LT-110 excellent alignment is especially easy to achieve because the signal-strength meter (S-meter) mounted on the front panel serves as a test instrument, indicating when the circuit is in alignment with maximum readings on its dial.

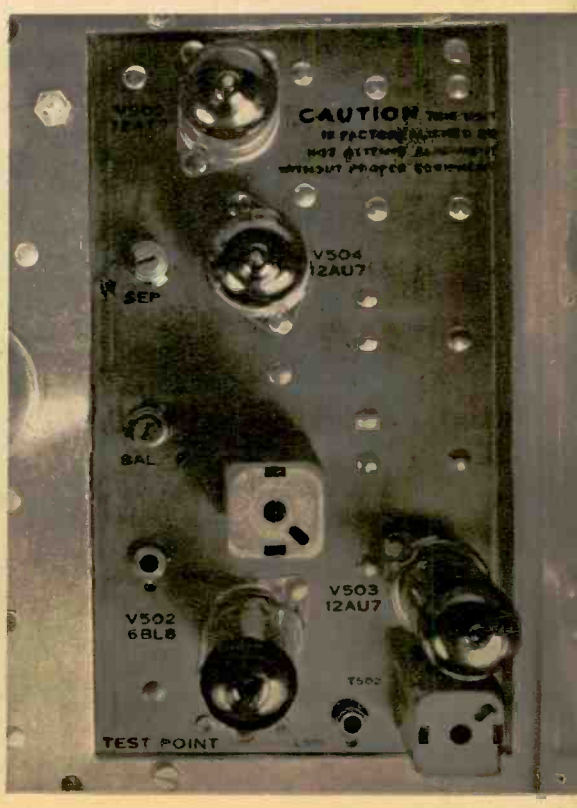
CHANNEL SEPARATION OF LT-110

Test Frequency (cps)	Channel A (db)	Channel B (db)
50	37	37
400	39	39
1,000	41	42
5,000	33	34
7,500	26	28
10,000	18	20
12,000	14	14
14,000	6	6

However, it is in this area that we find a fault in the instruction manual. Scott evidently forgot to take into account the extreme sensitivity of its own tuner. To align the intermediate-frequency (IF) coils properly, you need a relatively weak signal. The LT-110, even

Bottom and top of the multiplex section in the LT-110 tuner. It is pre-wired and mounted on chassis when you buy the kit. Note interconnections at left.





when fed by the small twinlead antenna supplied with the kit, is so sensitive and has so much gain that in a medium or strong signal area you are unlikely to find a station weak enough for the job. Our builder, who lives in a medium-strong signal area, finally reduced the antenna to a 2-inch piece of twinlead before he was able to get the signals down to a low enough level. The manual should give instructions on how to do this.

Once you find a weak signal (or weaken a strong one), you merely twist the alignment slugs in the IF coils until you get maximum S-meter readings. Alignment of the ratio detector coil incorporates a new procedure in this kit. The builder temporarily clips a .05-mf capacitor between two pins of the first IF tube. This injects low-voltage AC into the circuit and causes 60-cycle hum. The coil is then aligned for minimum hum and the capacitor removed.

As a rule of thumb, you can count on a sensitivity of about 3 microvolts after home alignment. Our novice builder was lucky and came out with a 2-microvolt reading. Either figure is excellent and the difference, of course, cannot be detected by the ear. Harmonic distortion amounted to 1.1% and the important signal-to-noise ratio was 60 db. Instrument alignment (which would not have been required) improved these figures to 1.8 uv, 0.7% and 62 db, respectively.

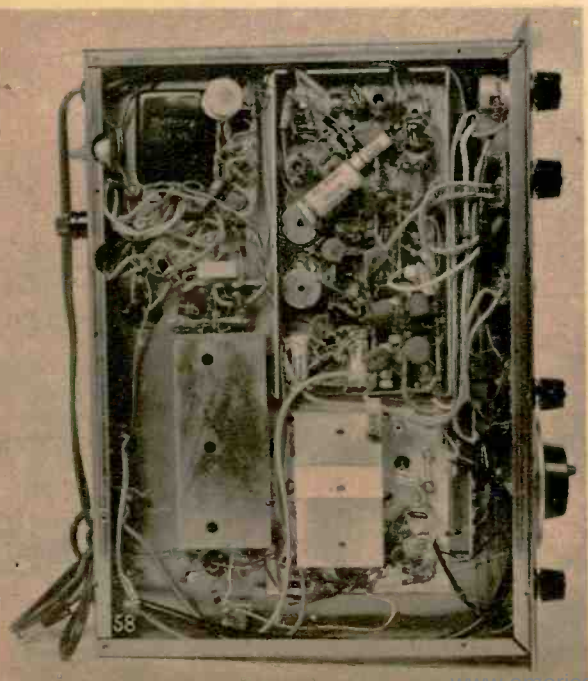
Residual noise from the adaptor was 43 db below full output, made up mainly of 19-kc pilot signal. There was little 38-kc signal.

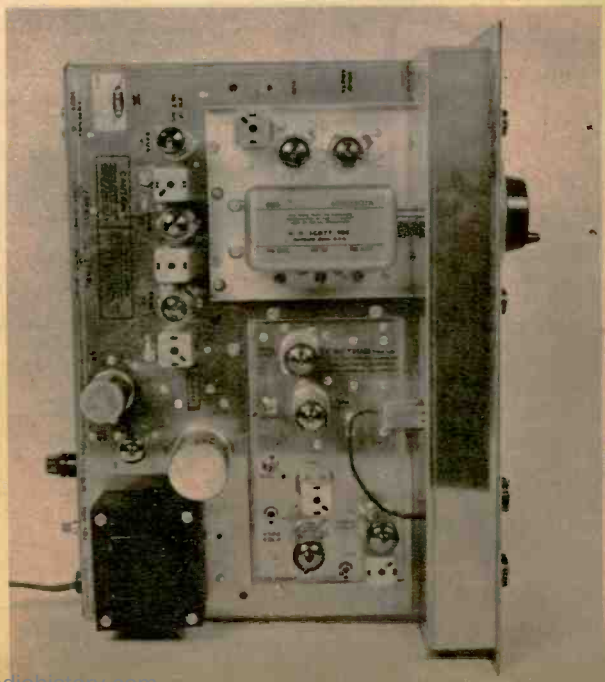
The chart on the second page of this report shows the separation figures we obtained. These readings were taken after we gave the multiplex section a critical realignment on instruments. The improvement over the factory's alignment was insignificant as meter readings and was inaudible. Separation was excellent both before and after realignment.

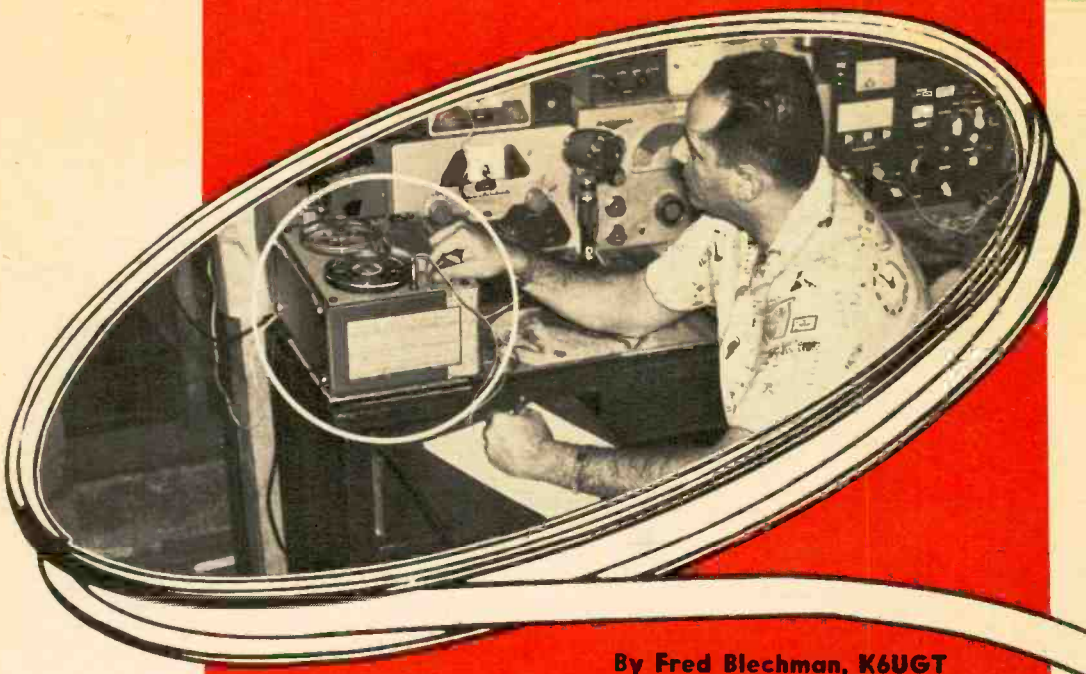
Note that our separation chart gives readings for both channels at a wide range of frequencies. Most manufacturers provide only a single separation figure—so many db—and they seldom specify the frequency at which it was achieved (they naturally pick the best reading). Frequency is important because it is a function of separation. In all equipment so far produced separa-

[*Continued on page* 104]

Bottom and top of the whole chassis. Mpx section is inside white rectangle in upper right of photo at left; it's at lower right in the other picture.







By Fred Blechman, K6UGT

how to use a TAPE RECORDER in your ham shack

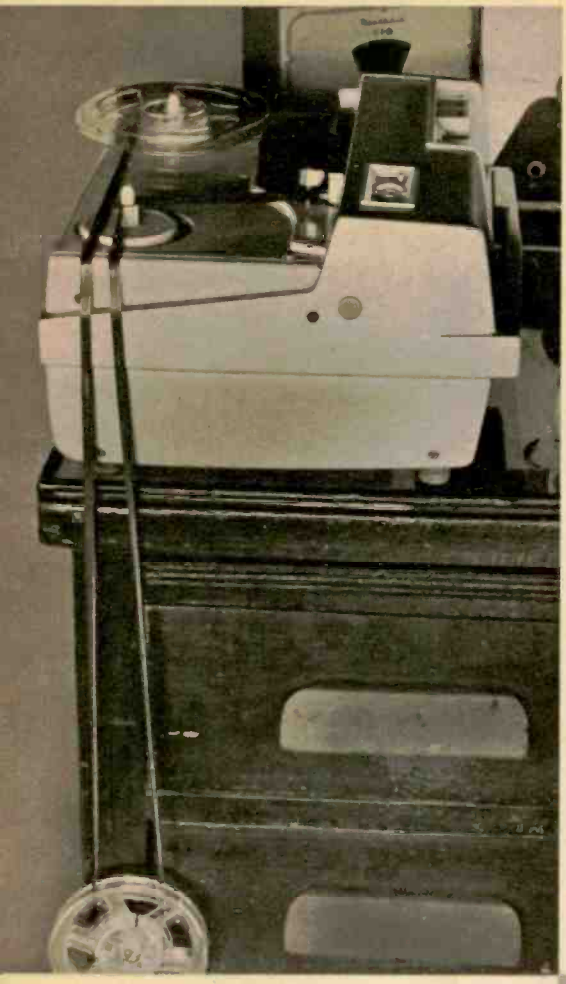
IN THE PAST few years I have read about hundreds of tricks that you can do with a tape recorder. Some of them are clever and some silly, but a good many can be used effectively by the radio amateur in his ham shack. With an inexpensive tape recorder you can give more meaningful signal reports, make use of an automatic CQ signal, record your own signals and perform many other operations.

The audio quality of the tape recorder is not particularly important because ham signals stay in the lower frequency domain and even cheap recorders have adequate response. The exact patch cords, adaptors and connectors required depends on the recorder and your other equipment but you should have no trouble making the hookup.

To record signals off the air, you can connect your receiver's speaker terminals directly to the high-level *radio* input of the recorder or possibly to the low-level *mike* input if you keep the volume low to prevent overload. A receiver's earphone output usually can be connected to the *mike* input. Use shielded leads.

For transmission of recorded information, we suggest the use of our Signal Conditioner (see Figs. 2 and 3), which serves as an input selector and also insures proper signal level from the

Fig. 1—Lazy man's CQer is 6-ft. tape loop with CQ call recorded on it; empty reel is ballast.



tape machine to prevent distortion and feedback.

Take a look at the Signal Conditioner schematic. SW1 is an SPDT switch for selecting tape or mike input to the transmitter. If your recorder's output is meant to be fed into an external amplifier, then R1 should be about 10,000 ohms and R2 about 100 ohms—both ½ watt. But if your recorder has only an *external speaker* output, then R1 is omitted and R2 should be a 10-ohm, 2-watt potentiometer. R2 controls signal level and prevents overloading of the transmitter's mike input. The Signal Conditioner should be built in a metal box with all external leads shielded.

In using a tape recorder in your ham shack you may have trouble with RF pickup. The problem comes about because of audio rectification of your transmitted signal in the amplifier of the tape recorder. Fortunately, this is easy to take care of. Just add an RF filter to the first audio stage of your tape recorder as shown in Fig. 4. The filter allows audio signals to get to the grid but bypasses RF signals to ground.

To record your own signals right off the air, build a simple untuned broadband receiver as shown in Fig. 5. Any crystal diode will serve as detector. The resistor and capacitor represent an RF

Fig. 3—Signal Conditioner circuit. It enables you to switch quickly from tape machine to mike.

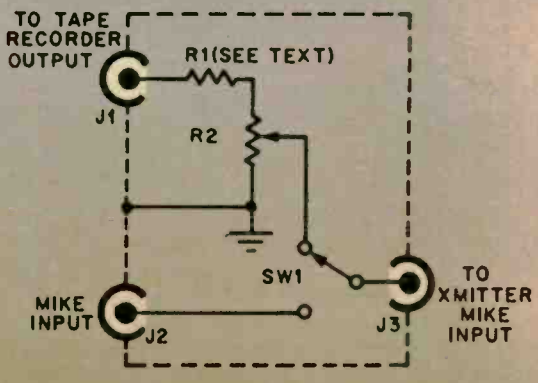


Fig. 2—Signal Conditioner, built in metal box, interconnects a tape recorder and transmitter.

filter. The antenna can be nothing more than a lead about a foot long. The whole detector can be built in a large phone plug.

Probably the most common use of tape among hams is the first one we mentioned, signal reporting. Most hams have never learned how they really sound on the air. If you record their signals and then play them back (or mail the tape) it represents a really meaningful signal report that is highly appreciated. Just remember, it is against the law to divulge the contents of such a transmission to *any* third person.

Alternatively, you can find out how your own signals sound by using the detector shown in Fig. 5 to record your transmissions.

To make a lazy man's CQer and save yourself all that talking or brass-pounding, take a piece of tape about 6 feet long and splice the ends together to form a loop. Using an empty reel as ballast (as in Fig. 1), hang the loop over the back or side of the machine and record your CQ call so it just fills the tape. Then sit back, flip on the recorder and transmitter, switch to *tape* on the Signal Conditioner and relax while your mechanical stand-in does the work.

If you want to brush up on code, try recording code practice sessions transmitted by W1AW, the ARRL station at West Hartford, Conn., for later playback and study.

If you handle a lot of traffic you know that a phone call or other interruption makes you miss part of a message or holds up your net while you get a fill. With a recorder handy, you can tape your own fills, and they'll be there waiting when you get back.

Because an unmodulated continuous carrier is illegal on the ham bands except for short periods, you may wish to use a tape-recorded signal which can be played through your transmitter again and again. Since the information is always the same, it gives you an ideal means of comparison between repetitive tests when you are checking for TVI, adjusting your modulator, etc.

It is sometimes convenient to use a recorder to keep a verbal record of readings, tests, equipment alterations and so on while the work is being performed. You just describe what you're doing as you do it, letting your recorder put it down on tape. Later playbacks tell you exactly what you did, and maybe what you did wrong.

Those are just a few of the ways you can use a tape recorder in your ham shack. You will be able to invent dozens more.

Fig. 4—RF filter network connected in first audio stage prevents RF pickup by your tape recorder.

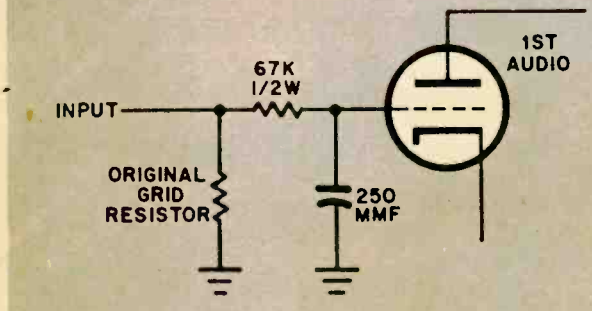
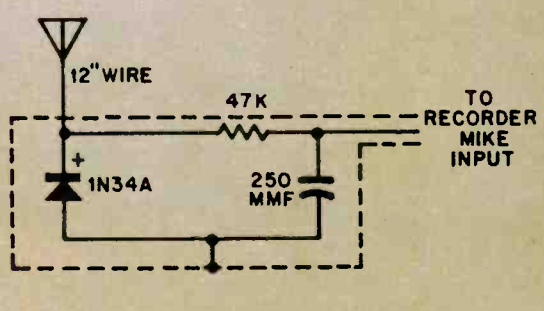


Fig. 5—Simple one-diode detector with 12-inch antenna permits you to record your own signals.



show off your hi-fi system with . . .

STEREO SAMPLERS

By Norman Eisenberg

TIME WAS, when monophonic high fidelity stood at its zenith, you got motioned into the den or living room by a friend who wanted to show off his new rig and were promptly run over by a freight train and two sports cars.

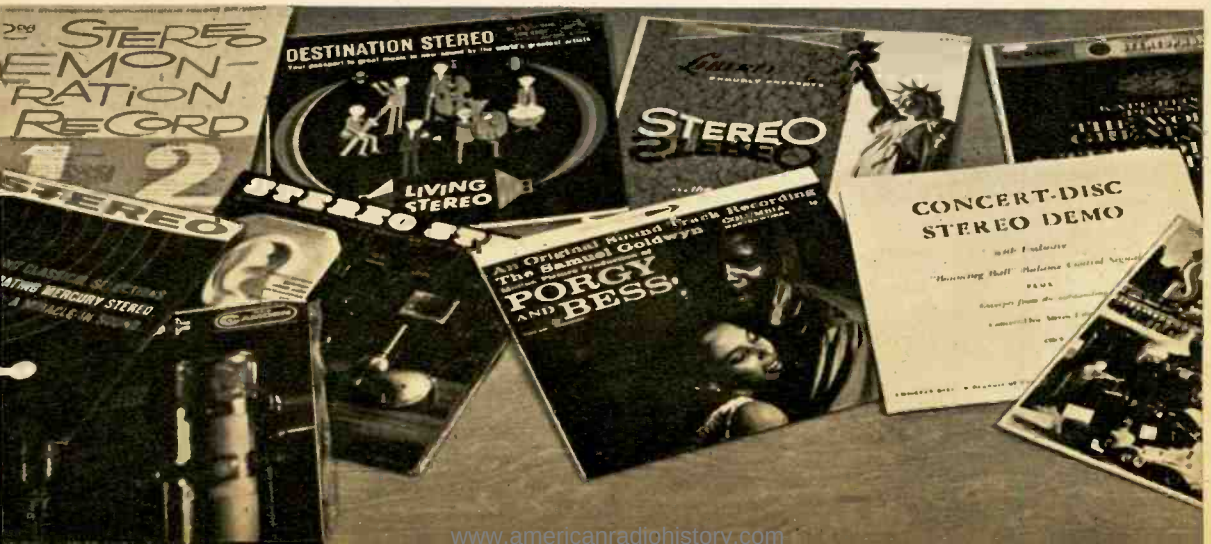
Stereo has changed things a bit. Now the train runs along the listening wall, wild animals circle at a distance and the racing automobiles make a turn right in front of you. Although illusions of this type are still the stock-in-trade of some demonstration and sampler recordings, there are now many two-channel discs that appeal to us on musical grounds.

The reason is simple enough. Stereo, when played on good equipment, enhances music to a marked degree. The point for stereo can be made without tricks. The sonic discs are fun (and some prefer them to music, no doubt), but for day-to-day enjoyment the incomparable glory of a full-dimensioned symphony or opera wears longer.

Some demos include both sounds and musical selections and a few more ambitious ones have test signals (left speaker-right speaker material; signals from low bass to inaudibility to test your system's response) and include an explanatory talk or printed brochure to supplement what you hear. The production becomes the equivalent of an aural magazine article. It's all stereo and all exciting—for the sense of acoustic adventure and discovery, as well as how it can show off (or show up) your sound system. Musical excerpts on demos have an added value. By presenting a wide range of styles, they provide a capsulized musical education and give you a basis for deciding what kind of albums you want for your collection —symphonic, operatic, popular, jazz, etc.

New demonstration records come out almost as fast as new books. Those described here are not necessarily the newest. They're what we regard as the most interesting, valuable or offbeat releases issued over the past several months. Some are readily available; others are not current but can be found in large record shops; still others have dropped from record-maker's lists and will be more difficult to find. All are stereo, of course.

Most unusual among the new discs is Mercury's Music in Depth (PPSD-4-12), made up of 12 varied numbers featuring different instrumental ensembles, all recorded with the new 35mm magnetic film technique. The



quality of sound possible from this record is almost unbelievable. Selling as a demo special, the disc is priced at 99 cents. An older Mercury disc is Operation Pageworth (SRD-3; $2.98), which offers no less than 32 classical and pop selections.

Audio Fidelity's Demonstration and Sound Effects (AFSD 5890; $5.98) comes out with 3-D sound (various animals, St. Patrick's parade) blended with narration and pop tunes on one side. The flip may well be the noisiest demo ever. Six sound bands transport you to the Army's Aberdeen Proving Grounds; the other six give you subway trains, fire engines, crashing timber and so on.

Bel Canto's Stereo Demonstration Record (SR 2000; $2.98) takes you on a wild tour of Los Angeles and then through a quick history of recording with samples of pre-electric records, 78-rpm discs and LP microgrooves. Pop numbers are included.

Capitol's The Stereo Disc (SWAL 9032; $5.98) is a lush boxed album with a booklet by Edward Tatnall Canby. Side A has an introduction to stereo with mono-stereo comparisons. Side B features classical and pop excerpts.

Columbia's sound track from Porgy and Bess (OS 2016; $5.98) is a smash. It's best played in a large room. The sounds of Catfish Row, spaced across your wall, are particularly effective.

Concert-Disc's Stereo Demo (CSD-2; $2.98) bounces a ping-pong ball around to help you balance your speakers, then lavishes some excellent sound on so-so music, although its resounding organ excerpt and percussion arrangement are well worth hearing.

Counterpoint's A Study in Stereo Sound (CPST-2505; $2.98) features some of the best jazzmen in the business. The stereo is so good you can almost smell the cigarette smoke. For non-musical kicks, there's a bowling ball sequence.

Epic BC-1 and Epic BN-1 ($2.98 each) both are called This is Stereorama and are similar in format. BC-1 is devoted to classical, BN-1 to pop selections. Each opens with a talk and balancing signals, then presents the clean sound of music by leading ensembles.

Everset is out of business but you may find its SDBR 2002 and SDBR 7001 ($1.98 each) in some shops. The two discs (pop and classical, respectively) pack a lot of full, clean stereo sound on quiet surfaces.

Fantasy's Stereo Demonstration Disc (FS 655; $2.98) has a Brubeck arrangement of a Bach chorale to recommend it. The last band, with the bass apparent on only one channel, is an example of exaggerated separation.

Kapp's contribution is KC-9031 ($5.98), a straightforward classical sampler which offers, as its title says, The World's Great Music in Stereophonic Total Sound.

Liberty's LST-100 ($4.98) starts with narration, a ping-pong game, people

[*Continued on page* 101]

Fairchild 440 turntable

E I Picturescope

What's that? Berkshire Mills experimenters call it an ultragram—a doodle made with ultrasound.

New A-shelter gimmick is pedal-powered generator to charge wet cell and provide electric power.

Aerial photo was split 250,000 ways, stored on magnetic tape as signals and then played back in a new computer recognition study at Cornell.

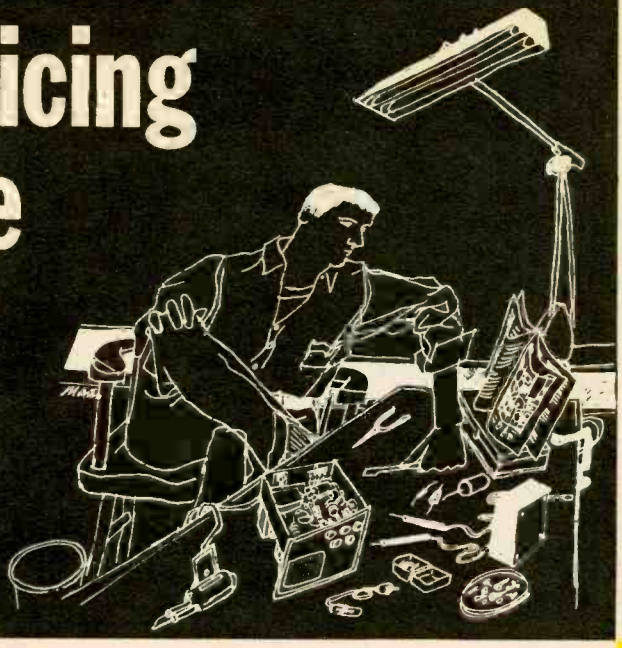
A mere 50,000 watts is consumed by giant light bulb fashioned by Toshiba. It operates on 100 volts and illuminates a newspaper at 1,968 feet.

A transducer is being installed in football helmet by this student at Northwestern U. to study shock suffered by player in a game. Data are telemetered to sidelines for analysis in helmet design study.

CB Servicing Made Easy

Part 2

By Herb Friedman 2W6045



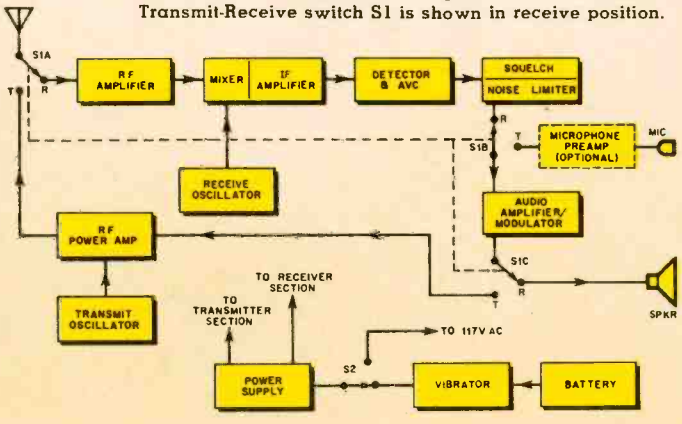
LAST ISSUE (May '62) we investigated the basic problems and trouble-shooting procedures for CB power supplies, audio and IF stages. We will now check out the receiver's RF and oscillator sections and take a look at alignment techniques.

Receiver Oscillators. Referring to the block diagram in Fig. 1, you can see that the receiver oscillator (as differentiated from the transmitter oscillator) feeds a mixer tube. Aside from the fact that the two functions—oscillation and mixing—in CB rigs usually take place in separate tubes, the oscillator performs the same function in a superheterodyne CB receiver as it does in a five-tube AC/DC radio.

Two common types of oscillators are shown in Fig. 2. These are the crystal controlled (A) and the tunable oscillator (B), also called the receiver VFO (variable frequency oscillator).

The best indication that an oscillator circuit is functioning is the presence of a negative 3 to 5 volts on the oscillator tube's grid. Some units may run grid voltages as high as —30, so set your VTVM

Fig. 1. Block diagram of a typical CB transceiver. Transmit-Receive switch S1 is shown in receive position.



to the appropriate range. Set the VTVM function switch to —DC volts and connect the common lead to ground, the DC probe to the oscillator grid, Fig. 2-Z.

If you fail to read the proper negative oscillator voltage on a crystal-control receiver, first check the crystal. Replace the crystal or, better yet, test it with an instrument such as the CRYSTalign-METER. In addition to testing for GOOD-BAD, this unit indicates the crystal's activity, which directly affects the receiver's sensitivity.

A word of caution on measuring oscillator grid voltages with a VTVM: If your VTVM is one of the ancient models without an isolating resistor in the DC probe, the probe capacity can detune the oscillator and kill the negative voltage. For this same reason you cannot use a VOM to check oscillator voltage.

If the oscillator and IF stages are working, the difficulty may be in the RF amplifier, though this is rare. Set your RF signal generator to provide a

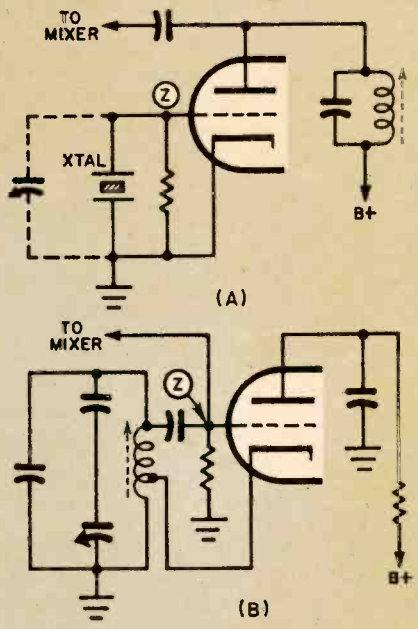


Fig. 2. Crystal-controlled receiver oscillator (A) variable oscillator (B) are typical. Both these types may feed separate mixer tubes.

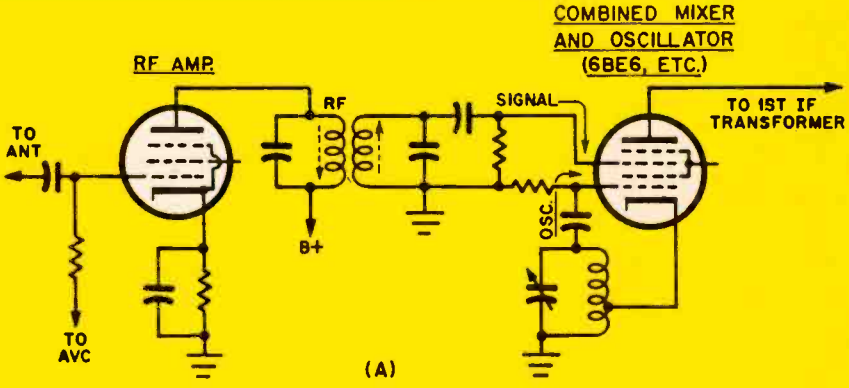
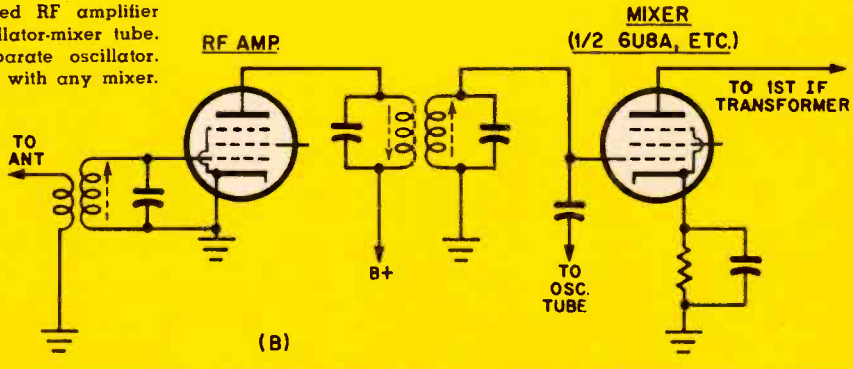


Fig. 3. (A) Simplified RF amplifier with combined oscillator-mixer tube. (B) Mixer with separate oscillator. Any RF amp works with any mixer.



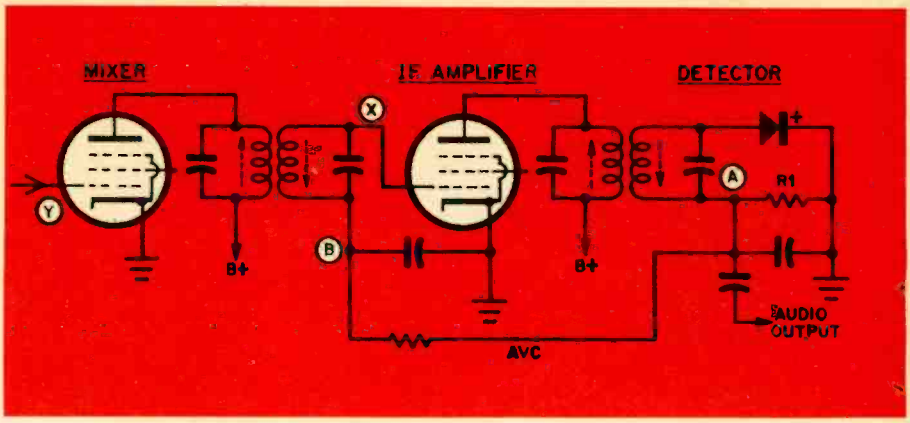


Fig. 4. Mixer's output feeds one or more IF amplifier stages. Detector stage follows. Test points are indicated by letters.

modulated 27-mc signal and connect its hot lead in series with a 5-mmf capacitor to the plate of the RF amplifier tube (see Fig. 3). Slowly tune the generator through the CB frequency range. A tone in the speaker indicates the RF output transformer (or coupling capacitor), the mixer and the oscillator are functioning. (If no tone is heard, the coupling between the RF amplifier and the mixer grid is defective.) Next, connect the generator to the RF amplifier tube's grid and check for the tone. Finally, connect the generator leads directly across the antenna jack; failure to hear the tone indicates a defective input transformer (or tapped coil). In electronically switched rigs the input capacitor may be at fault.

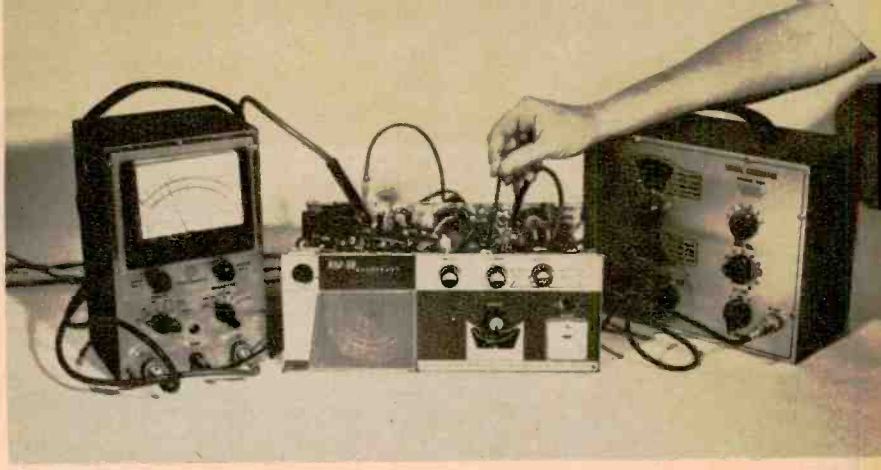
Aligning the Receiver. Contrary to the prevailing opinion among CBers, receivers do *not* need frequent alignment. Manufacturers deliver their units with maximum alignment and the CBer rarely can improve on the factory adjustment. IF transformers are delicate; the less tinkering with them, the better. However, there are occasions when alignment is in order; a kit transceiver usually will benefit from alignment with a signal generator. And alignment must be checked when an IF transformer, oscillator or RF coil is replaced. After a year or so of use, touching up the coils may be a good idea, but in general, unless there's a real need, keep your alignment tool out of the rig.

Tunable Receivers. Prepare the receiver for alignment by setting its tuning capacitor's plates to full mesh, unless stated otherwise in the unit's service notes. Set the VTVM to a 3-to-5-volt negative DC range, connect the common lead to ground and the DC probe to the top of the diode load resistor R1 (see Fig. 4-A). R1 may actually be several resistors in series. If you cannot determine the diode load, connect the DC probe to point B.

Warm up the generator for at least half an hour and set it to the transceiver's IF frequency. Set the generator's function switch to unmodulated RF and output control to zero. Connect the generator's common (ground) lead to the chassis near the IF section and the hot lead in series with an .001-mf capacitor to the grid of the *last* IF stage, Fig. 4-X.

Turn on the transceiver and adjust the generator's output control until the VTVM connected to the AVC line reads about 1 volt negative. Using an insulated alignment tool, first adjust the bottom and then the top slug of the last IF transformer (one closest to the detector) for maximum meter reading. After each alignment step, reduce the generator output to maintain an approximate —1 volt AVC reading. Perform the procedure with the other IF transformers all the way back to the mixer grid. Remember to use a 5-mmf series capacitor when connecting the generator to the mixer grid.

Since signal generators usually do not have the band spread necessary for accurate CB dial calibration, you will



Standard RF signal generator and VTVM are used to align the IF stages of a CB rig.

Multi-purpose CB test set by Seco performs a wide variety of tests, including crystal activity checks.

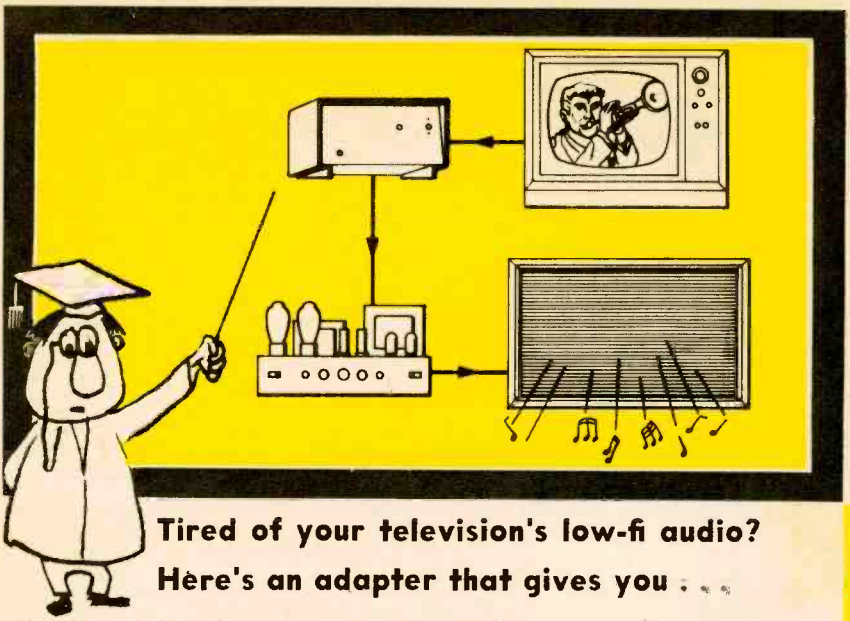
have to use either a CRYSTalign-METER, EI's CB Signal Generator (May '62) or improvise. If you have access to a CRYSTalignMETER, plug one of your transmit crystals into the unit and you will have an *accurate* CB signal generator. EI's generator works the same way.

With the VTVM connected across the diode load resistor as before, set the transceiver's tuning dial to the frequency generated by the CRYSTalign-METER, etc., and tune the receiver's oscillator for maximum VTVM reading. (Move the signal source away from the transceiver for minimum meter indication, thereby insuring maximum accuracy.) Some rigs have complex tracking adjustments requiring dial alignment at three points. Their instruction manuals are exact as to dial alignment procedure and should be followed to the letter.

The final step is RF amplifier alignment. Connect an antenna to the transceiver and tune in a generated signal around channel 9. Peak the antenna input transformer and the RF amplifier plate coil for maximum meter reading. This completes the alignment.

Crystal-Controlled Receivers. You may wonder why a receiver that's crystal-controlled requires alignment. For the answer, let's take a look at a receiver with a 455-kc IF strip. When receiving channel 9 (27.065 mc), the crystal is cut for 26.610 mc—the difference in frequency being 455 kc. Now if the crystal were off-frequency only 1 kc, it would still be within .005% toler-

[*Continued on page* 104]



Tired of your television's low-fi audio?

Here's an adapter that gives you . . .

HI-FI SOUND FROM YOUR TV

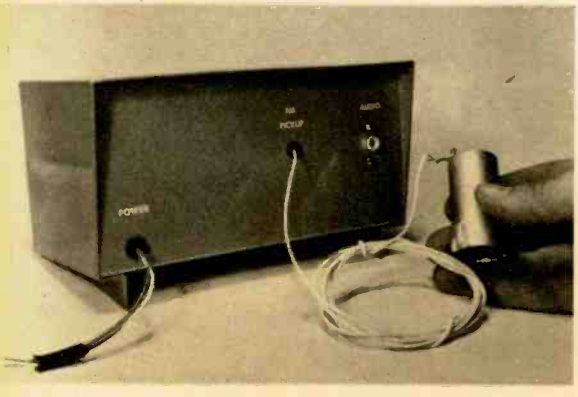
By Len Buckwalter, Contributing Editor

HAVE YOU been bothered by the low-fi sound of your TV set? As you probably know, the audio portion of TV is broadcast in FM and therefore has excellent quality—until it struggles through the skimpy audio section and out the 4″ speaker of the average TV receiver.

To improve this situation several methods have been used to pick up TV sound and feed it to a hi-fi system. Unfortunately, two of the most popular techniques can be dangerous. Wiring to the TV set's volume control or even clipping leads to its speaker could make your entire hi-fi rig a 117-volt death trap if the TV is a transformerless job.

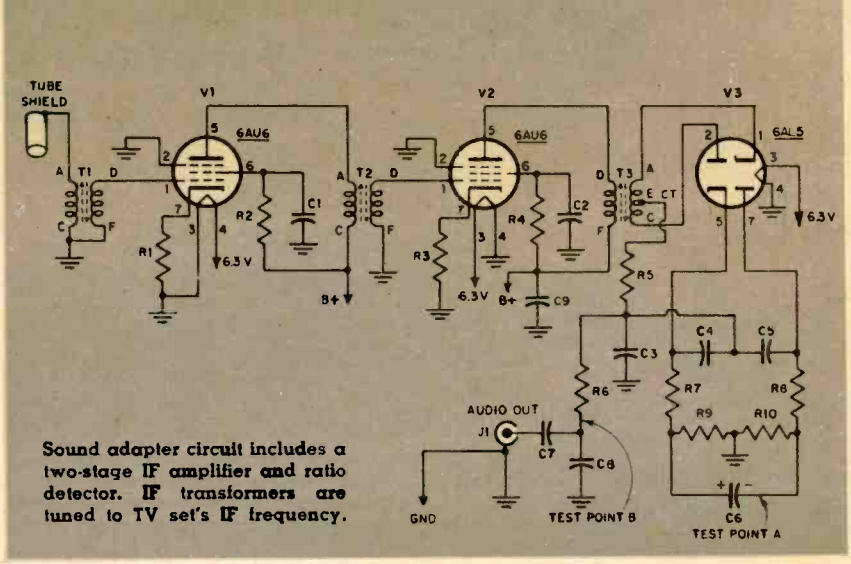
And even if your set is one of the better transformer-operated models, tapping in at the volume control or speaker terminals still introduces all the distortion inherent in its low-fi detector and audio circuits.

Compact cabinet houses 3-tube adapter. Power is tapped from amplifier or a separate power supply.



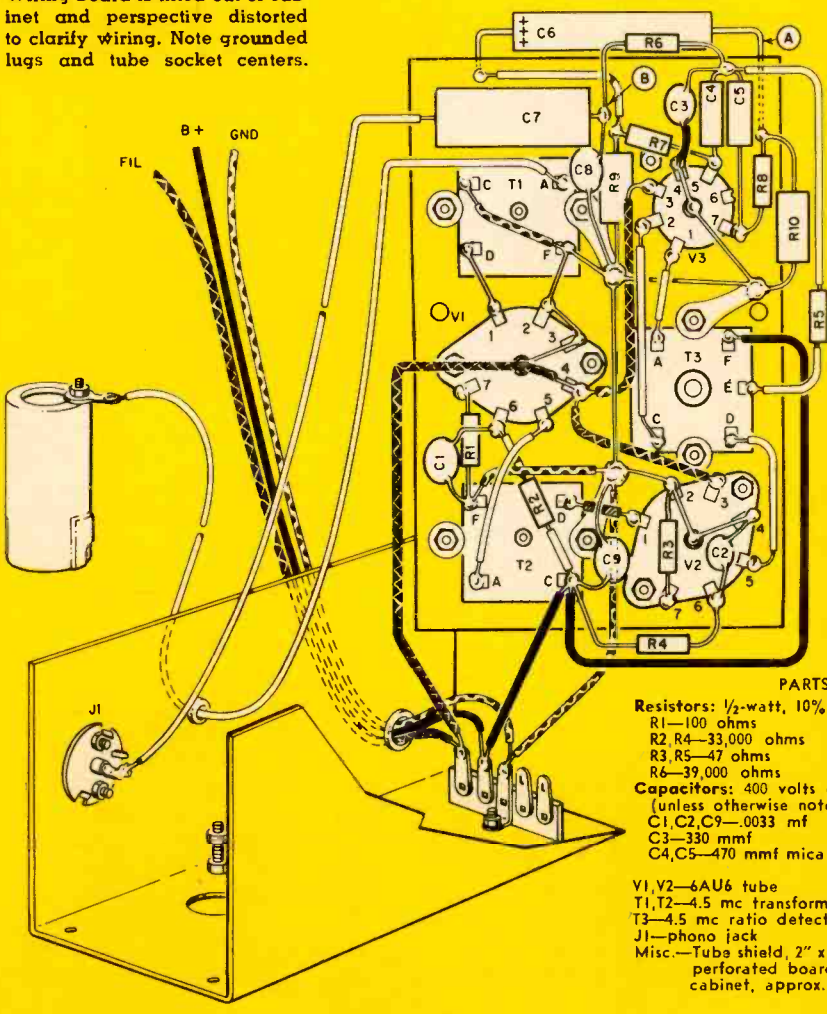
The Adapter described here eliminates all these problems and will work with any modern TV set with an IF of 4.5 mc. It picks up the TV audio in its most undistorted form—while it is still an FM signal in the TV set's IF stages. Live or video tape programs sparkle with the fidelity of regular FM broadcasts.

The Adapter incorporates a two-stage 4.5 mc IF amplifier and a ratio detector. To use it, simply slide the pickup (a tube shield) over the appropriate IF tube in your TV. Make sure the shield



Sound adapter circuit includes a two-stage IF amplifier and ratio detector. IF transformers are tuned to TV set's IF frequency.

Wiring board is lifted out of cabinet and perspective distorted to clarify wiring. Note grounded lugs and tube socket centers.



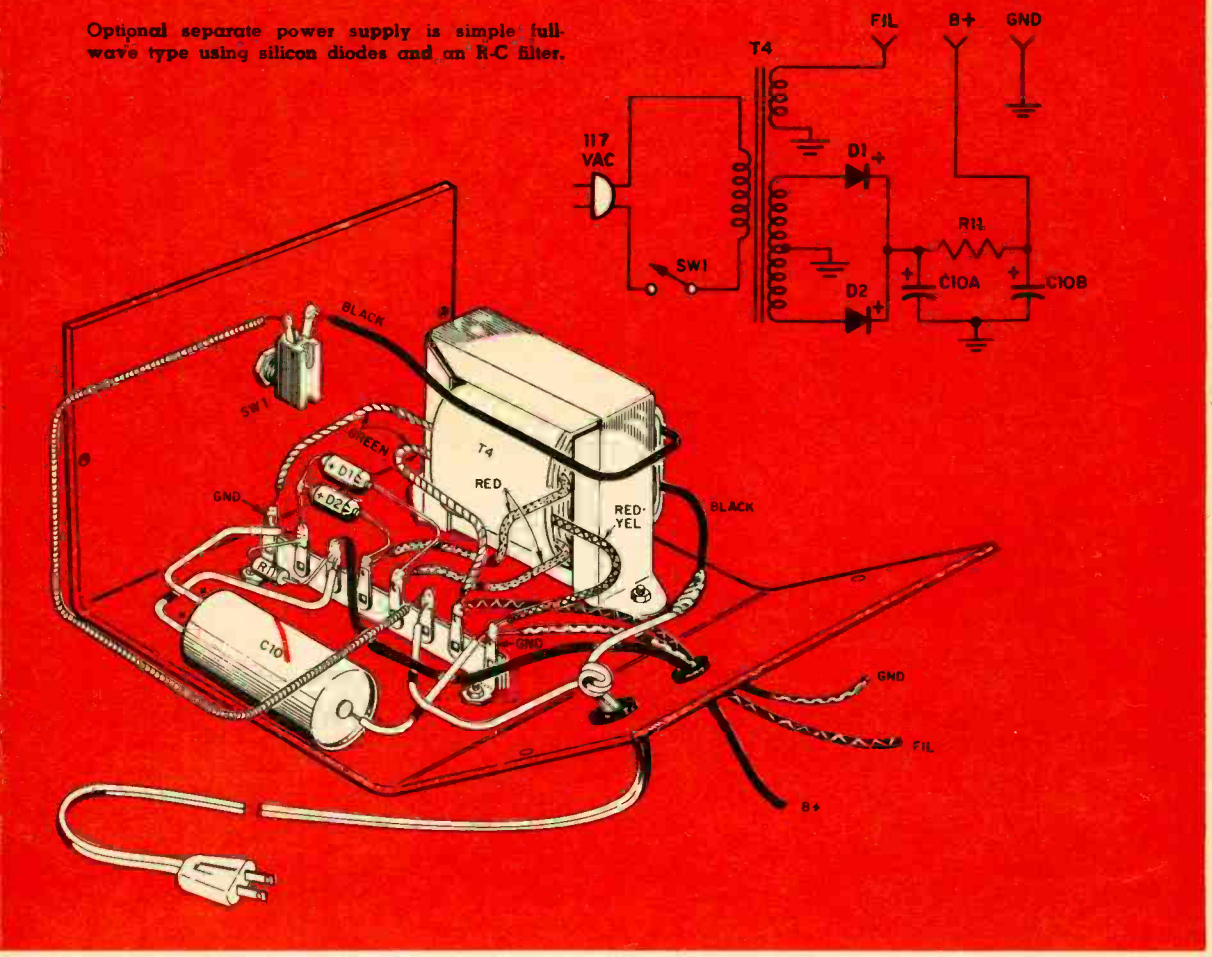
PARTS LIST

Resistors: ½-watt, 10% unless otherwise noted
R1—100 ohms
R2,R4—33,000 ohms
R3,R5—47 ohms
R6—39,000 ohms
R7—1,000 ohms
R8—1,500 ohms
R9,R10—6,800 ohms

Capacitors: 400 volts or higher, disc types (unless otherwise noted)
C1,C2,C9—.0033 mf
C3—330 mmf
C4,C5—470 mmf mica
C6—10 mf @ 25 v. electrolytic
C7—.05 mf paper
C8—.002 mf

V1,V2—6AU6 tube
V3—6AL5 tube
T1,T2—4.5 mc transformer (Miller 1466)
T3—4.5 mc ratio detector trans. (Miller 1468)
J1—phono jack
Misc.—Tuba shield, 2" x 1" with internal spring; perforated board, 4½"x3⅛"; Aluminum cabinet, approx. 3½"x7"x3⅜"

Optional separate power supply is simple full-wave type using silicon diodes and an R-C filter.



POWER SUPPLY PARTS

C10A,B—40-40 mf @ 150 v., dual-section electrolytic capacitor
R11—1,500 ohm, 1 watt
D1,D2—silicon diode rectifiers (Sarkes-Tarzian K-200 or equiv.)
T4—Power transformer, secondary: 250 v. center tapped (125-0-125) @ 25 ma; 6.3 v. @ 1 a.
SW1—SPST toggle switch
Misc.—8-lug terminal strip; cabinet, 5"x4"x3"; line cord, etc.

is not grounded, since its job is to serve as a capacitance pickup for the IF signal. No other wiring or connection to the TV is necessary. A standard shielded cable between the output of the Adapter and the *TV* or *Aux* input on your hi-fi amplifier completes the hookup.

As shown in the photos, the Adapter is packaged in two metal cases. The optional power supply was built separately since most hi-fi amplifiers can be tapped in to provide the modest power requirements of the unit. A filament voltage of 6.3 volts AC or DC at .9 a. and 140 volts DC at 10 ma is required. If higher B+ is supplied by the amplifier, use a series dropping resistor (about 10,000 to 20,000 ohms, 4 watts) to lower the B+ to 140 volts. Eliminating the power supply shown will cut total cost significantly.

Construction. Most wiring should be done before the perforated-board chassis is installed. Follow the pictorial, taking notes of these points. Each of the three 7-pin tube sockets used should have a centerpost to serve as a grounding point. Bare wire interconnects the sockets and joins with the three solder lugs (one under a stud of each transformer) to ground the transformer cans.

Before installing the board, drill three ¾-inch holes in the bottom of the cabinet. These serve both for ventilation and to provide access to the bottom adjustments of the transformers. Drill several holes in the rear of the cabinet for further ventilation. Mount the chassis board with two 6-32 screws, ¾" long—located on each of the long dimensions of the board. Use three nuts on each screw; one to secure the screw to the bottom of the cabinet, and two to lock the board onto the screw. This spaces the board from the bottom of the cabinet and prevents shorts.

Alignment Touch-up. You'll need a vacuum-tube voltmeter for the simple alignment required. While the two IF transformers (T1, T2) have exposed tuning slugs, the ratio detector (T3) has recessed slots. A narrow screwdriver must be used since the slots are about half the width of the can's access holes.

If the Adapter is built correctly, the TV set itself makes a fine signal generator. Moreover the transformers have been pre-set to 4.5 megacycles, making alignment easy. First connect a shielded audio cable from J1 to your hi-fi amplifier. Next, locate the TV's sound IF tube from the tube location function diagram inside the set's cabinet. Or use a schematic of the set.

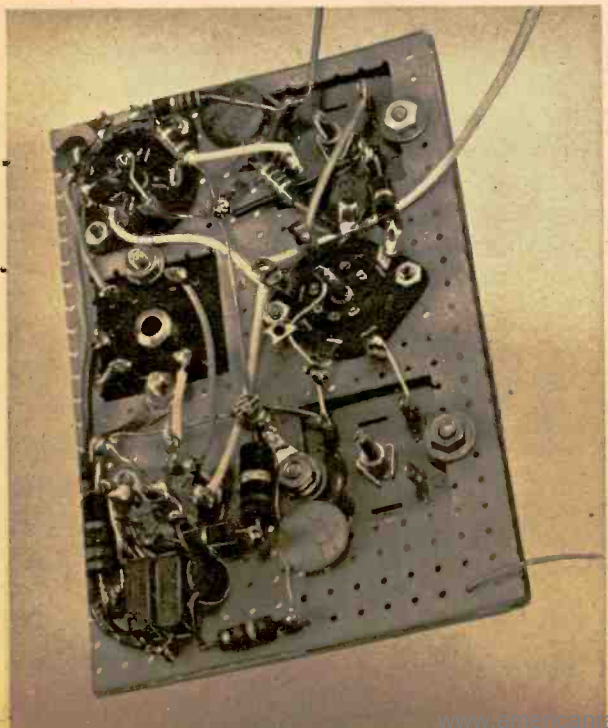
A spring-loaded type tube shield serves as the pickup, its coil spring supporting the shield above possible contact with the chassis. If necessary you can insulate the tube shield with tape. Lead the wire from the shield pickup out through one of the ventilation holes in the rear of the TV set.

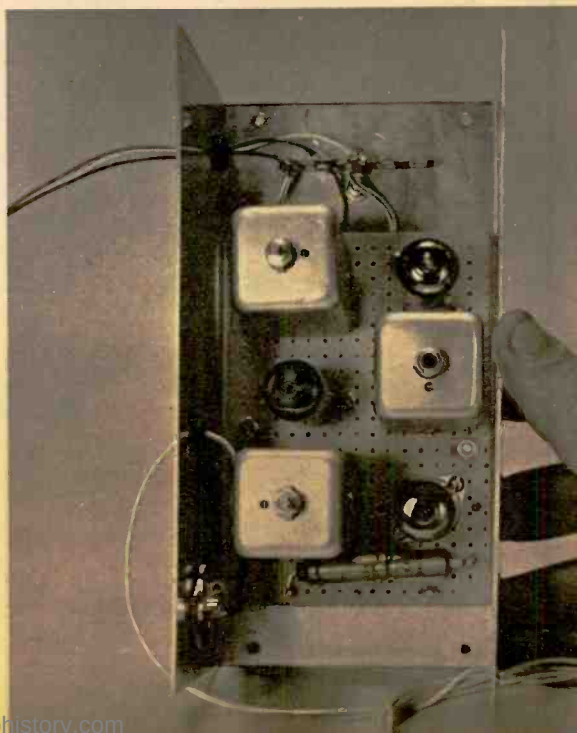
Now remove the top cover of the Adapter and apply power. Carefully tune in a strong TV channel and some audio should be heard through the hi-fi system. Note that the TV's volume control has no effect and may be tuned down after the channel is tuned in.

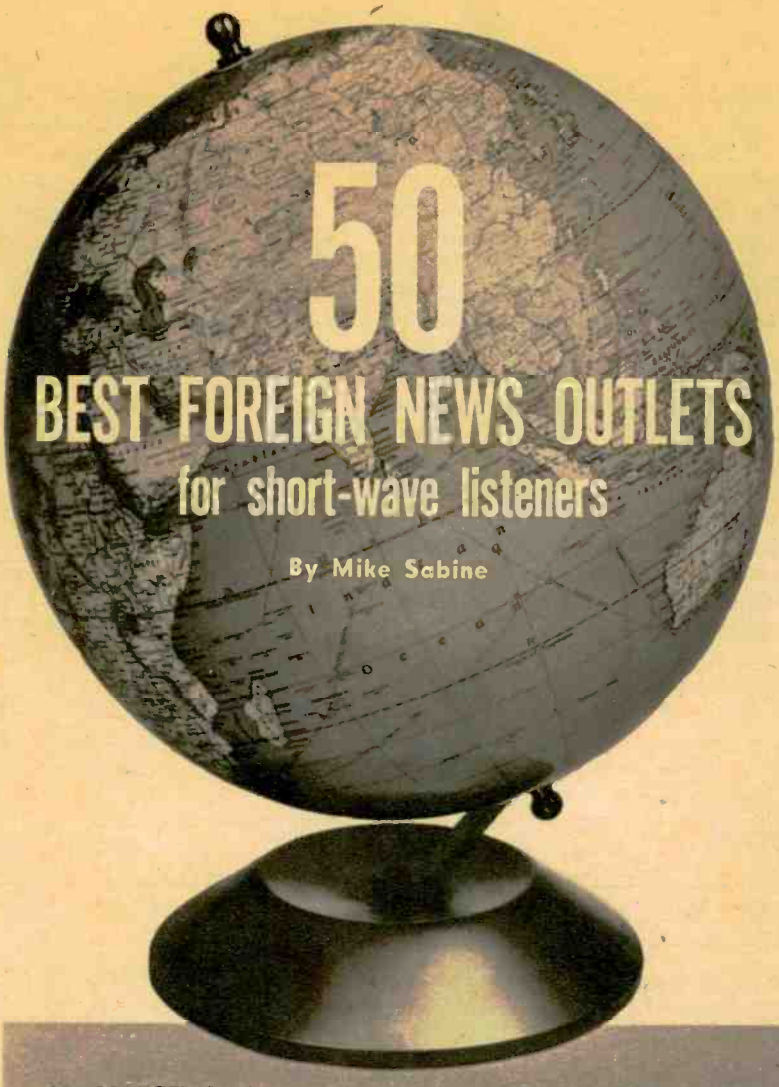
There are two test points shown in the drawings. Set up the VTVM to negative DC volts on a range of about 10 volts. Clip the ground lead to the Adapter's metal cabinet and touch the hot probe to (A) the negative end of C6. Tune the top and bottom slugs of T1 and T2 for maximum reading. Once this is done, you may find that rotating the fine tuning knob on the TV will raise the

[*Continued on page* 101]

Bottom of circuit board before installation in cabinet. Mounted in cabinet, board sits on small standoffs.







50 BEST FOREIGN NEWS OUTLETS for short-wave listeners

By Mike Sabine

AMONGST the hundreds of short-wave broadcast stations in the world you can find more ways of reporting a given news story than you could list in your kid brother's composition book. But that is what gives special interest to news reports from foreign stations. Listening to English-language newscasts from abroad doesn't so much give you the news (you can get that from your local broadcast station) as it tells you how a particular world event is viewed in other lands, or how local happenings are seen at the place where they occur. In addition, you learn how people of various political persuasions treat the news of the day. Our list of the 50 best English-language news programs from overseas represents a sampling of all political opinions from fascist to communist and a geographical spread that covers the globe. Most of these stations are relatively easy to pull in from any point in North America. But a few, such as Rhodesia and Guinea, require considerable skill and patience.

	COUNTRY	STATION	KC	TIME (EST)
1.	Albania	R. Tirana	7082	1730
2.	Argentina	RAE	9690	2200, 0002
3.	Australia	R. Australia	11710	0715
4.	Belgium	Belgian NBS	11805, 9705	1900
5.	British Guiana	ZFY	3265	Early eve.
6.	Congo Rep.	R. Brazzaville	11725	2015
7.	Rep. of Congo	R. Leopoldville	11755	2130
8.	C. China	R. Peking	15150, 9480	2000
9.	Cuba	R. Havana	5990	2200
10.	England	BBC	9825, 21675	1615, 1030
11.	Egypt	R. Cairo	11915	1700
12.	Finland	OIX4	15190	0630 TuSa
13.	E. Germany	R. Berlin	11765	1000, 1100
14.	W. Germany	V. Germany	9605, 9735	1715, 0000
15.	Ghana	R. Ghana	11800	1600
16.	Greece	R. Athens	17745, 15345	1730
17.	Guinea Rep.	R. Conakry	11965	1525
18.	India	AIR	11715	1000
19.	Indonesia	RRI	11795	0615
20.	Iran	R. Tehran	7024	1515
21.	Israel	Kol Israel	9009	1515
22.	Ivory Coast	R. Abidjan	11820	1345
23.	Japan	R. Japan	15135, 9505	1930, 2315
24.	Jordan	R. Amman	7155	2055
25.	Katanga	R. Katanga	11875	1515
26.	S. Korea	KBS	15125, 11925	0030
27.	Liberia	ELBC	3225	1645, 0200
28.	Morocco	R. Maroc	15345, 9505	1330
29.	Mozambique	R. Clube de M.	15300	1100 Fr
30.	Netherlands	R. Nederland	11730, 9490	1630
31.	Nigeria	W. Nigerian BS	6185	0030
32.	Pakistan	R. Pakistan	11672	1500
33.	Philippines	Far Eastern BC	11920	1100
34.	Portugal	R. Lisbon	17895, 17880	1330
35.	Senegal	R. Senegal	11895	1530
36.	Sierra Leone	SLBC	3315	0116
37.	S. Rhodesia	Federal B'casting	4911	0000
38.	S. Africa	R. S. Africa	15085	1400 TuThSa
39.	Spain	V. Spain	9360	2230, 2330
40.	Sweden	R. Sweden	9725, 11805	2130
41.	Syria	R. Damascus	15165	1500
42.	Taiwan	V. Free China	17785, 11815	2010
43.	Thailand	Overseas BS	11930	0530
44.	Tunisia	R. Tunis	9635	1600
45.	Turkey	R. Ankara	9515	1815
46.	U.S.S.R.	R. Moscow	9720, etc.	1800
47.	U.S.	V. America	9765	1800-2230
48.	Vatican	R. Vatican	17840	1115
49.	Windward Is.	WIBS	15085	Late aft.
50.	Yugoslavia	R. Belgrade	9505, 6100	1800

CAN YOU SPOT AN FCC MONITOR

GLANCE down the row of cars in the photograph above and see if you can pick out the Federal Communications Commission monitoring vehicle—the Big Ear. Parked among other cars at a recent Citizens Band get-together, the FCC roving mobile attracted little attention because it gave no outward clue to its contents—several hundred pounds of monitoring equipment.

As with all the FCC's Big Ears, this one was a veritable lab on wheels that could pick up, measure and record anything from a too-talky CBer to a hidden transmitter being used by Rudolph the Spy. But from its two whip antennas you might think the car merely belonged to some especially active CBer.

You may believe the FCC monitors are engaged in some sneaky cloak-and-dagger operation but a talk with the man behind the wheel of this car would change your mind. The man is Paul W. Gilligan and he's Assistant Engineer-In-Charge of the FCC's Boston bureau. Our talk with Gilligan was much like our other encounters with FCC personnel. He was pleasant and eager to explain that his job is not to harass CBers but to enforce the rules that keep the

band usable for the greatest number of licensees. It was through Gilligan's helpfulness that we were permitted to poke our camera inside the mobile unit and come up with the rare set of photos shown here.

Monitoring CB presents a special problem. Since the band by definition is short range, monitoring must be done close in. To handle this enormous job, mobile units of the type shown here usually listen while enroute to a higher-priority call. When something questionable is heard the car stops and performs an intercept. A portion of the offending transmission is recorded on tape for evidence and used to write up a citation when the engineer gets back to his office. The citation is mailed to the licensee and must be answered within three days.

This procedure is used chiefly to detect operating violations: improper use of the band, incorrect station identification, breaking the five-minute rule, etc. More specialized equipment is used to check transmitter performance, such as off-frequency operation and excessive harmonics.

Another job of the mobile unit is to work closely with a series of permanent FCC monitoring stations dotted around the country. These fixed monitors deal mainly with long-range listening and direction-finding, but they do refer cases to local FCC offices. Thus, the mobile may be dispatched into the field to track down individual violators.

Chock-full trunk includes cables for setting up field antennas and inverter to supply 117 volts.

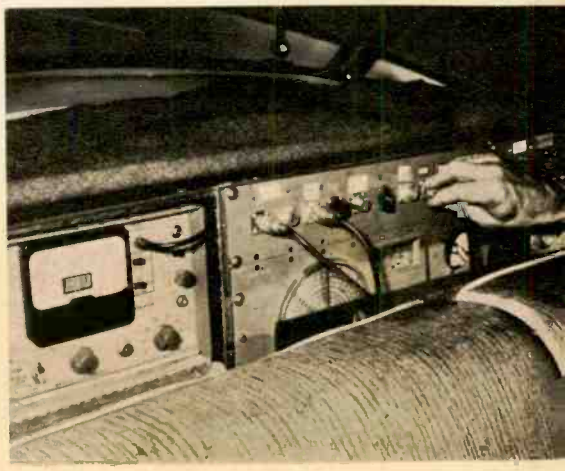
There's a brighter side to the activities of a mobile monitor. It's in cases of TVI. Packed in the trunk of the car is a TV set equipped with filters for suppressing television interference from CB, ham or other transmitters. Placed alongside a complainant's set, it can prove that interference is curable. This assumes that the CBer or ham has a clean rig and that the trouble stems from the TV's inability to reject normal transmitter signals.

Oh, yes, the monitoring car. It's the Plymouth closest to the camera.

—Len Buckwalter, 1W5733

Receiver with sensitive S-meter monitors hams and CBers, pops out for use in hotels, motels.

Blanket conceals field-strength meter (left), two receivers and a patch panel in rear seat of car.



If you can't make up your mind . . .
and don't have a coin to flip . . .

THE ELECTRONIC DECISION MAKER

By Ben Sherwood

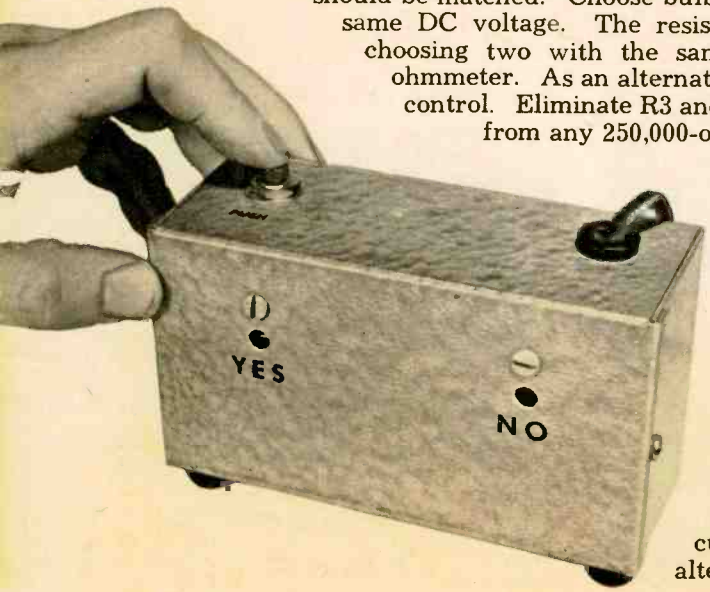
TO MAKE a decision, you ordinarily tote up the pros and cons and go with the long side. It's when the pros and cons are equal that you have trouble, and that's the time to bring out your handy-dandy little giant Decision Maker, an easily built gadget that electronically flips an imaginary coin for you.

The Decision Maker also can be used in a variety of games involving simple choices, such as Put 'n' Take, Odd or Even and Match The Coin.

When you plug in the Decision Maker its two small bulbs, labeled *yes* and *no* (or *put-take*, *heads-tails*, etc.), light up. When you push the button one or the other bulb goes dark; your decision is made by the bulb that remains lit.

Construction. EI's Decision Maker can be assembled in a metal, plastic, or wooden cabinet. Costs are held down by using NE-2 neon bulbs, mounted behind small holes in the box with cable clamps. You can make the unit self-contained by replacing power supply components SR1, R1 and C1 with a 90-volt battery or two 67.5-volt batteries in series. Polarity is not important.

For truly random choices, the bulbs and resistors R3 and R4 should be matched. Choose bulbs which light at about the same DC voltage. The resistors may be matched by choosing two with the same value as read by an ohmmeter. As an alternative, you can add a balance control. Eliminate R3 and R4 and connect the leads from any 250,000-ohm pot to the corresponding lettered points shown in the diagram. Then you can use unmatched neons. Adjust the pot so *yes* and *no* occur an equal number of times in a large number of trials. When constructing the unit keep all wiring insulated from the cabinet.



Operation. When voltage is applied to the circuit the two bulbs light alternately but at such a fast

rate that both appear to remain lit continuously. When the first bulb (let's say NL1) fires it becomes a virtual short circuit and the voltage across it drops. Now C2 charges through R4 from C to B, preventing NL2 from firing until C2 reaches full charge. NL1 remains lit during this period.

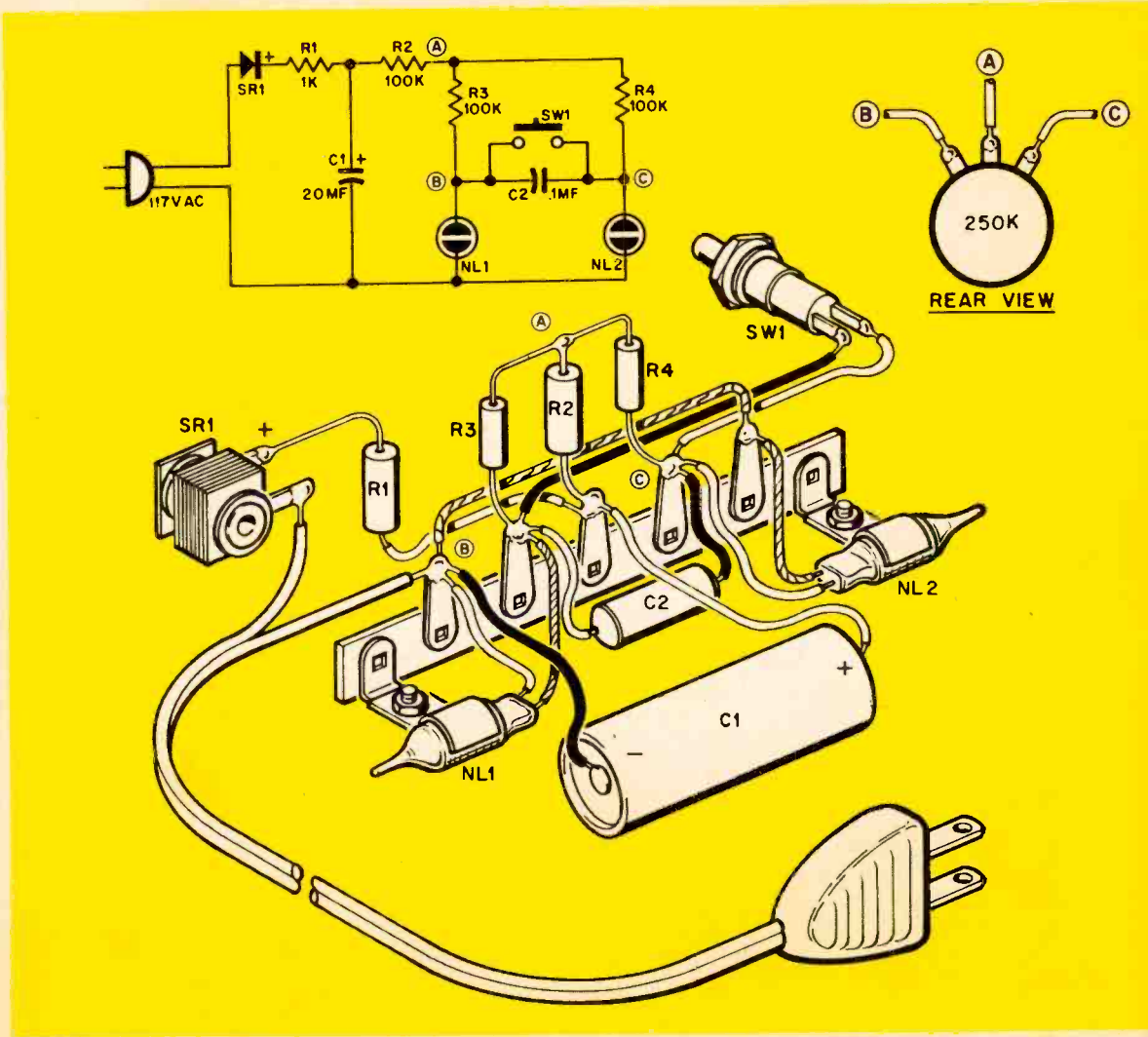
When the charge on C2 reaches NL2's firing voltage, NL2 fires and discharges C2, which then shorts out and extinguishes NL1. C2 promptly starts charging in the opposite direction through R3. NL2 remains lit until C2 reaches NL1's firing voltage and then is extinguished as the cycle is repeated.

Repetition rate depends on voltage and the values of R2, R3, R4 and C2. As these values increase, the rate decreases.

The Decision Maker's ability to act lies in the fact that when SW1 is depressed C2 is shorted and the action stops with one bulb remaining lit. Chance alone chooses the bulb.

PARTS LIST

R1—1,000 ohm, ½ w. resistor
R2,R3,R4—100,000 ohm, ½ w. resistor
C1—20 mf, 150 v. electrolytic capacitor
C2—.1 mf, 200 v. or higher paper capacitor
NL1,NL2—neon lamps type NE-2
SW1—SPST push-button
SR1—20 ma selenium rectifier
Misc.—2—¼" cable clamps, 5-lug terminal strip, line cord and plug, hardware, cabinet, etc.



MY BROTHER is a nut. A hi-fi nut. Believe me, they are the worst kind. He spends his time upstairs brainwashing preamps, crossovers, L-pads and such audio junk. Just think, he *could* be working on something worthwhile, like radio control. Now, *there's* a hobby. Just the other day I was putting the finishing touches on a neat little R/C transmitter when Dale (that's his name) came bursting in and dragged me off to see the latest addition to his hi-fi rig.

"Isn't she a beaut?" he murmured reverently, pointing to an ugly pine box riddled with holes of haphazard sizes.

"Yeah," I mumbled, figuring my brother had finally gone off his rocker and taken to constructing houses for transient birds. "But what does it *do*?"

"Man, that's my ultra-bass speaker system. Why, I've got a low-efficiency, high-compliance woofer in there that. . . ."

"Whoa, and spare me the details. Just show me whether it sounds better than it looks."

Dale gingerly lowered the tone arm on a jazzed-up record that would sound good on an Edison gramophone. It was one of those demos that began with a thunderstorm in Wisconsin and ended in New York Harbor.

"Not bad," I admitted when the last blast of the Queen Mary faded.

"Not bad?" Dale screamed. "That was the sweetest, cleanest bass you'll ever hear, you ninny."

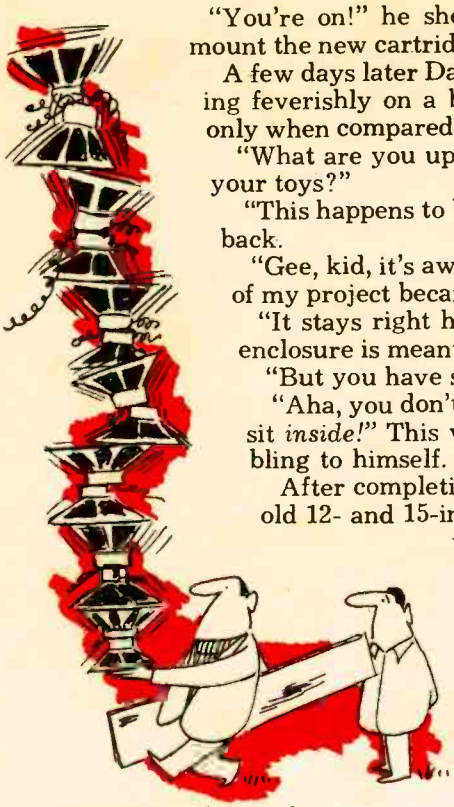
"Well now," I said, hitching up my belt, "when it comes to purity of bass I'll stand by the old, reliable infinite baffle."

"Oh, kid. You've been working on those R/C toys too long. You may be hip to proportional control but you don't know beans about audio."

"Izzat so?" I bristled. "It just so happens I've been brushing up on electromechanical reproducers. Why, even Mr. Bozak would agree that the purity of bass from an infinite baffle is unmatched by any other enclosure."

"You talk big, kid, but you couldn't build a birdhouse," Dale said, fondly patting his botched baffle.

"Well now, I bet I could throw together an infinite baffle that would out-bass that orange crate of yours. As a matter of fact I'll wager an M7-D cartridge against a DeBolt servo that my bass-box will make you think you never heard 50 cycles before."



"You're on!" he shouted, gleefully searching for a plug-in shell to mount the new cartridge in.

A few days later Dale sauntered into the back yard while I was working feverishly on a box-like structure that was modest in dimension only when compared to a blimp hangar.

"What are you up to now?" he growled. "Building a doll house for your toys?"

"This happens to be the ultimate in infinite baffle enclosures," I shot back.

"Gee, kid, it's awful big," he said in hushed tones as the immensity of my project became evident. "It'll never fit in my room."

"It stays right here," I said. "The sound that emanates from this enclosure is meant for all nature."

"But you have speakers all around. Which side do you sit on?"

"Aha, you don't sit on *any* side," I said, opening a little door. "You sit *inside!*" This was too much for Dale. He stumbled away mumbling to himself.

After completing carpentry work I spent several days mounting old 12- and 15-inch speakers, wiring them in a series-parallel network to match the output impedance of Dale's amplifier. The last step was to attach an iron pipe to the top of the enclosure and string wire across the yard and into Dale's window and hook it to his audio equipment.

The moment of truth arrived. As Dale and I approached the enclosure I could see he viewed it with skepticism. The mammoth structure, pockmarked with the backs of old speakers and topped with a spire that stabbed into the overcast sky, was truly a sight.

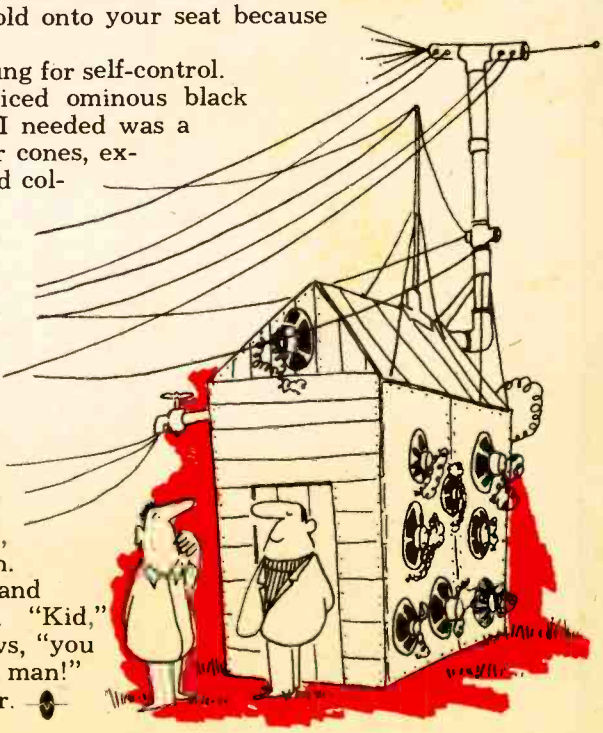
"In here," I said. "You sit on that little stool. After I shut the door I'll run up and spin that sound effects record. Hold onto your seat because you're going to hear some real bass."

"Go, man, go," Dale said weakly, trying for self-control.

Hurrying toward the house, I noticed ominous black clouds rolling in from the north. All I needed was a little rain. I could imagine the speaker cones, exposed as they were, becoming limp and collapsing. To my horror the first few drops fell, but before I could react a sound of doom shattered the air.

The sky was split by a bolt of fire that momentarily seemed to give my infinite baffle enclosure a direct connection to the Great Upstairs. As I gasped the iron pole slowly turned a cherry red and curled up like a tired worm. It was over in an instant; only a ring of burnt grass and the hiss of rain on the pole spoke of the awful bolt. "Dale!" I screamed, dashing through the now driving rain.

As I neared, the door swung open and Dale, pale and shaken, stumbled out. "Kid," he sighed, rubbing his singed eyebrows, "you have got a system. Spin that one again, man!" He shuffled inside and closed the door.



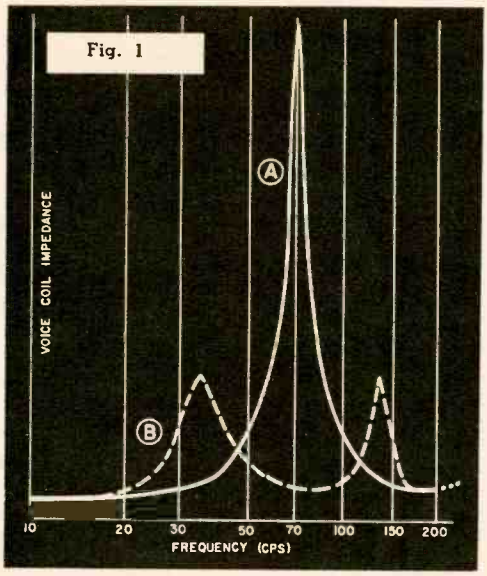
Tech Editor's Test Bench

by Larry Klein

A Baffling Problem *or* All Boxed In

IT MAY surprise you, but designing a small hi-fi speaker system is a lot more difficult than designing a large one. A case in point is the Duoflex, presented in this issue. Several brands and types of loudspeakers were tried and a lot of sawdust and impedance curve tracing sheets littered the floor of my workshop before I got satisfactory results.

The main problem in designing a system is resonance—the resonance of the loudspeaker mechanism itself. This resonance is mechanical, a product of the stiffness of the speaker cone suspensions. The looser the suspensions, the lower the resonance. And, all things being equal, the lower the resonance of the speaker in free air, the better its bass response.



However, speakers are not mounted in free air, and here's where the story gets complicated. As you know, the cabinet preserves the bass response of a loudspeaker by preventing the low-frequency pressure wave produced by the cone's forward movement from meeting the opposite-phased wave produced when the cone moves backwards a fraction of a second later. The speaker cabinet serves as barrier between the front and rear of the cone and thereby prevents the pressure waves from cancelling each other.

Here's where we encounter the big-*vs*-little problem. Let's say you take a good quality 12-inch speaker with a free-air resonant frequency of about 30 cps and mount it in a 1½-cubic-foot sealed enclosure. The air trapped in the box behind the speaker is relatively incompressible and hence prevents the speaker cone from moving freely. This has the effect of stiffening the cone suspension. If you were to remeasure the cone resonance in the box you would find it now peaks at around 70 cps. A listening test would tell you that the system has an unnatural boomy quality on the male speaking voice and is unable to reproduce cleanly any bass note below about 80 cps.

There are several ways out of this dilemma. One of the most popular is the bass reflex tuning technique. With the bass reflex baffle, the bigger the box—the better (up to a maximum of about 7 cubic feet). But a properly designed reflex system such as EI's Duoflex can be limited to bookshelf dimensions and still give good results.

Superficially, the only difference between the bass [*Continued on page* 112]

KIT EI REPORT

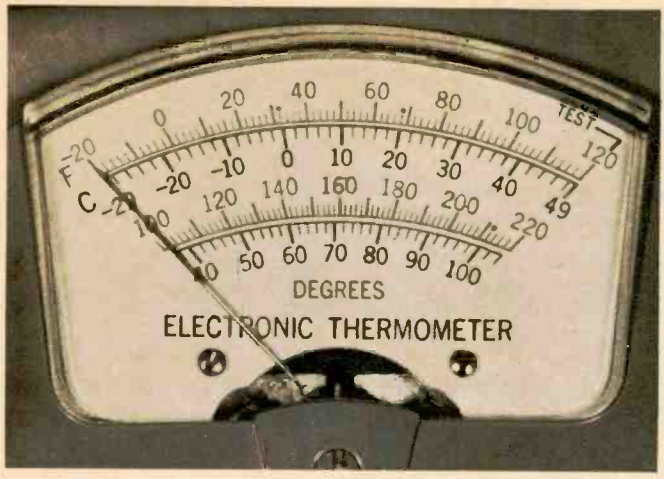
An Electronic Thermometer

EVER SINCE Sir Charles Wheatstone had his bright idea in the mid-19th Century, we've been getting accurate measurements by using the bridge bearing his name. The bridge circuit is like a balance scale: you put a known (or standard) quantity on one side and an unknown quantity on the other. Some sort of indicator shows the precise difference between the two. In general, the accuracy of a bridge is limited only by the accuracy of the standard.

In electronic measurements—where you are comparing a known resistance, capacitance or inductance against an unknown one—the theory of operation is fairly basic. But suppose you want to compare other physical phenomena by means of a bridge? How would you go about it? The answer lies in transducers. A transducer is a device that translates one type of energy into another. Some common transducers include a phonograph cartridge, which translates wiggles in a record groove into electrical energy; a photocell, which translates light into electrical energy; a loudspeaker, which translates electrical energy into sound, and a thermistor, which translates temperature into resistance.

It is the thermistor that concerns us here. Usually small enough to sit on the end of your finger (see photo), the thermistor can be designed for almost any temperature range and resistance value.

The thermistor's special quality is its ability to maintain an almost linear relationship between its internal resistance and applied heat. The hotter it gets, the lower its resistance. Typical thermistor ranges are 5,000 ohms at 0° C to 25 ohms at 40° C,



Closeup of the Novatherm's easily read meter face shows temperature ranges available. The bottom scale requires an accessory kit.

and 300,000 ohms at 0° to 100 ohms at 300°

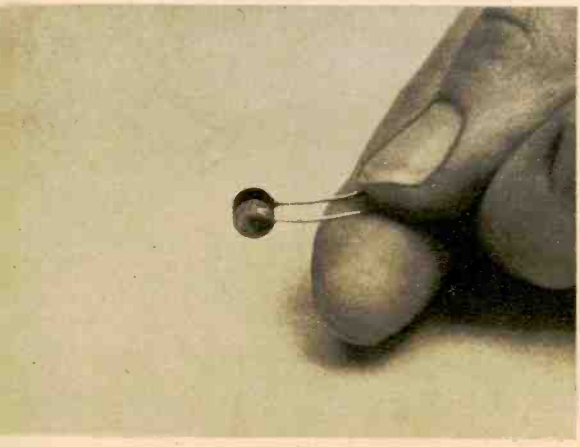
At hand is Radio Shack's novel kit called the Novatherm, an electronic thermometer utilizing thermistors in a bridge circuit. The instrument is powered by a 1.5-volt flashlight cell and a damped 200 microamp double-jeweled movement provides a direct temperature reading in degrees F and C.

Assembly is a straightforward one-evening job. Liberal use of color-coded wire and a well-done manual make it difficult to err. However, care is required in wiring the function switch. As in any instrument with a multi-contact switch, there are two things you must avoid. Don't drip solder into the contacts of the switch, and double-check every wiring connection before it is made. If you have a screw-holding type screwdriver it will facilitate final assembly, when you mount the parts board inside the cabinet.

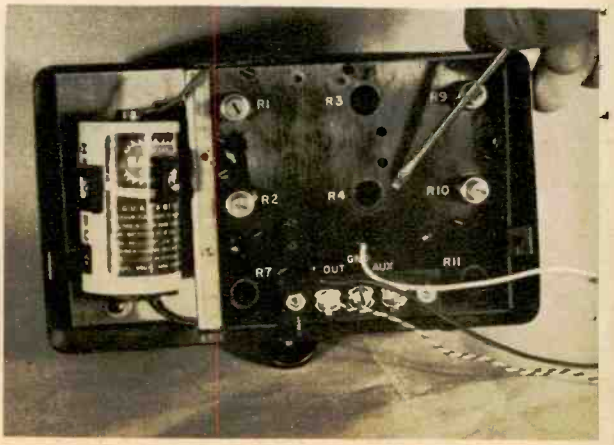
The basic range of the $19.95 kit is minus 20°-120° F (minus 29°-49° C). An accessory kit extends the range to 220° F. Since the high-temperature accessory kit is only a few dollars more, we recommend that you incorporate it at the time you assemble the Novatherm. This will save disassembly and back-tracking.

[*Continued on page* 104]

Heart of the Novatherm is the tiny thermistor. It can provide a remote reading over 1,000' of wire.



Most components are assembled on Bakelite rear panel. The empty spaces are for the accessory kit.



EI's ELECTRICITY Contest

THE RESPONSE over the last year to EI's Electricity Contest has been amazing to the Editors. Hundreds of our readers have put a great deal of time, thought and research into formulating their answers to the question, "What is electricity?" The entry below represents the final winner and the termination of our contest. In our next issue we will present a definition of electricity as given by an expert in the field.

HORACE R. BISSETTE

BOX 115

BATTLE CREEK, N.C.

ELECTRICITY

ALL MATTER IS ELECTRICAL IN NATURE AND CONSISTS OF ATOMS. EACH ATOM HAS ONE OR MORE ELECTRONS AND ONE OR MORE PROTONS. AN ELECTRON IS NEGATIVELY CHARGED. A PROTON IS POSITIVELY CHARGED. THESE PARTICLES EXERT EQUAL FORCE, ATTRACTING EACH OTHER BUT REPELLING THOSE OF THEIR KIND. PROTONS FORM THE CENTERS OF ATOMS. ELECTRONS ORBIT FREELY AROUND THEM. AN ATOM ORDINARILY IS NEUTRAL, HAVING AN EQUAL NUMBER OF ELECTRONS AND PROTONS. IF IT GAINS AN ELECTRON IT BECOMES A NEGATIVE ION. IF IT LOSES AN ELECTRON IT BECOMES A POSITIVE ION. NEGATIVE IONS REPEL FREE ELECTRONS. POSITIVE IONS ATTRACT THEM. THE RESULTING MOVEMENT OF ELECTRONS IS CALLED AN ELECTRIC CURRENT. THUS AN ELECTRIC CURRENT IS A FORCE THAT IS IONIC IN ORIGIN.

THE LISTENER

Notes for the short-wave listener and DXer

By C. M. Stanbury II

IS IT OR ISN'T IT? . . . One of the more confusing and controversial phases of DXing is the QSL card or letter—how to count them and what really constitutes an authentic verification. One of EI's DX Club certificate winners asks, "Can I count French Equatorial Africa, the Belgian Congo, Tangiers and the United Arab Republic twice if I verify them again now that they've changed names?"

A nice letter from WMIE in Miami, but is it a QSL?

Dear Mr. Stanbury:

Thank you for your letter requesting "reception verified" confirmation.

Enclosed please find our program schedule.

Dear Mr. Stanbury:

This will confirm your reception of KRSC November 3, 1953 from 12:30 AM to 12:25 AM Pacific Standard Time.

KRSC, Seattle, leaves no doubt about verification.

Unfortunately, there is no universal answer. A change in a name in itself does not constitute a new country, but when countries divide or unite the count becomes complicated. When a territory such as French Equatorial Africa splits up into smaller units, you should not count the same location or area twice. If your FEA QSL is from Radio Brazzaville, you should not verify it again as the Congo Republic. But you could verify as separate countries such former FEA districts as Tchad (4904.5 kc) and Gabon (7270 kc). In other words, one station should not represent more than one country.

When a small country is taken into a larger nation, the situation is different. A DXer who QSLed Tangiers as a separate country can now re-verify that same station as being in Morocco (but Morocco counts as only one country, of course).

As a rule of thumb on what is or isn't a country, we refer to the American Radio Relay League and Newark News Radio Club lists . . . and play it by ear.

On the matter of what is or isn't a QSL, there is room for a lot of argument. Take a look at the two actual letters from broadcasters shown on this page. I sent approximately the same report to each one. KRSC leaves no doubt that he is verifying my report. On the other hand, the top letter, from WMIE in Miami, appears to be a kind of thank-you note. It's nice and all that but it just never quite verifies my reception report. Would you count it as a QSL? [*Continued on page* 102]

MPX Q. & A.

HI-FI CLINIC

Distorted Stereo

I've recently purchased an FM multiplex adaptor manufactured by the same company that made my three-year-old tuner. I'm using an outdoor antenna in a good signal area. I have checked the tubes in my tuner and replaced two. The tuner alone performs well. However, I still can't get good stereo. During multiplex broadcasts the signal is distorted and accompanied by a high, steady hum. What can I do?

In a high-signal area, a quality tuner can be out of alignment and still perform adequately on mono FM. The steady hum (it could also be howl or motorboating) indicates the MPX adaptor is not receiving sufficient 19-kc pilot signal to synchronize. This may be due to a misaligned adaptor (unlikely), poor signal strength (your location and external antenna rules this out) or a poorly performing tuner. Take your tuner *and* adaptor to a service agency that has facilities for *aligning multiplex adaptors* as well as FM tuners.

Adding MPX

I have an imported AM-FM console and want to add multiplex to it. How would I go about adding the adaptor?

Frankly, we doubt that you will be able to do it. In any case, the manufacturer (or importer) certainly knows his equipment better than EI does and, therefore, is the one to advise you. It *is* possible to check out a tuner in advance using a multiplex generator to determine if it will provide good stereo, but without having the equipment on the bench, all we can do is guess.

Optimum *vs* Universal

How can there be such a thing as a universal adaptor (such as EI's in the January 1962 issue) if you maintain that for optimum results each adaptor should be designed for a specific tuner?

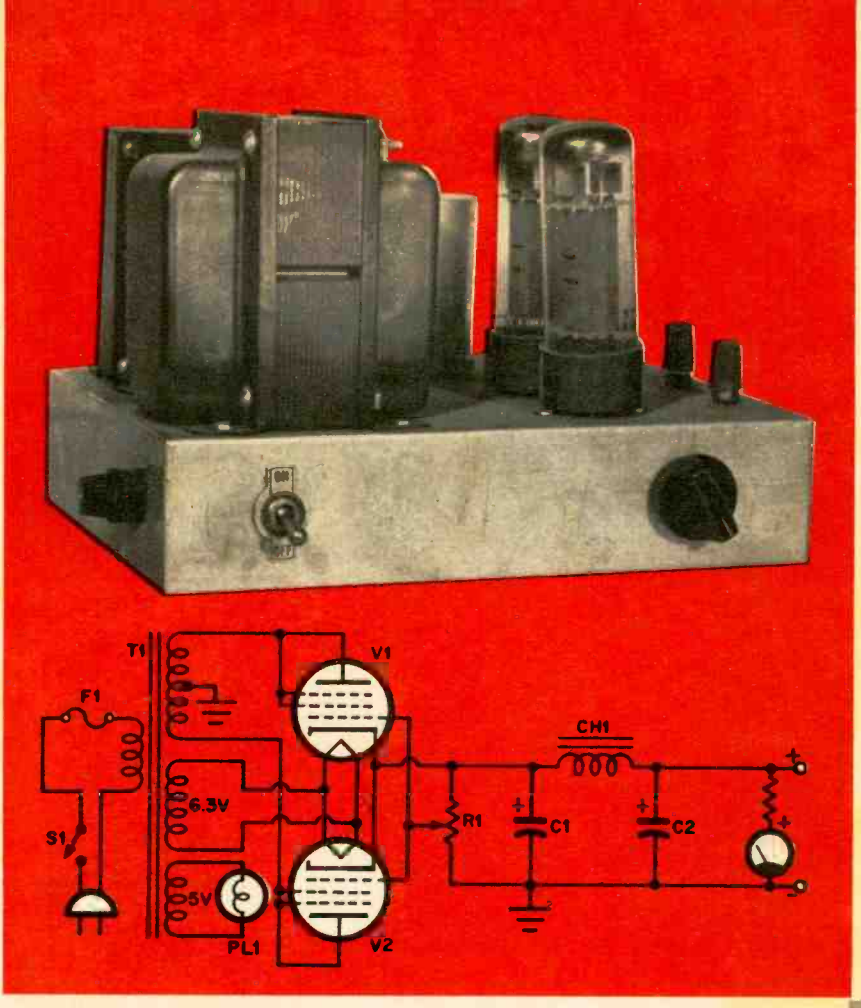
The important word here is optimum. Since there are very few tuners available with *all* the bandpass necessary for optimum stereo reception, compensation must be made in the adaptor. This is not to say that it isn't possible to plug in any adaptor at random to any tuner and occasionally get good separation, etc. But, unfortunately, the less expensive the adaptor, the poorer your chances of being able to do this. EI's adaptor had every trick we knew engineered into it to make it as universal as possible—and letters from our readers indicate we were successful. However (and here's that word again), for optimum results even EI's adaptor and the tuner you use should be aligned to each other. For that, a multiplex generator (such as the Scott 830) is required.

How Wide a Bandpass

I've been told that unless a tuner has a wide bandpass it can't use a multiplex adaptor. What is wide bandpass and how do I know if my tuner has it?

For stereo reception, the detector circuit in a tuner should have a bandpass of at least 1 mc and preferably 2 mc. The narrower the bandpass, the greater the phase shift and the more difficulty in receiving stereo. Since few tuners have zero phase shift, some compensation usually is made in the multiplex adaptor circuit. If the manufacturer of your tuner also has an adaptor, you should be able to get good results from the two units. However, if your tuner is more than three years old it may be a good idea to check with the tuner's manufacturer before purchasing any adaptor.

Because of the tremendous interest and frequent confusion concerning stereo FM reception, EI has made special arrangements to handle questions on this subject. Address your letters to Multiplex, Audio Workshop, 732 Broadway, New York 3, N. Y. Please enclose a stamped, self-addressed envelope.



By Joseph Goglia

VARIABLE DC POWER SUPPLY FOR THE EXPERIMENTER

HOW MANY times have you had to steal B+ voltage from a receiver or amplifier to check out a newly completed project or experimental circuit? The charred resistors and time wasted in jury-rigged setups prove that crime does not pay! Here is a rock-bottom-cost, heavy-duty, build-it-yourself variable power supply that will fill the bill for 90% of your B+ requirements.

Construction is simple because almost all the parts are non-critical. Surplus or junk-box components serve nicely. An old TV power transformer and choke, surplus power tubes, etc., can play an important role in keeping the cost down. In fact, with a judicious choice of surplus components the cost can be kept below $10.

The unit provides a variable, well-filtered DC voltage from about 50 to 500 volts. Current drain determines the maximum voltage output in any particular control setting. At the highest-voltage setting, about 15 ma current is available

and at the low-voltage end about 50 volts at 240 ma can be had. The maximum current and voltage output of your supply will be determined by the current capabilities of the tubes, chokes and transformers used.

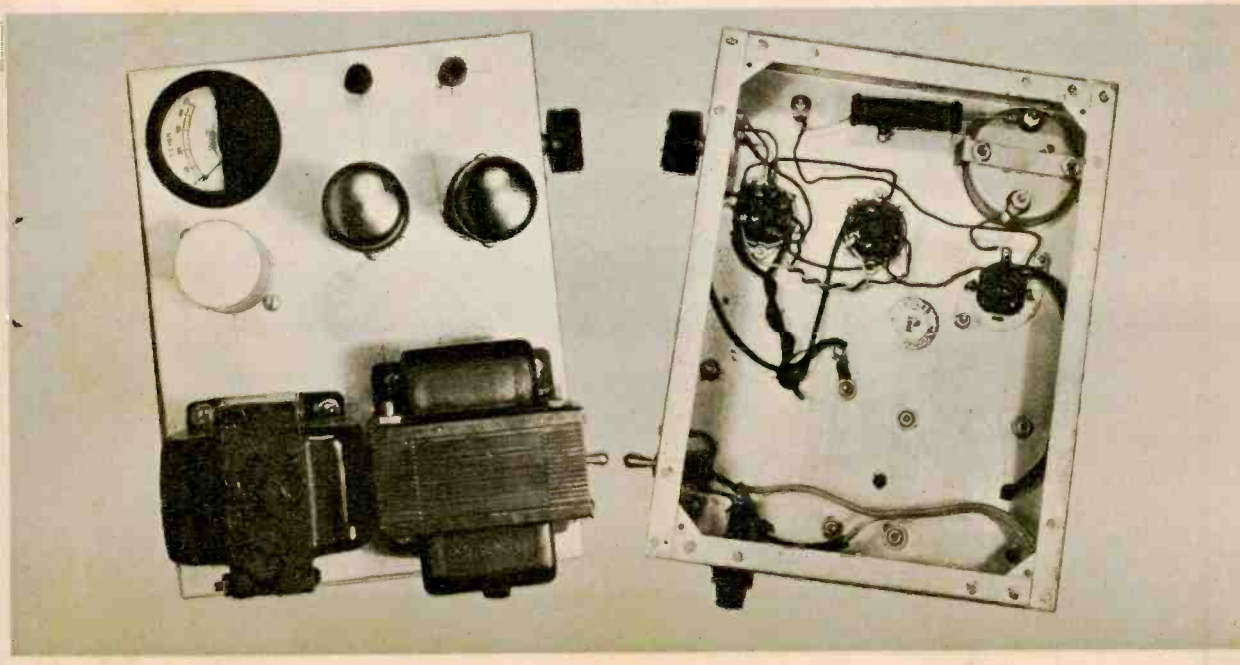
Here are a few hints in selecting the components: Transformer T1 should have a high-voltage, center-tapped secondary winding of about 850 volts maximum (425-0-425), at a current rating of 100 ma or more—the higher the better. Choke CH1 can be any value from 1-5 henrys at 200 ma or higher. Filter capacitors C1 and C2 can be 8 to 20 mf at 500 or 600 volts, oil or electrolytic. Tubes V1 and V2 can be any high-power output type of sufficient current capacity (6L6 types), including some low-power transmitting types (807, etc.).

Any 500-volt DC meter movement may be used. The one shown is made by Shurite and is supplied with an external series resistor shown in the schematic. Most 500-volt meters won't require the resistor. A 3-amp fuse (F1) is about right. If it blows, try a higher value.

Theory of Operation. The circuit of the supply is roughly that of a full-wave rectifier, but with certain modifications. Instead of a single rectifier tube with its two plates, we used a pair of power output tubes (V1 and V2) with their screen grids connected to their plates, which converts them into triodes. The cathodes of V1 and V2 are connected together and perform the same function as the cathode in a standard rectifier tube.

The control grids are joined together and brought to the wiper arm on 500,000-ohm control R1. The setting of R1 determines the bias applied to the tubes and hence the amount of current that will flow through them. The main advantage in this system is that heavy-duty controls and heat-producing, voltage-dropping resistors are not required. Note that this power supply is *not* regulated and the voltage output changes with the load. This unit is not designed to provide high current at low voltage or to power transistor radios. No attempt should be made to employ it for those purposes.

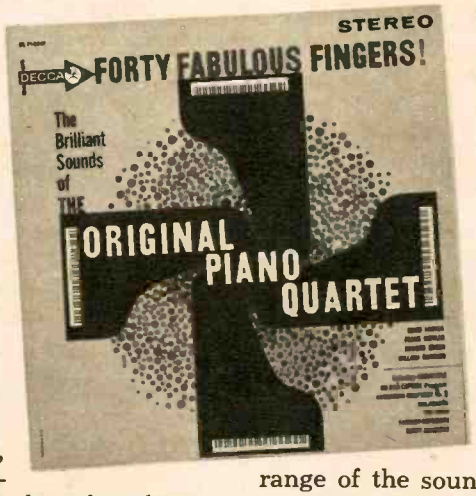
Top and bottom views of completed supply. Layout is not critical, but keep the filter capacitors away from the hot tubes and mount the choke and power transformer at right angles to each other as shown in photo to prevent hum coupling.



HI-FI RECORD GUIDE

by Warren DeMotte

MUSIC played by two, three or four pianos never sounds right when recorded monaurally, invariably giving the impression of a single piano poorly played. In stereo, despite the identical timbre of the instruments, their spatial relationship is caught and each piano retains its individuality. In Forty Fabulous Fingers (see cut) the Original Piano Quartet sounds like eight hands at four keyboards, rather than trying to crowd on one, and it is quite impressive to have a panorama of pianos spread across your listening wall.



One of the hottest names in folksong circles is at her best in The Many Voices of Miriam Makeba. Surrounded by an instrumental ensemble in an elaborate production that would swamp a lesser personality, the intensity and vitality of this African girl come through miraculously. In two of the songs, electronic multiplication of her voice takes place, but that is just a case of gilding the lily.

Having made their mark via Audio Fidelity's sensational recording, the Dukes of Dixieland are now on Columbia with Breakin' It Up on Broadway. Show hits are prettty resistant to Dixieland treatment that never has been noted for its imaginativeness, but the sound's the thing. For the nostalgic, Audio Fidelity has assembled a dozen characteristic Delta ditties in The Best of the Dukes of Dixieland. They are.

For concentrated musical passion, there is nothing like the Flamenco guitar. In Flamenco Virtuoso, Mariano Cordoba goes to the heart of the matter with 11 numbers divided between the dramatic Cante Jondo and the lyrical Cante Chico. The record title is no misnomer, but who is the anonymous castanet player? Such virtuoso assistance deserves recognition.

Among the Old Guard of Flamenco guitarists is Vicente Gomez. In Rio Flamenco he essays an elaborate original production, with poetry recitations, singing, heel-stomping, hand-clapping, castanet-clacking—the whole bit. It's meant as a tribute to the Guadalquivir River in Spain and it adds up to an unusual, colorful entertainment.

A panorama of what Mercury's engineers have been accomplishing with 35mm magnetic film appears on Music in Depth. Twelve numbers from as many individual discs, each featuring a different instrumental ensemble, offer splendid variety. If the use of film is what makes the depth, purity and range of the sound on this special disc so impressive, older recording media are merely standing in the way of progress. The disc is sold as a kind of demo for just 99 cents.

In Brazen Brass Zings the Strings, ten microphones pick up the 40-piece orchestra conducted by Henry Jerome. Ours not to reason why, but it sounds like an application of the idea that if two mikes can do a good job, five times as many should do a job five times as good. They don't.

Heard any of Victor's Stereo Action records yet? Holiday for Percussion, with Dick Schory's Percussion Pops Orchestra, is a good specimen of what is advertised as The Sound Your Eyes Can Follow. Individual instruments, groups

[*Continued on page* 106]

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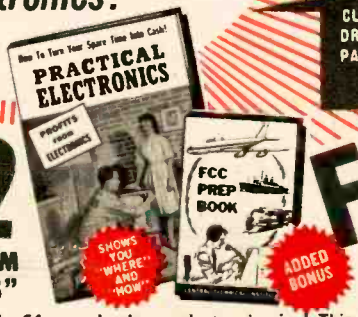

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"THANKS to my Central training, I have my First Phone (FCC) Ticket, which gives me an advantage over my competitors. I am a franchised RCA dealer, employ a bookkeeper and usually two servicemen." R. R. "Jack" Merrill, Pryor, Oklahoma.

Superintendent of Communications for the K. C. Southern Railway Company is Central graduate Lawrence D. Fry, with 15 years of railroad communications experience. "Central is a fine school," says Mr. Fry. "I've always recommended it, and have sent several students to Central."

Field Service Representatives for the Bendix Computer Division, L. A., California, are Central graduates E. John Kempf, left, and Robert Young. Mr. Kempf was employed as a maintenance man before he became interested in radio and TV. His first project was building test equipment at home. After enrolling with Central, he began to make extra money repairing radios, auto radios, etc. "The field of Computers is expanding, and there's a real need for trained technicians," he says. "I have found the work to be both profitable and interesting!"

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RESIDENT TRAINING—Central also offers a full time ECPD-Accredited Technical Institute program at its resident school in Kansas City, Missouri. Mail the coupon at page top for information.

Spring Cleaning for your electronic gear

DOES the volume control on your hi-fi amplifier snap, crackle and pop when you turn it? Does your short-wave receiver snarl and spit when you're trying to pull in that rare DX station? Does the tuner on your TV set give the picture St. Vitus's dance every time you switch from Darts For Dough to The Throat-Cutters?

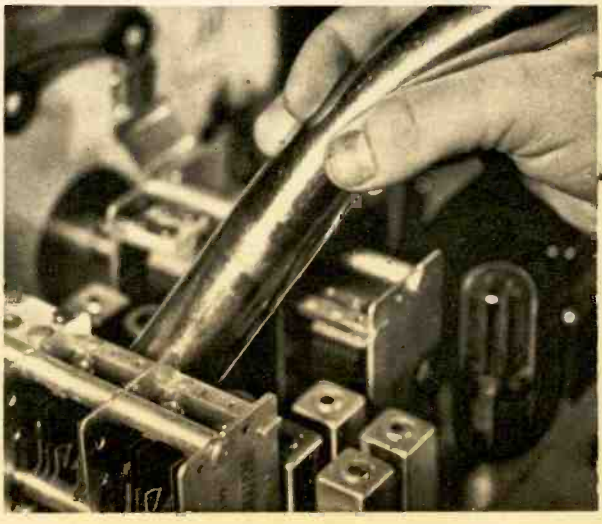
Friend, you may be the victim of dust and corrosion in your electronic gear. But we've got the magic cure right here: some spring cleaning amongst the tubes, capacitors and resistors.

Every piece of electronic equipment works only because insulators insulate, conductors conduct and resistors resist. That sounds pretty basic, but let's see what a lack of cleaning can do to foul things up.

Unplug your short-wave receiver and remove the cover. Phew! Let the dust settle (if you're like most of us) and look around. See the dust on the capacitor plates? Well, sir, the air gap between those plates should insulate them from each other. The

Vacuum brush cleans dirt from bottom and top of equipment; and don't miss the capacitor plates.

Bare tube at end of vacuum hose gets dust out of unhandy corners with its powerful suction.



dust acts as a conductor and can cause arcing between the plates, breaking down the insulating air. Result: noise that makes your set sound like the crackling of your wife's deep-fat fryer. Chances are, you'd find the same mess inside the potentiometers, only it's hidden by the covers.

Remove one of the tubes and inspect the pins. Are they bright? Or do they have the greasy, tattle-tale grey look? If it's the latter, the pin sockets most likely are as bad. Result: poor contacts and poor operation of the equipment

To set things right you merely give all the equipment around the shack a good cleaning. Here are the tools you need:

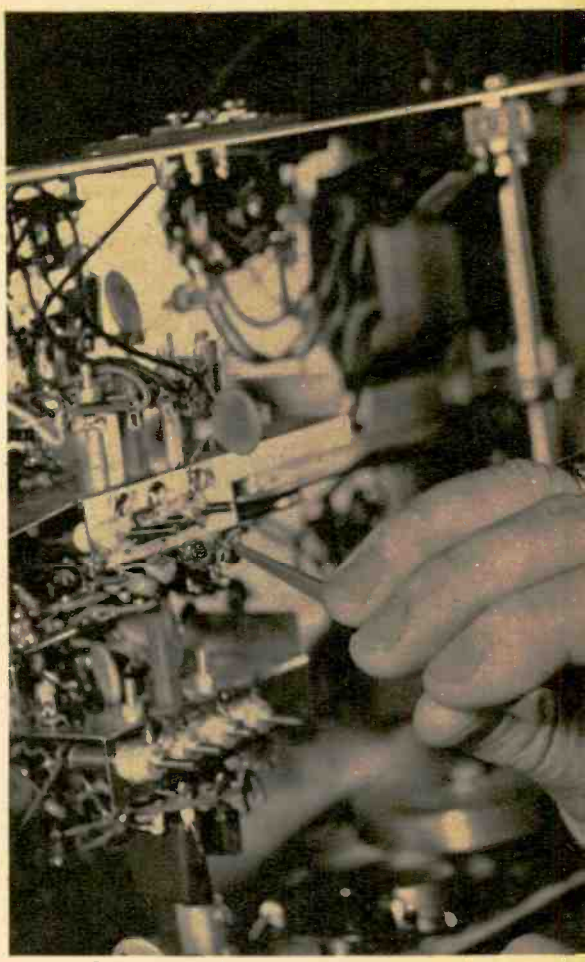
1. The XYL's vacuum cleaner with the brush attachment.
2. One of the new aerosol tuner and volume control cleaners with needle applicator (cost: $1.98).
3. A piece of fine emery paper.
4. A half hour or so of your spare evening time.

Our photographs show what's involved. It will pay you to set up a regular maintenance program for each piece of equipment you have and see that it's cleaned and inspected twice a year. And now's the time to start!

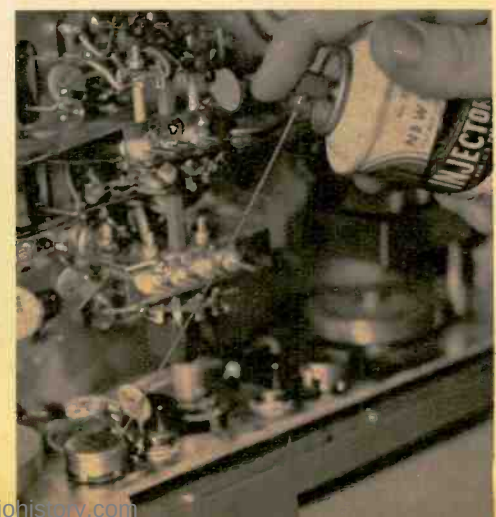
—Saunder Harris

Removing and replacing tubes one by one, brush up each pin and cap with piece of emery cloth.

Check (and take care of) solder joints, melting capacitors, burned resistors, bare-wire shorts.



Spray cleaner on shafts, in pots and holes of tube sockets, inside shielding around TV tuners.



CRADLE OF U.S. WIRELESS

By W. A. Gregory

LATE in the last year of the last century a distinguished foreigner who dressed in natty tweeds appeared suddenly in the sleepy country village of Babylon, on Long Island just east of New York City. The word soon got around: the stranger was one Guglielmo Marconi, an Italian scientist who sent messages through the air without wires. But what was he doing in Babylon?

Marconi then was fairly well known for his wireless experiments, though he was by no means universally famous, and the townspeople kept an eye on him. They watched as he took the offshore ferry to Fire Island on several occasions, and then one of the Ketchams saw him talking to old Mr. Chew in the field beside his big two-story house.

It wasn't long before everyone in Babylon knew exactly what Signor Marconi was up to. He was going to build a wireless station in Mr. Chew's field. Exciting though the news was, few Babylonians could foresee a place in history for their town because of the project. But what the Italian built in Mr. Chew's field was the first commercial wireless station in the United States, and Babylon can rightly claim to be the cradle of the medium in this country.

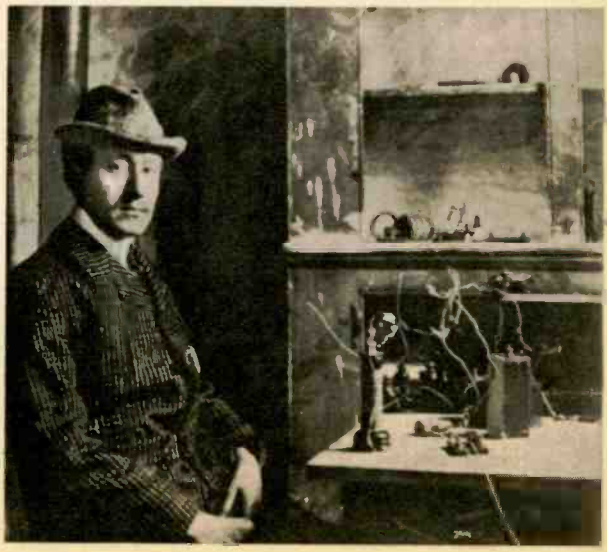
A tiny frame shed that measured just 12 by 14 feet and looked like a smokehouse soon appeared in the Chew field and beside it was erected a 170-foot wooden mast. Around its base was buried a zinc ring measuring 40 feet in diameter. A wire sloped down from the top of the mast and disappeared inside the building.

Marconi, holder of several wireless

[*Continued on page* 105]

Revised historical plaque in Babylon, N. Y., now bears Marconi name; people are local historians.

Guglielmo Marconi and some early equipment in his first wireless station in U. S., circa 1901.



11 Via Condotti Rome.
June 26th 1958.

Dear Mr. Taylor.

Many thanks for the very interesting photographs taken of the Marconi building in Babylon where my husband made his first work on Wireless for the Marconi Company in America.

That spot was really the cradle of the wireless in the United States of America.

Yours Very Sincerely
Maria Cristina Marconi

Picture post card of 1901 shows tiny shack that was cradle of U. S. wireless, as identified by 1958 letter above written by widow of Marconi. Insert photo shows shack being moved about 1930: beside it are Marconi and David Sarnoff of RCA.

GOOD READING

By John Milder

COMPUTER BASICS. By Technical Education and Management, Inc. Howard W. Sams, New York & Indianapolis. Five volumes. App. 250 pages each. $4.95 each

New books on computer theory are appearing these days almost as fast as new computers. These five volumes take an unusually thorough look at the subject. The approach and material originally were devised for a Navy training course. Just about every aspect of current computer theory is covered. If there are any sins of commission or omission this reviewer would have to borrow at least a Compominimac to ferret them out. A sixth volume, on solid-state computer circuitry, is due shortly.

ELECTRONIC EQUIPMENT MADE EASY FOR THE BOAT OWNER. By John D. Lenk. John F. Rider, New York. 194 pages. $5.95

With an awesome number of amateur mariners now pursuing potential collision courses on every navigable body of water, this book is welcome. The author is a veteran boating enthusiast and has aimed his words at fellow boat-owners rather than electronic hobbyists. His approach is practical. He knows what subjects are likely to confuse his colleagues and he handles them well. Included are sections on power requirements, wiring, radiotelephones, direction finders, depth-sounders, radar, loran and electronic fire prevention. If you intend to spend much time on the water this summer this volume can help make your life easier and safer.

HINTS AND KINKS FOR TV, RADIO AND AUDIO. Edited by Martin Clifford. Gernsback Library, New York. 128 pages. $2.35

This is a good collection of helpful hints for the serviceman, kit-builder and hobbyist. Most of the remedies recommended are simple, involving the use of items usually lying around the house. As with any book of this type there are problems in organizing a mass of loosely related problems and cures, but the index provided should help make this a good reference when you get trapped in an electronic corner.

TROUBLESHOOTING AMATEUR RADIO EQUIPMENT. By Howard S. Pyle. Howard W. Sams, New York & Indianapolis. 128 pages. $2.50

Howard Pyle's credentials for doing a book of this kind need not be paraded for readers of EI and active hams everywhere. Like his previous books, this one is practical and wastes no words. Knowing that most ham shacks are not electronics laboratories, he outlines fairly simple remedies that require a minimum of test equipment. And when W7OE predicts what troubles are most likely to beset ham gear, this reviewer believes him.

WORLD RADIO-TV HANDBOOK, 1962. 16th Edition. Published by O. Lund-Johansen, Hellerup, Denmark; distributed by Gilfer Associates, Park Ridge, N. J. 232 pages. $3

An invaluable book for short-wave listeners that year after year lists all the major short-wave broadcast stations

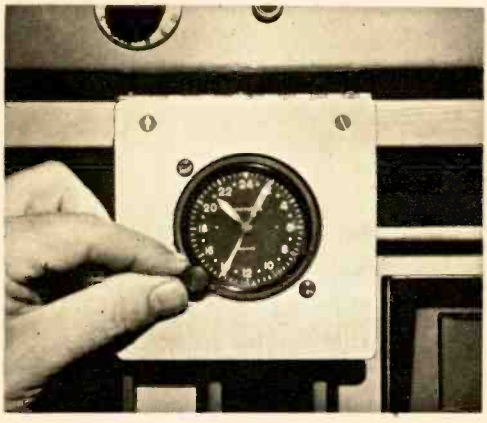
in the world, gives details of their programming and even includes their musical signatures. Our cut shows the musical identifier for the Voice of America—the first ten notes of Columbia, the Gem of the Ocean. Medium and long-wave stations and international TV transmitters also are noted.

The incredible roll-call of propaganda broadcasts from every country shows how intense is the battle for men's minds. [*Continued on page* 110]

The Ham Shack

By Robert Hertzberg, W2DJJ

ZULU?? . . . I've received quite a few inquiries from hams and short-wave listeners about the word *Zulu*, which



you hear used with four-digit time figures, especially by GI operators overseas.

Zulu is the international phonetic for Z, and this letter is the military designation of the Greenwich (England) time zone that is the starting point for the international 24-hour clock system. In other words, Z time is GMT (also GCT and UT).

Speaking of 24-hour clocks, I recently picked up a neat and handy little timepiece for my shack (see cut). It is Lafayette Radio's No. F-775L, a Swiss instrument only 2¼ inches in diameter that can be mounted on the operating table or built into the front panel of a receiver or transmitter just like a meter. It needs winding once a week.

Still Growing . . . According to recent FCC figures, ham radio continues to grow at a steady rate. The number of licenses in force at the end of 1961 was 231,100 as against 217,700 for 1960.

As usual, there were the extremes of age among new hams last year . . . a boy of 10 and a great-grandfather of 74. There also was a family of four—father, mother and teen-age son and daughter—who demonstrated a new kind of togetherness by taking and passing the exam at one sitting.

Trick Calls . . . The mention of K2HAM and K9DOG in this column has elicited a card from Robert Douglas, WA2VNE/8, who writes: "I had an experience similar to yours. I called CQ on 6 meters and was answered by K8AOK. I thought it was a joke, but the now-famous astronaut's phrase is the real call of a student here at Ohio University in Athens."

Too Good To Be True? . . . I am indebted to Bob Brown, K2ZSQ, publisher of The VHF Amateur, for passing along the information that many TV manufacturers furnish *free* high-pass filters to individual set owners bothered by TVI. Among the firms which participate in this activity are General Electric, Montgomery Ward, Admiral, Zenith, RCA, Hotpoint, Magnavox, Philco, Emerson, Capehart, Westinghouse, CBS-TV, Crosley-Bendix and Sylvania.

The set owner must make the request to the manufacturer but it is to the advantage of hams to cooperate (especially those causing the TVI). After all, you have to live with your neighbors. The first step is to locate the nearest dealer, distributor or factory branch handling the receiver involved.

The following information must be supplied by the set owner: 1) name, address and phone number; 2) make, model, serial number and year of purchase of receiver; 3) type of antenna; 4) name, address and call letters of the offending ham station. At the end the letter should request an R. L. Drake TV-3000-HP filter.

Relatively unpublicized, this free-

[*Continued on page* 113]

DXing The Russian Spaceships

A BASIC SIGNAL pattern seems to have emerged from the manned and unmanned spaceships put into orbit by the Soviet Union. The Reds do make frequency changes in their space shots, of course, but there are certain channels that seemingly are used by every satellite.

The lower frequencies employed by Communist spaceships are of special interest to short-wave listeners because they can be picked up on any communications receiver with a fair antenna.

Communications with our own Mercury astronauts were described in the March '62 EI. As hobbyists, we don't have as much comparable information about Russian spaceships (our government presumably does) but we do have a general picture. Vostok II, which carried Maj. Gherman S. Titov into orbit, used most of the familiar channels (see chart), so let's examine its operations.

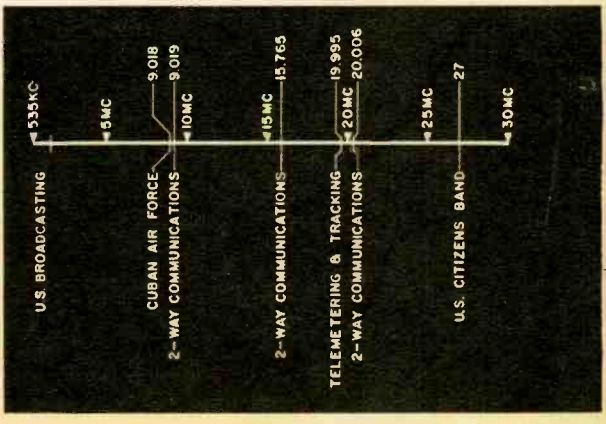
Because Titov remained in orbit 24 hours, a lot of DXers pulled in his signals (see QSL card above). There was time enough for the word to get around as to where he was operating. Vostok II used a great number of frequencies between 143.625 mc (just below the 2-meter ham band) and 9019 kc, right in the middle of the short waves. The variety in frequencies was made possible partly by the size of Vostok II. It could carry a big power supply.

Channel-switching apparently depended on the time of day and the distance to the nearest *zarya*, a code word for monitoring station. (Zarya 4, from all evidence, was located in Cuba.) Three short-wave frequencies—9019, 15765 and 20006 kc) were used often for both voice and code transmissions and were widely received in North America. Many of Titov's messages were in code because of the greater range and low noise possible with CW.

Only telemetry channel announced by the Russians was their old stand-by, 19995 kc. An advanced type of pulse modulation was heard here. The pulses were grouped in little packets or clicks which were sent at a rate of one per second. Variations in pulse amplitude, pulse length and spacing could be detected. Titov's physiology and information on his capsule presumably were being transmitted.

By the way, the business about Titov's saying he was an eagle (the comedians have it: "I'm an eagle! I'm a Russian eagle! I'm a sick eagle.") has led to much confusion. Turns out that "Eagle" was his code name.

Four of the short-wave channels used by Russia's Vostok II spaceship are shown in the chart below.



Stereo Sampler

Continued from page 63

swimming, amusement parks and other sound pictures that give the record its name—Liberty Presents Stereo, the Visual Sound. On the musical side, there is a way-out arrangement of Stranger In Paradise with sounds floating clear across the room.

London comes in with A Journey Into Stereo Sound (PS-100; $4.98), with an engaging narration plus classical (mostly) and pop tunes; and Classical Stereo Showcase (SS-2; $2.49), containing excerpts from famous operas. No account of demos could omit London's Phase 4 releases and Command Classics ($5.98 each). Experiments with channel manipulation while recording make for an illusion of tremendous space. One of the latest in the continuing Phase 4 series is Percussive Latin Trio.

Omega's Sounds Out of This World (OSD-1; $5.98) combines a pop sampler with useful stereo tests, including channel separation and balance, speaker phasing, equalization and stylus tracking.

RCA-Camden's This Is Stereo (CAS 535; $1.98) has narration, historical examples of older recordings and varied musical excerpts.

RCA-Victor's Destination Stereo (LSC-2307; $2.98) is a classical sampler mostly devoted to the full orchestra.

Riverside's Stereo Stew (RLP-1117) presents a parade, sports car meet, a tractor, the Queen Mary, a thunderstorm and a tobacco auction.

Urania has folded but its Stereo Sampler (USS-58) is worth finding. It has an excellent organ excerpt and a rollicking aria from The Grand Duchess of Gerolstein with bass passages that show off your woofer superbly.

Vanguard's Stereolab Demonstration records in the SRV-100 series ($2.98) are, as the liners claim, unique. They offer complete performances of major orchestral works played by leading ensembles. The sound is clean and the stereo solid. Lovers of big sound should try SRV-113 SD, on which Vladimir Golschmann conducts the Vienna State Opera Orchestra in the suites from Gayne and The Comedians. SRV-115 SD is more sedate, coupling Handel's Royal Fireworks and Water Music suites. Eighteen records have been issued in this series.

Vox's Stereovox Sampler (VST-1) mixes a sports car race with fine classical excerpts.

Warner Bros. offers two interesting demos. You Ain't Heard Nothin' Yet! (XS-1307; $1.98) derives its title from the prophetic boast by Al Jolson in the first talking movie, The Jazz Singer. The incident (as well as highlights in recording history) is recalled on this disc. How to Get the Most Out of Your Stereo (XS-1400; $2.98) is a pop sampler with printed instructions which tell you from what spot in the room to listen for various instruments. The disc ends with a beat version of Poe's The Raven, which is wild but fun, although after one play you may say *nevermore!*

What the demos really demonstrate is that stereo is still fresh and new.

Hi-Fi Sound From Your TV

Continued from page 73

reading. However, don't do it as picture quality will suffer.

Ratio detector T3 should have its bottom slug tuned to further raise the meter reading. In our unit, the voltage (on a strong station) reached about 10. Now set your VTVM for a zero-center reading and touch the hot meter probe to test point (B) (junction of R6, C7, C8). Adjust the top slug of T3 for no deflection from zero center with the VTVM's range switch on the lowest voltage scale. Alignment is complete.

Operation. The unit now requires no further attention (except for switching power on and off) and may be hidden if desired. The only tuning required is the normal adjustment of the TV set. Keep the pickup wire under 4 feet in length, especially if the voltage at test point (A) is much below five or six volts. And use low-capacity shielded cable between Adapter and amp.

The Listener

Continued from page 86

The answer depends partly on the DXer himself, and also on the policy of the station (some send nothing but thank-you letters or cards and these must be accepted as genuine QSL's) and the rarity of reception. Really fabulous catches, one might theorize, require a QSL that leaves no doubts. No one is likely to doubt that you pulled in Moscow or London, but you need the proof for those rare ones.

Some radio men insist that every QSL must include both date and frequency. These are perfectionists, though, and there isn't much perfection in the world. A more realistic approach is to determine whether the card or letter was intended as a QSL and whether it implies verification, no matter how loosely worded. The best way to make a station stop QSLing altogether is to complain about the quality of its QSL's. If you must ask for better verification, be tactful!

Low Frequency . . . That term, used to define a frequency range, confused many of our DXers who applied for DX Club certificates. Perhaps *long wave* would have been easier to understand. At any rate, in order to qualify for a ten-country DX Club certificate all your stations must be operating at 535 kc or below; 535 kc is the bottom end of the AM broadcast band.

On the low-frequency bands you will find reception down to about 200 kc is similar to the BCB, with the dial populated by radio beacons and similar devices. An exception is 415-505 kc, which is marine CW territory. Around 200 kc reception begins to reach out. This was where the first international broadcast stations operated. In Europe a few still do, such as Radio Luxembourg and Europe No. 1. Long-wave receivers can best be obtained via surplus sales.

The European Picture . . . If you listen very often to two of Europe's commercial stations—Radio Luxembourg in Belgium and Europe No. 1, transmitting from the Saarland region of Germany—you may get to wondering what they have against Europe. Both transmit what amounts to anti-European material (you also could see it as anti-U.S. and anti-British). Luxembourg comes in here often on 6090 kc and East Coast DXers can pick it up on 1439 and 233 kc. Europe No. 1 is parked at 182 kc.

Much anti-European material is found on a program called The World Tomorrow, which we mentioned in our last column in connection with Russia's "lost cosmonaut." World Tomorrow, besides its European outlets, is heard on stations throughout the rest of the globe. It sticks usually to standard religious material but sometimes free publications are offered. One of these pieces, called *1975 In Prophecy*, predicts the formation of a United States of Europe that would exclude Great Britain but include ten other European nations centered around Germany. The author of the tome, Herbert W. Armstrong, foresees a kind of new Roman Empire that would conquer both America and Britain. I suppose we'll have to wait a few years to find out whether Mr. Armstrong might be right, but this anti-European (at least anti-status quo) pitch makes for good DXing material because it is unusual.

Halfway around the globe, The World Tomorrow is carried by the Broadcasting Corporation of China on Formosa. Among other things, the BCC, which is privately owned but under government contract, produces Formosa's international SWBC service, The Voice of Free China. One wonders whether the BCC (and a good many other stations) knows the content and opinions of the World Tomorrow program it carries.

The Voice of Free China transmits to North America from 2010 to 2040 EST on 11815, 11825, 15225 kc and other frequencies. Luxembourg, mentioned above, is best heard here around 1700 EST but, unfortunately, its English-language programs do not start until after 1800 (it signs off at 2100) and by that time there is QRM from LRY1, R.

Belgrano, Buenos Aires, and from XECMT, Ciudad Mante, Mexico.

Notes . . . Two radioteletypers have camped 3 kc on either side of the Caribbean intership channel of 2752 kc. Signals are getting through but a Q-multiplier or crystal filter is almost necessary . . . Castro's radio manipulations, mentioned in our March '62 column, seem to have confused even our proof reader. The piece should have identified CMBC (690 kc) as the key station in the Radio Progresso net and CMQ (630 kc) as the hub for Circuito CMQ.

Happy listening!

CB Corner

Continued from page 46

terminal is provided on the transceiver, secure the wire under a cabinet or chassis screw, being certain that there is no paint to insulate the connection. The ground wire must be short and direct. Any looping of the lead or sharp corners reduces its effectiveness.

If a convenient ground point is not available, you can drive a six-foot length of pipe (about one inch in diameter) into the earth. You can purchase ground rods commercially, or use a piece of water pipe. The ground wire is bolted firmly to the upper end, which may stick up out of the earth an inch or two.

Try one of these grounds if your station is floating electrically. A good ground is worth the effort.

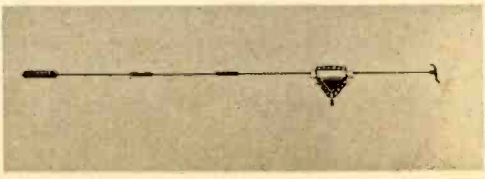
Mayday . . . REACT is a program in which The Hallicrafters Co. is attempting to set up round-the-clock channel monitoring throughout the country. Standing for Radio Emergency Associated Citizens Teams, REACT is to assist clubs and individuals in organizing CB radiotelephone networks. The system is designed to handle local emergency situations. There's no membership fee and enrollees get automobile stickers, membership cards and periodic bulletins. The REACT address is 4401 W. 5th Ave., Chicago 24, Ill.

Marketplace

SSB KDK . . . Sounds like too many consonants, but add a vowel or two and you have the news that a single-sideband ham transmitter in knock-down kit form has hit the market. It's Heathkit's HX-10 Marauder, a 92-pound table-top job complete with built-in power supply. Rated at 180 watts, the

unit includes the works: crystals for full coverage of 10 through 80 meters, VOX, break-in on CW, temperature-compensated VFO, jack for oscilloscope monitoring, phone patch facility and more. Alignment requires a calibrated receiver and VTVM. This kit for advanced hams runs about $335. Heath Co., Benton Harbor, Mich.

Dieting Doublets . . . Slenderized traps give a neat appearance to a new line of two-band doublet antennas produced by Hy-Gain for the ham service. Rather than looking like a bunch of crows sitting on a clothesline, the traps are



barely thicker than the wire. There are three models (for 10-20, 10-40 and 10-80 meters), all able to handle up to 500 watts AM. SWR is said to be 2:1. Priced from $17.50 to $34.95. Hy-Gain Antenna Products, 1135 N. 22 St., Lincoln, Neb.

Marine Lightning Arrester

Continued from page 39

ground wire should be avoided. Where it is necessary to turn a corner, the bend should be gradual. The ground wire requires no special insulation, but it should be fastened securely in place at both ends.

Gap spacing should be adjusted to the minimum distance that will *not* spark during transmitter modulation peaks. The ground stud can be screwed in and out to find the proper spacing, then locked by tightening the nuts.

Inductance of L1 is small enough (about 1 microhenry) so that an antenna peaking adjustment on the radiotelephone band will usually not be required.

Incidentally, this type of arrester is effective on other medium-frequency antennas, such as amateur or SWL. The principle has long been used in commercial and military installations—you might as well take advantage of it.

CB Servicing Made Easy

Continued from page 69

ance, but the difference in frequency would now be 456 or 454 kc (depending on whether the crystal is off on the high or low side). One kilocycle may not seem like much, but in a selective receiver the result would be sideband hash which is a sort of high-pitched hiss or distorted sound. Crystal-controlled receiver alignment therefore compensates for the tolerance which exists in nearly all crystals.

First, align the IF strip using the tunable procedure, this will put you close to the required alignment. Then, with the VTVM connected across diode load resistor as before, tune to the signal from (preferably) the mating transceiver, or from a CRYSTalignMETER or handie-talkie. Now peak the IF's for maximum meter reading. The final IF alignment may be slightly off the exact IF specified in the manual, but this is not important. What is important is that the alignment now compensates for the crystal, resulting in on-the-nose reception. If the transceiver is used for receiving only a unit 2, use the unit 2 transceiver for the generator and you will then have an alignment which compensates for both the receiving *and* the unit 2 transmit crystal. If your transceiver has both a crystal control and variable tuning, it is best to align the IF for crystal reception and then recalibrate the dial for variable tuning. In practice, the difference in dial calibration will be so slight as to go unnoticed.

Next issue, in the final article in this CB servicing series, we will check out the transmitter section of the typical CB transceiver.

Stereo FM Tuner

Continued from page 58

tion decreases markedly at the upper end of the audio band. The LT-110, in maintaining almost 20 db separation at 10 kc, is doing better than most of its competitors.

The LT-110 uses the time-switching type of detection, a technique that has proven exceptionally effective. Simply explained, time-switching involves the sampling of one channel and then the other at the rate of 38,000 times a second (38 kc).

If you have hesitated to go into stereo FM because of imagined complexities and highly technical skills and knowledge that might be required, fear no more. The LT-110 shows you how to enjoy stereo FM the easy way. The kit's price is $159.95.

An Electronic Thermometer

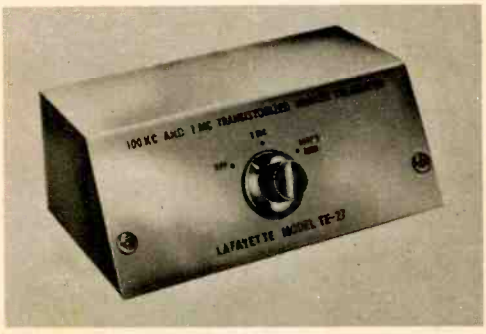
Continued from page 84

The accuracy of your unit will depend on how carefully you calibrate it after assembly, but Radio Shack claims an accuracy of ± .5° F.

One of the prime uses for an electronic thermometer is taking remote readings. With the Novatherm it is possible to take readings at 1,000 feet and in different locations simply by switching in various thermistors.

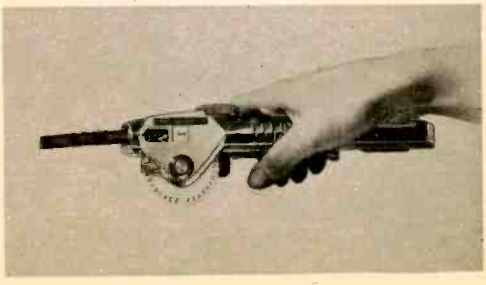
Marketplace

QRG? . . . Tired of asking, "What is my frequency?" You can break the habit with a transistorized crystal calibrator in your ham shack. Two new self-contained Lafayette units that require no warm-up are the easy way of calibrating and aligning receivers and VFO's, and



of marking band edges. Model TE-27 (shown), at $19, contains 1-mc and 100-kc crystals. The TE-29, $12, has a 100-kc rock. Both calibrators generate spaced harmonics up to 54 mc. Lafayette Radio, 111 Jericho Tpk., Syosset, N. Y.

Print It! . . . Nowadays the do-it-yourselfer has no trouble finding things to do, and here's another one. He can print his own identification labels for knobs, switches, etc., on electronic equipment which, of course, he has built. The



Dymo Tapewriter is a hand-held tool that works much like a kiddie typewriter. You set a dial to the letter or number desired, take a firm grip and—presto—clear lettering on a colored or black background. Dymo Industries, Inc., Berkeley, Calif.

Cradle of U. S. Wireless

Continued from page 97

patents, had established stations along the coast of Britain to communicate with ships as much as 100 miles at sea. But his fame in this country arose mainly from his on-the-scene reports of the America's Cup yacht races which he had done earlier that year (1899) for the New York Herald. These blow-by-blow descriptions of the Columbia's victory over Sir Thomas Lipton's Shamrock, flashed to shore by wireless, became the talk of New York.

Just after the races the Army Signal Corps got hold of Marconi and asked him to establish wireless communications between the Fire Island Lighthouse and the Fire Island Lightship, lying 12 miles offshore. The station in Babylon, on the mainland, came about when Marconi realized that Fire Island itself had no telephone contact with the shore. A station in Mr. Chew's field would link both the lightship and the lighthouse with the mainland.

The station's equipment was modified during its life of some ten years, but the original transmitter and receiver were quite simple. The continuous-wave (CW) transmitter used a ten-inch spark coil Marconi had developed for his first permanent station in Britain. The antenna and ground ring also were the same type used in the English Channel installation. The receiver had an improved and relatively sensitive transformer utilizing the principle of the Faraday induction coil and a redesigned Branly coherer which fed the signal to a telegraph printer.

When Marconi set up his Wireless Telegraph and Signal Company, Ltd., in England in 1898 he was interested only in wireless communications between lightships and lighthouses along the coast. He had no thought of earning money by transmitting commercial messages. It was only after Lord Kelvin insisted on paying commercial telegraph rates for sending a message that Marconi realized the possibilities at hand.

Marconi's reporting of an Irish yacht

race in 1898 attracted the attention of the New York Herald and brought about the inventor's first visit to America in 1899. This in turn, led to his work for the Signal Corps, which then operated our lightships and lighthouses.

The equipment at Babylon was guarded closely and visitors were not permitted. The operator, an Englishman, and his wife and daughter lived in the Chew house and kept an eye on the shack.

During 1900 the station's work was limited to messages for the Signal Corps and experiments. Marconi had gone back to England to work on a rig that was to bring about variable tuning, making it possible to use different wavelengths and giving the inventor a virtual monopoly on tuned wireless in England and America. At this time he also was engaged in setting up a wireless station in Cornwall that was to send the first transatlantic signal to Newfoundland in 1901.

In that year the Babylon station for the first time began communication with ships at sea, the first wireless station in the United States to do so. For this purpose, its location was ideal. Situated to the east of New York and with a direct command of ship lanes approaching the port, it provided the first mainland contact with inbound vessels. A rapid increase in the number of ships with wireless equipment aboard offered an opportunity for ship-to-shore communication that shipping and business interests found valuable and began to use extensively.

When the greater range of newer, more powerful stations led to the abandonment of the Babylon installation, it lay idle and forgotten. The newly organized Radio Corporation of America bought Marconi's American interests shortly after World War I without realizing the existence of the historic shack.

Around 1929 or 1930 Major Edwin Armstrong, inventor of superregenerative, superheterodyne and FM radio, learned by accident of the existence of the building from an early associate of Marconi. Armstrong purchased the shack and presented it to RCA for preservation as an historic relic. It was transported to the RCA reservation at Rocky Point, Long Island, where it is now kept in a barn to protect it from further deterioration.

In December of 1958 the village of Babylon placed a stone marker at the corner of Fire Island Avenue and Virginia Road to commemorate the historical events that had taken place there. A housing development now covers the Chew property but the old frame house has been moved across the road and is still occupied.

In the files at Rocky Point there is a letter dated June 26, 1958, that in part says: "That spot was really the cradle of . . . wireless in the United States of America." It is signed Maria Cristina Marconi. She was Mrs. Guglielmo Marconi.

Hi-Fi Record Guide

Continued from page 90

of instruments and the whole orchestra take turns in swinging on a pendulum from speaker to speaker. The purpose? You've got me, but if you want the effect of being in a rowboat during a storm, here it is.

The Ira Ironstrings Band started as a gag many moons ago, spoofing some of the hallowed conventions of popular music, but in Ira Ironstrings Destroys the Big Bands, I sense something new. Sure, the playing is deliberately old-fashioned, with stylistic imitations of name bands, but the music swings. And when you've got that swing, man, you've caught the brass ring.

A lovely girl with a lovely voice sings lovely songs in Love Makes the World Go Round. Anna Maria Alberghetti, the winsome star of Carnival, does a dozen tuneful standards, including the hit of her own show, appealingly and piquantly, with an assist from orchestra conductor Luther Henderson and some sympathetic recording engineers.

For sheer aural excitement, the sound generated during a performance of Serge Prokofiev's Alexander Nevsky is hard to beat. Young Thomas Schippers conducts the New York Philharmonic

and the Westminster Choir in a rousing rendition of this modern masterpiece, and the recording is engineered with imposing depth and breadth of sound.

Almost four centuries ago stereo was anticipated by Giovanni Gabrieli, who wrote music that was meant to be performed by widely separated choirs of players. Frederick Fennell leads the Eastman Wind Ensemble in characteristic pieces by the Renaissance composer and his Uncle Andrea, beautifully recorded by the 35mm film process. The sonority of the massed brass is thrilling.

Probably the most prolific composer who ever lived was Georg Philipp Telemann. A contemporary of Bach and Handel, he wrote more music than both of those old masters combined. His Suite in A Minor is an attractive item in Music for Recorder and Orchestra, very well played by Bernard Krainis and his Baroque Ensemble. The recorder, which is making a new bid for popularity after a hiatus of more than two centuries, is fascinating in sound and blends beautifully with other woodwinds and with strings.

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

Forty Fabulous Fingers *Original Piano Quartet*	Decca DL-10047	$4.98
	DL-710047	5.98
The Many Voices of Miriam Makeba	Kapp KL-1274	3.98
	KS-3274	4.98
Breakin' It Up On Broadway *Dukes of Dixieland*	Columbia CL-1728	3.98
	CS-8528	4.98
The Best of the Dukes of Dixieland	Audio Fidelity AFSD-5956	2.98 (stereo only)
Flamenco Virtuoso *Mariano Cordoba*	Capitol P-8574	4.98
	SP-8574	5.98
Rio Flamenco *Vicente Gomez*	Decca DL-4156	3.98
	DL-74156	4.98
Music in Depth *Various Artists*	Mercury PPMD-4-12	.99
	PPSD-4-12	.99
Brazen Brass Zings the Strings *Henry Jerome*	Decca DL-4187	3.98
	DL-74187	4.98
Holiday for Percussion *Dick Schory*	RCA Victor LSA-2485	5.98 (stereo only)
Ira Ironstrings Destroys the Great Bands	Warner Bros. 1439	3.98
	S-1439	4.98
Love Makes the World Go Round *Anna Maria Alberghetti*	MGM E-4001	4.98
	SE-4001	5.98
Prokofiev: Alexander Nevsky *Schippers, New York Philharmonic*	Columbia ML-5706	4.98
	MS-6306	5.98
Gabrieli *Fennell, Eastman Wind Ensemble*	Mercury MG-50245	4.98
	SR-90245	5.98
Music for Recorder and Orchestra *Krainis, Krainis Baroque Ensemble*	Kapp 9066	4.98
	9066-S	5.98

FEEDBACK

Continued from page 6

● ***Thumbs Down***

This is in regard to the "winning" entry in your Electricity Contest as it appeared in your March issue. The winner briefly describes atomic electron-state transitions and then makes the statement that the energy thus obtained is called an electric current. This could not be farther from the truth. Intra-atomic electron-state transitions are associated with electromagnetic energy . . . and the energy released is in the form of light waves. You are stretching your imagination quite a bit if you can consider a light wave to be an electric current.

Louis Hoff
San Francisco, Calif.

The fact that reader Hoff and a few others in our audience (surprisingly few, considering the general interest in our contest) have disagreed with some of the winning entries in our Electricity Contest does not surprise us. No one yet has been able to write a definition of electricity that gained universal acceptance. In this case, our judges have tried to pick as winners those definitions which showed aptness of thought, were easily understood and demonstrated some originality (as the rules said). Whether the winning definitions were "correct" is an unanswerable question because no one knows what is "correct."

● ***A Beef***

Hundreds of thousands of hams, SWLers and plain people have radio receivers that reach up to 30 or 35 mc. But few have sets covering 145 mc. So where do the hams put the OSCAR transmitting frequency? On 145 mc, of course, where a minimum number of people could pick up the signal. (See THE HITCHHIKING HAM, March '62 EI.)

Phooey, I say. It's a plot against us poor SWL slobs.

Ken Greenberg
Chicago, Ill.

FEEDBACK

● *Author's Add*

From my own experience with the CB Directional Beam antenna described in my construction article in the May '62 EI, I have found a problem which was not covered in the original piece.

Because there is more boom on one side of the mast than on the other, the antenna naturally is not balanced. Consequently, in high winds, I've found, the boom tends to turn in the fitting atop the mast, with the longer end going down and the shorter one going up, teeter-totter fashion.

To prevent this, lengths of plastic clothesline should be fastened tautly between either end of the boom and a point about two-thirds of the way down the mast. The line on either side will prevent the end of the boom on that side from rising (and from sinking on the other end).

Charles Tepfer, 2W4223
Chappaqua, N. Y.

● *Right Set, Wrong Year*

I hate to tell you this but in your Album of Memories relating to amateur radio (March '62 EI), you are wrong. The Hallicrafters Super-Skyrider did not come out in 1925, as you say. You are too early by a decade. Am I right?

Lance Borden
Rome, N. Y.

Yes, you are, and we weren't.

I own the United Wireless Type D tuner you showed in the Album of Memories. I might add that this tuner was used at old PR, the United Wireless station at San Juan, P. R., as early as 1906. It goes back farther than you indicated.

The set is now in the "W2ZI Antique Wireless Museum" I maintain as a private enterprise here in Trenton, and have for 25 years. I have over 300 items on display, as well as a side collection of some 95 Morse and wireless keys dating back to 1850.

Ed G. Raser, W2ZI
Trenton, N. J.

All About Radio Clubs

Continued from page 35

sequently, most clubs that survive have a Publisher and board who are cut from the same mold (the Publisher in some cases hand-picks his board). This may make for harmonious operation but it has disadvantages if the Publisher (or board) has a personal ax to grind. In that case, the club is likely to become the grindstone and the members are left watching the performance. Then, too, if the head man is a devotee of one particular band, all the club's interests and activities are likely to center right there. If you don't like it you can join another club.

Occasionally a group of members living in one area will share a club's work load and power.

The above may sound as if I am debunking radio clubs. But that is not my intention. Clubs are valuable and their activities can be interesting. That they have a frail human side is no more than normal.

Radio clubs could wield tremendous influence but they don't because the vitally interested hard-core members are relatively few in number. Secondly, there are enough clubs to be competitive and each tends to undercut the others.

Most clubs from time to time conduct contests based on verifications received in a season and other QSL data. These appeal much more to hard-bitten DXers and QSL hunters than to general SWLers, of course. A few organizations have even stuck their fingers into the FCC's pie by assigning call letters.

One ingredient missing in this field is the local club. Many years ago there were community or regional clubs that were especially close-knit and active because most members knew each other. They held periodic in-person meetings, were truly democratic and had flexibility. Some were affiliated with national organizations and some were independent. Their activities and influence are sorely missed.

The newest radio club, however, is an experiment in this field. It is the Mid-

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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west DX-SW Radio Club, limited to residents of Indiana, Illinois and Wisconsin and headquartered in Decatur, Ill. It will be interesting to observe the organization's progress.

The oldest, largest and probably best known club is the Newark (N. J.) News Radio Club, which covers all bands and boasts about 1,000 members.

Coming up fast in terms of membership is another New Jersey-headquartered group, the American Short Wave Listeners Club. It has about 230 members and goes in for everything from broadcast-band to TV DXing.

The National Radio Club, operating out of Buffalo, N. Y., confines its activities to the broadcast band. It has about 300 members and, as mentioned previously, publishes its bulletin on a weekly basis part of the year for an annual total of 34 copies.

The Canadian DX Club, a new group started in April 1961, confines its full memberships to Canadians (foreigners may become associate members). The club, centered at London, Ont., has around 50 members, covers all bands and also has set up a couple of awards, a tape-trading bureau, an English-French translation service and a QSL swapping bureau.

The Universal Radio DX Club, once quite active, has disbanded for the time being. We mention it because radio clubs have a way of appearing and disappearing almost overnight. By the time you read this, Universal may be back in business.

The Beacon That Talks

Continued from page 40

The voice information in the signal is supplied by the optical sound track of an endless loop of 35mm movie film, previously recorded by having someone read out a complete circle of bearings. The film and antenna are coupled mechanically and the bearing transmitted changes every 2 to 5 degrees (see chart). The headings are *reciprocal*—that is, a boat directly to the east of the station would have a bearing of 090 degrees relatively to the station. However, the signal received by the boat's skipper would be composed of a station identifier and the *opposite* heading of 270 degrees—the heading the boat would take to get to the station. Directly south, a craft would hear (in the case of Wildwood): "Wildwood 360," and to the southeast: "Wildwood 315," etc.

To get your exact position you can take readings from two stations and draw lines on a chart accordingly. You would be located where the lines intersect. By advancing your bearing and taking two readings some distance apart you also can get a fix when only one station is available.

The range of the talking beacon is put at ten miles, which is as far from shore as most small pleasure craft ever venture.

Movie film is used to record the bearings for two reasons. It is cheap to produce and the sprockets mechanically synchronize the film with the rotating antenna. Magnetic tape could slip in the transport mechanism, producing an incorrect heading.

In listening to a talking beacon, it is likely that as the beam passes a boat owner could hear as many as three bearings because the signals would overlap. However, it would be easy for him to tell which transmission applied to his area. That signal would be much louder than the others.

Good Reading

Continued from page 98

CITIZENS BAND CALL-BOOK. Horizons Publications, Oklahoma City, Okla. 223 pages. $3.95

This volume is a listing by call signs (with names and addresses of the licensees) of all Q-prefix CB lincenses issued during 1961 by the FCC. It also includes a few general CB articles.

And make note of. . .

BASIC MATHEMATICS, Vol. 3. By Norman H. Crowhurst. Rider. 137 pages. $3.90 Latest in a series previously reviewed here. One more volume to go.

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Tech Editor's Test Bench

Continued from page 82

reflex baffle and a closed box is the opening (s) or port cut into the box. The presence of a port changes the cabinet into a Helmholtz resonator, which is simply an air-filled cavity that resonates at a particular frequency. The tone you hear when blowing across the mouth of an empty soda bottle is an example of Helmholtz resonance at work. The resonant frequency is determined mainly by the enclosed volume of air and secondly by the size of the opening.

When properly tuned, the port size is adjusted so that the Helmholtz resonance of the cabinet falls at the same frequency as the mechanical resonance of the speaker. For reasons we won't go into here, the resonance of the speaker and cabinet are out of phase with each other and tend to cancel. Now, instead of a single high-resonant peak (Fig. 1, impedance curve A), which produces one-note bass and drives the speaker into distortion, we have two lower peaks (B) which stay within the linear portion of voice coil movement and not only eliminate the one-note bass boom, but even extend the response downward almost an octave.

Acoustically important in the Duoflex is the fact that two speakers are used (we can ignore the tweeter because it plays no part in the acoustics of the enclosure). Several advantages are realized with a two-speaker setup such as this.

- The power-handling capacity is doubled.
- The speakers acoustically load each other and hence are able to push more air. There is about a 3 db increase in the bass response because of this mutual coupling.
- The impedance curve is flattened, which results in a smooth peak-free bass response.

In the lower corners of EI's cabinet are two triangular cutouts. These are the ports, critically adjusted to the resonance of the speakers used.

The odd-looking speaker cutouts deserve some explanation. This particular arrangement, originated by a British speaker manufacturer, achieves several things. The vertical slot joining the upper and lower circular cutouts in front of each speaker fans out the mid-range and high frequencies and minimizes beaming. This is necessary because the speakers, like a lot of other inexpensive models, have a tendency to concentrate their high frequencies in a narrow beam. If the listener moves off-beam, most of the highs seem to disappear. In addition, since the front of each speaker is loaded slightly (the two holes alongside the slot keep the loading within reason), the speaker's resonant frequency is lowered somewhat. There is a slight loss of efficiency using this technique but the smooth impedance curve (Fig. 1B) and the clean bass it reflects, more than justify it.

Beginner's Page

Continued from page 41

from. The vinegar serves as the electrolyte between two dissimilar metals (can cover and copper). Since vinegar is an acid (acetic acid), it chemically attacks the atoms which make up the metal of the can cover. Atoms are normally balanced electrically, having equal positive (proton) and negative (electron) charges, but now the vinegar begins to split off electrons from the can cover. The resulting positive ions (positively-charged atoms) combine chemically with the vinegar, while the negatively charged electrons remain on the surface of the metal. When a complete circuit is made by the wire attached to the cover, the excess electrons flow through the wire (and the coil) and rejoin the positive ions in the solution around the copper electrode. Note that the can cover was attacked by the acid because copper is less active and low on the list of what the chemist terms the "Electromotive Series." Thus the electrons accumulate in great numbers on the can cover and pour into the wire. They travel around the circuit attempting to restore the + and − balance in the battery.

Electrical unbalance caused by

chemical action is the basic idea behind the operation of many battery types. The common flashlight cell has a zinc can which serves as the negative terminal. A carbon rod at the center is the positive terminal and a thick paste of ammonium chloride serves as the electrolyte.

The compass "indicator" used in the experiment deserves mention. It reacts to current flow because electrons moving through a wire set up a magnetic field. This attracts or repels the magnetized needle of the compass, depending on which side of the coil the electrons enter.

There are a number of other experimental batteries you can make. For example, try pushing a penny and a dime —spaced about ¼-inch apart—into a lemon. Connect your indicator across the two and see what reading you will get. You can make a saliva cell by wetting a small piece of paper with saliva and placing it over a dime. Leaving the edge of the dime exposed, touch the positive meter leads to the dime's edge. Connect one end of a length of stranded copper wire to the negative meter terminal and fan out the other end, pressing it on the paper. Both the above readings will be small, but significant.

Ham Shack

Continued from page 99

filter program has done wonders in restoring hams to good standing in many communities.

Postman's Holiday . . . The letter carrier who walks for exercise on his day off has nothing on some engineers who design communications equipment for the National Company in Malden, Mass. They have organized an amateur radio club, set up an elaborate station (K1RSX) in the company's plant and hold regular meetings. The club is called the National Employees Amateur Radio Society and now is attracting factory workers who want instruction in code and theory in order to qualify for their tickets.

Good luck, men!

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FREE COPIES newspaper "Tax Land Sales." Grant Allen, 210E Fifth Ave., New York, N. Y.

...electronics in the news

CB Goes for a Ride . . . The Citizens Band (also known as the Crowded Band) may have many new occupants

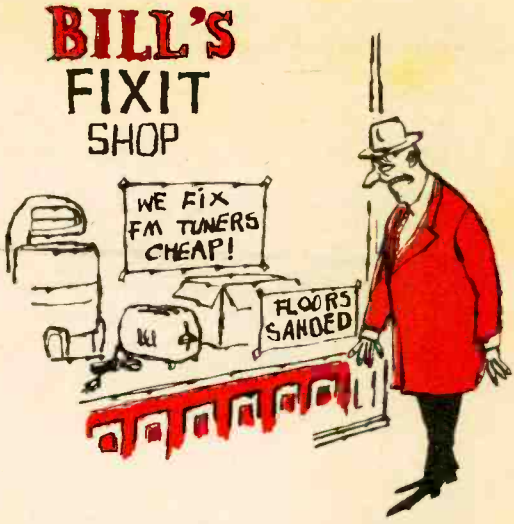
if an idea hatched by Ford and Raytheon goes over. The plan is to offer a five-channel Raytheon transceiver as optional equipment on all 1962 Ford, Mercury and Lincoln passenger cars and on Ford trucks. The cost will be about $190 per unit. An identical package will be available for fixed-station use in office or homes. The mobile unit can be run off a 6- or 12-volt battery pack. It features push-to-talk microphone and a set of matched crystals.

A Ford truck installation is shown in our photo.

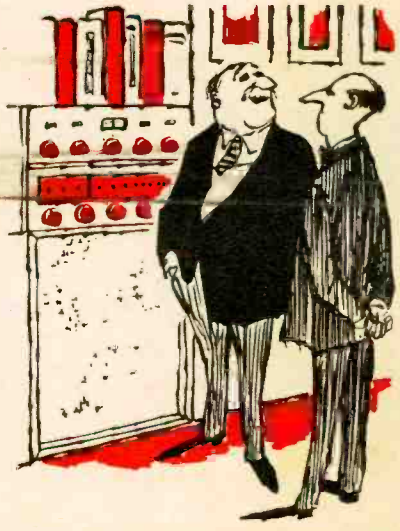
Index to Surplus Gear . . . Owners of surplus electronic equipment who are wondering what to do with it can, for $1.50, get a list of magazine articles about conversion of surplus which appeared between 1945 and 1961. The booklet, Index to Surplus, tells you the name and nature of the article (indexed by the model number of the surplus gear) and in what issue of what magazine it appeared. Finding back copies is up to you. Amateur Radio Publishing, Inc., 1379 E. 15th St., Bklyn. 30, N.Y.

OVER AND OUT

"640 or 1240? What about US? Aren't FM listeners entitled to Conelrad information, too?"



"They're really exclusive. The lease says you can't even use the TV antenna for FM."



"What do I want with a turntable, Barnes? Since I own the station, they play only what I like."

"Egad! A super-fringe antenna. We're STILL miles from civilization!"

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Electronics Training

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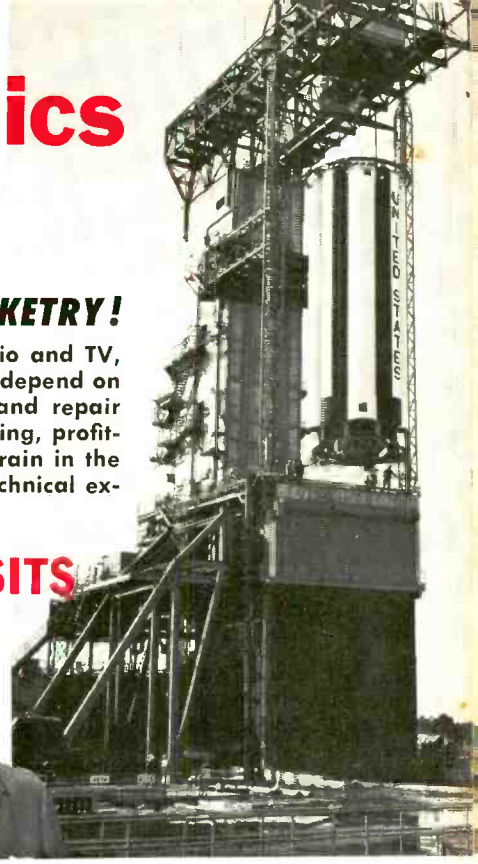
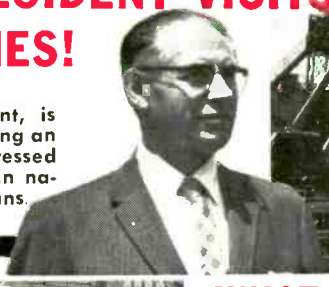
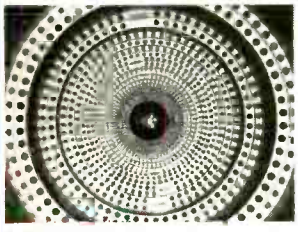
Not only the basic applications of electronics like Radio and TV, but also the satellites, space ships, guided missiles, all depend on Electronics Technicians who install, adjust, maintain and repair the equipment needed. What other job can be so exciting, profitable and promising? Yet many men, 17-55, can now train in the DeVry way at home for such jobs—without previous technical experience or advanced education.



DeVRY TECH PRESIDENT VISITS MISSILE FACILITIES!



Mr. T. J. Lafeber, DeVry's President, is shown here at missile test stand. During an inspection tour, he was deeply impressed with the role that is being played in national defense by electronic technicians.



A RARE VIEW! This inside view of a ballistic missile is seldom seen by a civilian. It's a sight that greatly impressed Mr. Lafeber.

THE COUNT DOWN! Here is a control panel for missile tests. Missile check-out and adjustment are largely the work of the Electronics Technician.

WHAT SOME DeVRY TECH GRADUATES ARE DOING!

Edward Hahn, Illinois, was a laborer. Now he is an Electronic Project Engineer with the Martin Company, a large producer of missiles.

Dale L. Gawthorpe, Illinois, left a clerk's job to take the DeVry program. He is now enjoying his work with automatic pilot equipment at Sperry Phoenix Company.

Charles Morishita, Oregon, worked as a farmer before taking DeVry's training. Now he builds and tests equipment at Lockheed's Space and Missile Division.

George D. Crouch, California, was a retail store clerk. He took the DeVry training program and today he is doing very well with his own business in the servicing field.

THE HEART OF THE MISSILE! Missile wiring soon becomes clear to a DeVry Tech man because he learns basic circuits by use of the "Electro-Lab," a training device that helps speed up learning.

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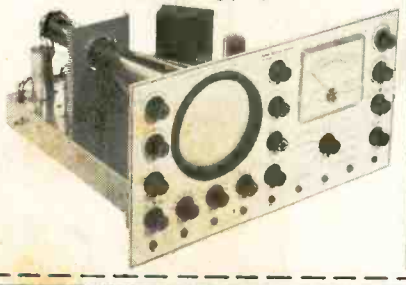

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