Special Issue: CITIZENS BAND RADIO

ELECTRONICS ILLUSTRATED

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on the Citizens Band

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By Herb Friedman, 2W6045

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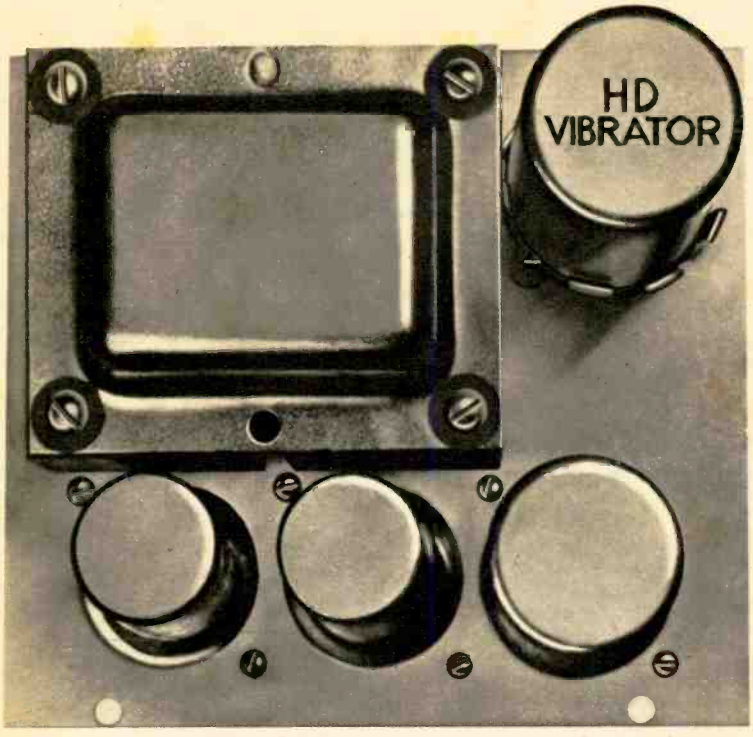

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Special CB Projects

General Features

Radio: Amateur • SWL

Audio & Hi-Fi

Regular Departments

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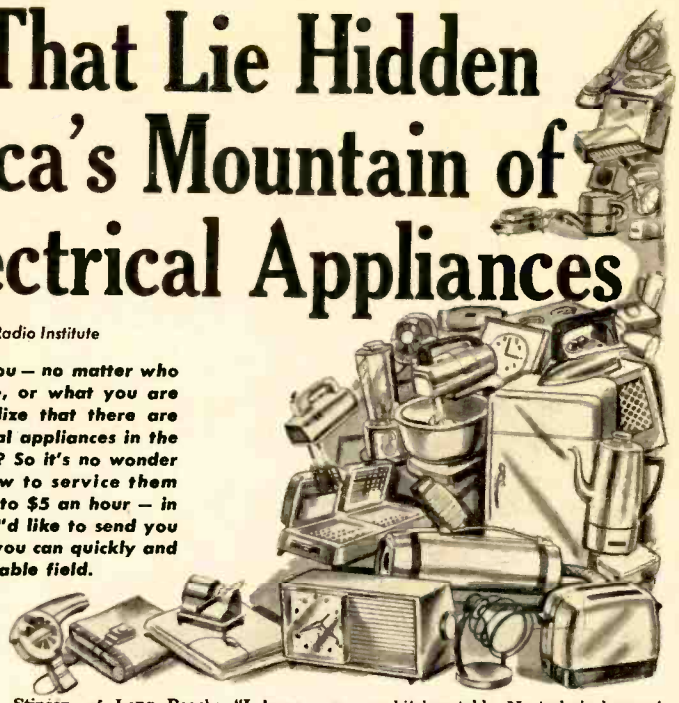
Profits That Lie Hidden in America's Mountain of Broken Electrical Appliances

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

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



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

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

A Few Examples of What I Mean

Now here's a report from Earl Reid, of Thompson, Ohio: "In one month I took in approximately $648 of which $510 was clear. I work only part time." And, to take a big jump out to California, here's one from J. G. Stinson, of Long Beach: "I have opened up a small repair shop. At present I am operating the shop on a spare time basis — but the way business is growing it will be a very short time before I will devote my full time to it."

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

We Tell You Everything You Need to Know

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

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

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I think that our 24-page Free Book will open your eyes to a whole world of new opportunities and how you can "cash in" on America's "Electrical Appliance Boom."

I'll also send you a Free Sample Lesson. It shows how simple and clearly illustrated our instruction is — how it can quickly prepare you for a profitable future in this big field. Just mail coupon, letter, or postcard to me: *Mr. J. M. Smith, President, National Radio Institute, Dept. KE2, Washington 16, D.C.* (No obligation, of course — and no salesman will call on you.)

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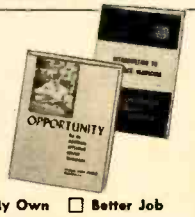
With this Tester you save time and make money by doing jobs quicker, making sure appliances operate correctly after repairs.

MAIL THIS FOR FREE BOOK and SAMPLE LESSON

Mr. J. M. Smith, President
NATIONAL RADIO INSTITUTE
Dept. KE2, Washington 16, D.C.



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

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FEEDBACK from our readers

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

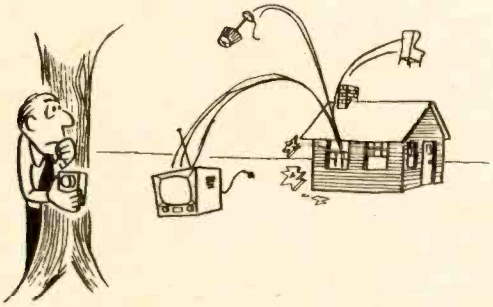
● ***Red Bug***

I am curious about your description of the listening device they found in our Moscow embassy (HOW RUSSIAN SPY RADIOS WORK, January '61 EI) as compared to the description given at the same time by a "big weekly picture magazine." They printed the same picture you did of Henry Cabot Lodge and the Great Seal and said the spy gadget was a hidden microphone. You said it wasn't a hidden microphone, but a special kind of tuned-cavity gismo. Who takes the honors for stupidity here?

Bill Sheffield
Seattle, Wash.

The picture-magazine people win the laurels without a struggle, Bill. EI was correct.

● ***Panic in the Bedroom***



That Panic Button you told how to build in your November issue has uses you didn't even mention. It knocks down houses better than a wrecking ball. I completed mine one night and took it upstairs and set it off beside my sleeping wife. Her reaction was instantaneous. She picked up a $15 alarm clock and threw it. She missed me but, unfortunately, not an $8.70 window that got in the way.

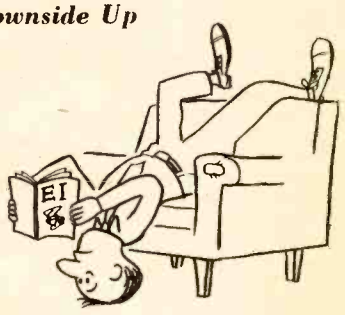
I withhold my name for reasons of safety.

Name Withheld
Los Angeles, Calif.

My face is red. I wired and rewired the Panic Button several times and it still didn't work. Then I found the trouble—a bad pushbutton. I just wish it had another stage of amplification to get a little more volume. This I am working on. Anyway, it works like a charm.

Dutch Meyer
Technical Director
KMSO-TV
Missoula, Mont.

● ***Downside Up***



The cover of your January issue, having to do with your special articles on Short-Wave Listening, was quite colorful. Posted on the wall were some QSL cards, including the rarest one of all. I'm talking about the one reading NS6ZO. Maybe it's from Mars or someplace like that. Or should it be turned upside down to read OZ9SN, from Denmark?

Richard Frost, K1JVG
Burlington, Mass.

Could be, Dick. Could be.

Your Special Issue on SWL made a mistake on the Lafayette HE-30 receiver. The price was listed as $99.95 for the kit. Shouldn't that be $79.95?

Paul Justyna
No Address Given

Yes, the price should be $79.95. Thanks for writing, Paul . . . wherever you are.

[*Continued on page 6*]

men 17-55

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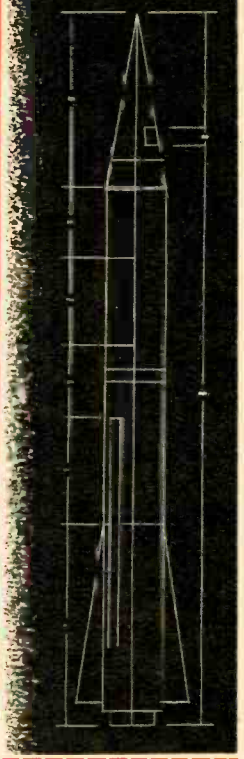

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FEEDBACK

Continued from page 4

May I compliment you on your very interesting articles on SWL and DX? I gain much needed information from your magazine.

Stephen Sauer, WN9ASZ
Age 14
Indianapolis, Ind.

Your January '62 issue was a masterpiece as far as we SWL's are concerned. I'm glad your magazine realizes the tremendous scope and potential of our hobby.

Ken MacNeilage
Editor
American Shortwave Listeners Club
Cranford, N. J.

EI thanks the several dozen readers who wrote us complimentary letters about our January issue.

● *Indian Offer*

I read your magazine with keen interest. I would like your readers to know I have organized a sort of tape-friendship club for exchanging tapes and I can send tapes anywhere in the world on such subjects as classical, instrumental and vocal Indian musics, Indian marriage, religious ceremonies, villages, streets and ways of cooking.

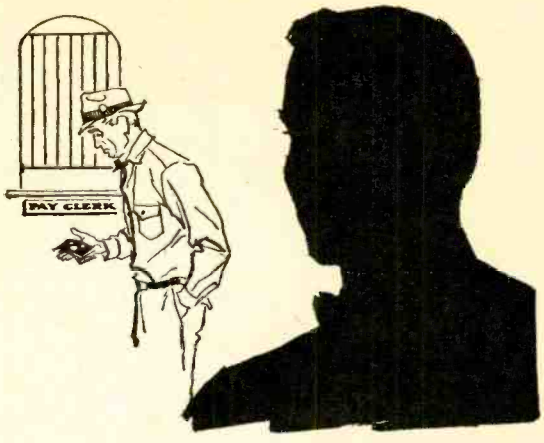
Ambika Shrivastava
30 Pagnispaga
Indore City (M.P.)
India

● *The New ARMy*

Reader Tom Duignan's suggestion in your January FEEDBACK column that Amateur Radio Monitors (ARM's) de-

[*Continued on page* 110]

"I SAW MYSELF 10 YEARS FROM NOW!"



It happened one payday...

Fred worked on the line next to me. Nice guy. Married. Two children. Been on the same job 10 years.

As we walked away from the pay window together he said, "Funny. Each week I get to feel like I'm letting my family down. You know. Not getting ahead so I can give them the things they need."

His words hit me all of a sudden. I could see myself saying the same thing—*10 years from now!*

Not only that. I could see the same job. Same thin paycheck. Same worries.

I thought about Fred all day. Then that night I saw an ad for I.C.S. It told about the job opportunities that open up with I.C.S. training. How people had found new careers and job success.

I mailed the coupon and that was the start. In just a few months my boss discovered I was an I.C.S. student. He was so pleased he decided to move me off the line. A year and two raises later I was made an assistant supervisor.

What about Fred? He's still working on the line. Still hoping for the future.

I told him about I.C.S. But so far he hasn't done anything. I guess some people never will.

How about you?

For Real Job Security—Get an I. C. S. Diploma! **I. C. S., Scranton 15, Penna.** Accredited Member, National Home Study Council

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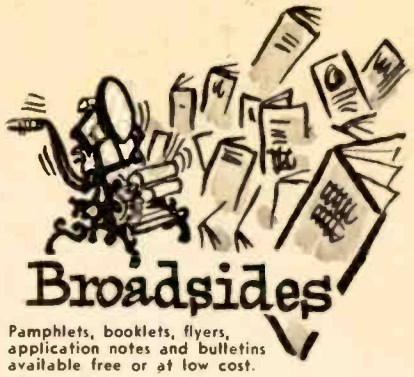

Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

A third revision of the Atomic Energy Commission's catalog of **Technical Books and Monographs** (1947-62) is available free from the AEC Div. of Technical Information Extension, Box 62, Oak Ridge, Tenn. Books listed are Commission-sponsored and cover such areas as medicine, chemistry, engineering, etc., as they relate to atomic energy.

Two new Scott hi-fi amplifiers are described in a **Guide to Custom Stereo.** Write to H. H. Scott, Inc., Dept. P., 111 Powdermill Rd., Maynard, Mass. It's free.

The method used in transmitting and receiving **stereo FM** programs is illustrated in a color wall chart put out by Harman-Kardon for its dealers. Free copies are available from the company's Sales Dept., Plainview, N. Y. Requests must be on a dealer's letterhead.

Whether you like the classics or jazz, children's stories or foreign languages, you'll probably find what you're after in Allied's new **Discount Stereo Record and Tape Catalog.** For a free copy write to Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. Ask for catalog No. 211.

EICO's newest catalog covers their line of kits and wired products ranging from stereo hi-fi equipment to CB and ham gear. Free copies are available on request from EICO, 33-00 Northern Blvd., Long Island City, N. Y.

The uses of near-ultraviolet energy, referred to as **Black Light,** are discussed in a new booklet by General Electric. A free copy can be had from GE's Inquiry Bureau, Nela Park, Cleveland 12, Ohio.

Solder, Its Fundamentals and Usage is free for the asking from Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.

What Does F.C.C. Mean To You?

What is the F.C.C.?

F. C. C. stands for Federal Communications Commission. This is an agency of the Federal Government, created by Congress to regulate all wire and radio communication and radio and television broadcasting in the United States.

What is an F.C.C. Operator License?

The F. C. C. requires that only qualified persons be allowed to install, maintain, and operate electronic communications equipment, including radio and television broadcast transmitters. To determine who is qualified to take on such responsibility, the F. C. C. gives technical examinations. Operator licenses are awarded to those who pass these examinations. There are different types and classes of operator licenses, based on the type and difficulty of the examination passed.

What are the Different Types of Operator Licenses?

The F. C. C. grants three different types (or groups) of operator licenses – commercial radiotelePHONE, commercial radioteleGRAPH, and amateur.

COMMERCIAL RADIOTELE*PHONE* operator licenses are those required of technicians and engineers responsible for the proper operation of electronic equipment involved in the transmission of voice, music, or pictures. For example, a person who installs or maintains two-way mobile radio systems or radio and television broadcast equipment must hold a radiotelePHONE license. (A knowledge of Morse code is NOT required to obtain such a license.)

COMMERCIAL RADIOTELE*GRAPH* operator licenses are those required of the operators and maintenance men working with communications equipment which involves the use of Morse code. For example, a radio operator on board a merchant ship must hold a radioteleGRAPH license. (The ability to send and receive Morse is required to obtain such a license.)

AMATEUR operator licenses are those required of radio "hams"–people who are radio hobbyists and experimenters. (A knowledge of Morse code is necessary to be a "ham".)

What are the Different Classes of RadiotelePHONE licenses?

Each type (or group) of license is divided into different *classes*. There are *three* classes of radiotelephone licenses, as follows:

(1) Third Class Radiotelephone License. No previous license or on-the-job experience is required to qualify for the examination for this license. The examination consists of F.C.C. Elements I and II covering radio laws, F.C.C. regulations, and basic operating practices.

(2) Second Class Radiotelephone License. No on-the-job experience is required for this examination. However, the applicant must have already passed examination Elements I and II. The *second class* radiotelephone examination consists of F. C. C. Element III. It is mostly technical and covers basic radiotelephone theory (including electrical calculations), vacuum tubes, transistors, amplifiers, oscillators, power supplies, amplitude modulation, frequency modulation, measuring instruments, transmitters, receivers, antennas and transmission lines, etc.

(3) First Class Radiotelephone License. No on-the-job experience is required to qualify for this examination. However, the applicant must have already passed examination Elements I, II, and III. (If the applicant wishes, he may take all four elements at the same sitting, but this is not the general practice.) The *first class* radiotelephone examination consists of F. C. C. Element IV. It is mostly technical covering advanced radiotelephone theory and basic television theory. This examination covers generally the same subject matter as the second class examination, but the questions are more difficult and involve more mathematics.

Which License Qualifies for Which Jobs?

The THIRD CLASS radiotelephone license is of value primarily in that it qualifies you to take the second class examination. The scope of authority covered by a third class license is extremely limited.

The SECOND CLASS radiotelephone license qualifies you to install, maintain, and operate most all radiotelephone equipment except commercial broadcast station equipment.

The FIRST CLASS radiotelephone license qualifies you to install, maintain, and operate every type of radiotelephone equipment (except amateur, of course) including all radio and television stations in the United States, and in its Territories and Possessions. This is the highest class of radiotelephone license available.

How Long Does it Take to Prepare for F. C. C. Exams?

The time required to prepare for FCC examinations naturally varies with the individual, depending on his background and aptitude. Grantham training prepares the student to pass FCC exams in a minimum of time.

In the Grantham *correspondence course*, the average beginner should prepare for his *second class* radiotelephone license after from 300 to 350 hours of study. This same student should then prepare for his *first class* license in approximately 75 additional hours of study.

In the Grantham *resident course*, the time normally required to complete the course and get your license is as follows:

In the DAY course (5 days a week) you should get your *second class* license at the end of the first 9 weeks of classes, and your *first class* license at the end of 3 additional weeks of classes. This makes a total of 12 weeks (just a little less than 3 months) required to cover the whole course, from "scratch" through *first class*.

In the EVENING course (3 nights a week) you should get your *second class* license at the end of the 15th week of classes and your *first class* license at the end of 5 additional weeks of classes. This makes a total of less than 5 months required to cover the whole course, from "scratch" through *first class*, in the evening course.

The Grantham course is designed specifically to prepare you to pass FCC examinations. All the instruction is presented with the FCC examinations in mind. In every lesson test and pre-examination you are given constant practice in answering FCC-type questions, presented in the same manner as the questions you will have to answer on your FCC examinations.

Why Choose Grantham Training?

The Grantham Communications Electronics Course is planned primarily to lead to an F.C.C. license, but it does this by TEACHING electronics. This course can prepare you *quickly* to pass F. C. C. examinations because it presents the necessary principles of electronics in a simple "easy to grasp" manner. Each new idea is tied in with familiar ideas. Each new principle is presented first in simple, everyday language. Then after you understand the "what and why" of a certain principle, you are taught the technical language associated with that principle. You learn more electronics in less time, because we make the subject easy and interesting.

Is the Grantham Course a "Memory Course"?

No doubt you've heard rumors about "memory courses" or "cram courses" offering "all the exact FCC questions". Ask anyone who has an FCC license if the necessary material can be memorized. Even if you had the exact exam questions and answers, it would be much more difficult to memorize this "meaningless" material than to learn to understand the subject. Choose the school that teaches you to thoroughly understand – choose Grantham School of Electronics.

Is the Grantham Course Merely a "Coaching Service"?

Some schools and individuals offer a "coaching service" in FCC license preparation. The weakness of the "coaching service" method is that it presumes the student already has a knowledge of technical radio and approaches the subject on a "question and answer" basis. On the other hand, the Grantham course "begins at the beginning" and progresses in logical order from one point to another. Every subject is covered simply and in detail. The emphasis is on making the subject easy to understand. With each lesson, you receive an FCC-type test so you can discover daily just which points you do not understand and clear them up as you go along.

HERE'S PROOF that Grantham Students prepare for F.C.C. examinations in a minimum of time. 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
Thomas J. Hoof, 216 S. Franklin St., Allentown, Pa.	1st	22
Clyde C. Morse, 7505 Sharronlee Dr., Mentor, Ohio	1st	12
Louis W. Pavek, 838 Page St., Berkeley 10, Calif.	1st	16
Wayne Winsauer, 2009 B St., Bellingham, Wash.	1st	12

To better serve our many students throughout the nation, Grantham School of Electronics maintains four separate schools – located in Los Angeles, Seattle, Kansas City, and Washington, D.C. – all offering the same resident courses in F. C. C. license preparation. (Correspondence courses are conducted from Hollywood.)

For further details concerning F.C.C. licenses and our training, send for our FREE booklet, "Careers in Electronics". Clip the coupon below and mail it to the School nearest you.

Get your First Class Commercial F.C.C. License Quickly by training at

GRANTHAM SCHOOL OF ELECTRONICS

1505 N. Western Ave.	408 Marion Street	3123 Gillham Road	821-19th Street, N.W.
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To: GRANTHAM SCHOOL OF ELECTRONICS
NATIONAL HEADQUARTERS OFFICE
1505 N. Western Ave., Hollywood 27, Calif.

Please send me your free booklet telling how I can get my commercial F.C.C. license quickly. I understand there is no obligation and no salesman will call. 28-E

Name _____ Age _____

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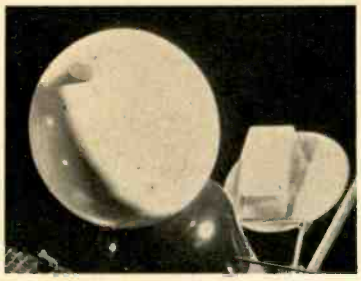
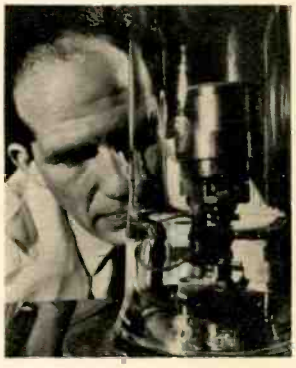
...electronics in the news



Moon Ball . . . Those hefty (96.5 lbs.) white balls we've been shooting at the moon on the nose of Ranger spacecraft are jam-packed with instruments and radio equipment. (See OUR AMAZING NEW ROBOTS, July '61 EI.) The job of the 25-inch spheres is to gather data on such things as temperature, moonquakes and other lunar conditions. The moon balls are produced by Ford's Aeronutronic Division. They have a thick outer shell of balsa and a 12-inch inner survival sphere in which the scientific instruments are stored.

Designed to withstand the fantastic lunar climate, the survival area is protected by an insulating vacuum and a shot of water that is supposed to keep the temperature fairly constant.

According to the standard flight plan, the capsule separates from the Ranger at 25 miles from the moon's surface and slows down to about 150 mph by the use of retrorockets before landing on the green cheese. The Ranger isn't so lucky. The builders don't plan to hear from it again after it takes a 5,000-mph swan dive into the face of the man in the moon.



Hot Stuff . . . RCA has developed a thermoelectric material that generates electricity more efficiently than any of its kind. The substance is an alloy of germanium and silicon. A multi-layered sandwich measuring a foot square produces up to 10 kilowatts of electricity when heated to 1800° F. The RCA people envision self-contained, silent generators using the heat of a nuclear source, solar energy or a flame to power equipment in remote areas or outer space (see THESE GENERATORS HAVE NMP! March '62 EI). Our photo shows an RCA researcher testing a small model of the new generator in a vacuum chamber.

Cleaner Wasteland . . . Westinghouse has built a new TV picture tube that eliminates those annoying horizontal lines. The left side of our photo shows a cleaned-up vast wasteland image, while on the right is the normal line-filled image.

Westinghouse does it by subjecting the electron beam in the picture tube to a high-frequency wobbler signal that jiggles the scanning spot up and down to fill in between the lines. A split-focus grid in the electron gun permits the simple combination of the wobbler and the regular horizontal sweep.

Pocket Rocket . . . The unhappy dogface slogging through a ground war used to have just one defense against strafing planes—he dived into the ditch. But the Army and Marines are changing things. The GI of today can whip out a 20-pound guided missile capable of tracking down and destroying any strafer. The missile's called Redeye.

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YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

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

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

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

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 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.

FREE EXTRAS

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

SERVICING LESSONS

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

UNCONDITIONAL MONEY-BACK GUARANTEE

Please RUSH my Progressive Radio "Edu-Kit" to me.

BE SURE TO INCLUDE all the FREE EXTRAS and BONUS RESISTOR and CONDENSER KITS WORTH $7.00.

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. 541AE, Hewlett, N. Y.

. . . electronics in the news

As you might deduce from its name, Redeye has an eye in the nose which detects infrared energy given off by a plane's engine and steers the missile to its target. Two pop-out fins control flight. The Redeye measures just 4 feet 3 inches from eye to tail, is 3 inches in diameter and can be shoulder-fired like a bazooka. Its guidance system was developed by General Dynamics of Pomona, Calif.

Bee-Bob SOS . . . A new sound has been added to the maritime distress frequency of 2182 kc. It's a distinctive alert signal adopted recently by the Coast Guard, consisting of two modulating tones—one at 2,200 cycles and the other at 1,300—which alternate four times each second for 45 seconds. When the bee-bop signal is heard, it means the Coast Guard has received a distress message and all stations must clear the

frequency to facilitate communications with the ship or plane that is in trouble. Since the signal is so new, the Coast Guard wants reports (send them to CG headquarters in New York or San Francisco) from anyone who hears the signals as to readability, listener's location, time, date and how well the bee-bop quieted traffic on the frequency.

The little transistorized signal generator is shown in our photo.

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Your 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.

Cleveland Institute Announces

A New and Dynamic Technician Training Program in Computers, Servo Mechanisms, Magnetic Amplifiers, and Others.

Other advanced fields covered include Basic Math, A. C. Circuit Analysis, Pulse Circuitry, Color TV, Radar, Advanced Measuring Techniques, Industrial Electronics, Instrumentation, Automation, Radio Telemetry. Send for information today.

FIND OUT how the FCC license helps you get a better job or increase your pay on your present job

MAIL COUPON TODAY

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Cleveland Institute of Electronics
Desk EI 39, 1776 E. 17th St., Cleveland 14, Ohio

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

- ☐ Military
- ☐ Radio TV Servicing
- ☐ Manufacturing
- ☐ Amateur Radio
- ☐ Broadcasting
- ☐ 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 .....

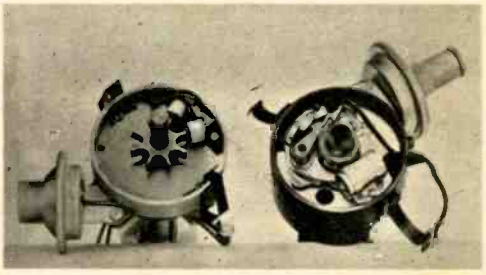
City ..... Zone .... State .....

EI-39

. . . electronics in the news

Sparkling Development . . . Ever since the transistor revolutionized radio, everyone from do-it-yourselfers to big business has been trying to cash in on the invention. The automobile industry is hard at work on a transistorized ignition system. A few models have been developed and some put on the market, but in our opinion *none* of them is practical from a cost-benefit standpoint.

Motorola has announced development of the newest transistorized ignition design. In place of the conventional mechanical breaker arm, points and condenser you find in normal distributors (right, in photo), the Motorola device (left, in photo) uses a pulse generator



which consists of a small, spoked wheel rotating past a pair of electromagnets without touching them. The pulses created by this cutting of magnetic lines of force trigger an amplifier that fires the regular ignition coil. Because there is no direct contact, distributor breakdown from wear is virtually eliminated. Dwell time is constant at all speeds, Motorola says, and battery drain is low.

The apparatus is still in the testing stage and there are no concrete marketing plans. Motorola has not announced any cost figures so a close evaluation is impossible.

The New Giant Size . . . That black cylinder held by the young man in our photo is neither a chunk of gas pipe nor a telescope. It is just a plain resistor. But don't ask to see the rest of the radio that goes with it. The giant component, made of glass by the Corning Works, is designed to serve as a dummy load for testing transmitters of 10,000 to 40,000 watts in the Project Mercury tracking

...electronics in the news

network. It also can be used as a power dissipating termination for big transmitting antennas. The resistor, measuring 4 feet in length and 5 inches in

diameter, is made up of a tin oxide film fused into the glass. Various models have 140 to 300 ohms resistance or 70 to 600 ohms impedance.

ITEMS . . . New York got its first **all-stereo FM broadcasting station** in WTFM, operating on 103.5 mc. Transmitter and studio are on Long Island. Enough other FM stations are broadcasting stereo part-time to give New Yorkers some variety in their multiplex.

With all those **satellites** careening around the globe you need a score card to tell which one is doing what. The Air Force Research Labs have devised a system that can display six orbital tracks at the same time on a large cathode-ray tube. The tracks are superimposed on a projection of the world. When a light beam is pointed at one of the spots representing a satellite, computer-stored information flashes on the screen, giving the craft's identification, exact location and other data.

The Coast Guard has set afloat in Chesapeake Bay the first **nuclear-powered navigation buoy** ever built. The 7-ton, 26-foot-high buoy is topped by a blinking light. Power comes from a drum-size generator in its base, under the waterline. The generator consists of

The Fisher KX-200 80-Watt Stereo Control-Amplifier StrataKit, $169.50.*

It has four things that others haven't.

1. StrataKit Construction. Assembly by totally error-proof stages (strata). Each stage corresponds to a *separate* fold-out page in the Instruction Manual. Each stage is built from a *separate* transparent packet of parts. Major components come already mounted on the extra-heavy-gauge steel chassis. Wires are *pre-cut* for every stage—which means every page. Result: Absolutely equal success by the experienced kit builder or the completely unskilled novice!

2. Built-In d'Arsonval Meter. For laboratory-accurate adjustment of bias and balance. Assures peak performance from the start; permits 'touching up' for continued peak performance throughout the years, regardless of tube aging. No other single-chassis control-amplifier kit has this vital feature.

3. Third-Speaker Output with Volume Control. Blends the two stereo channel outputs to feed a third loudspeaker system—at *any* desired volume level. Ideal for center-channel stereo fill-in or for a mono extension speaker in another room of the home. A Fisher exclusive among control-amplifier kits.

4. The Fisher Name. No comment necessary.

*Walnut or Mahogany cabinet, $24.95. Metal cabinet, $15.95. Prices slightly higher in the Far West.

USE THIS COUPON FOR FURTHER INFORMATION

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

Please send me without charge the complete Fisher StrataKit catalogue.

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

E1-511

...electronics in the news

60 pairs of thermoelectric elements heated by strontium-90. It should keep sending up juice for about 10 years.

The sparsely inhabited **Very Low Frequency band** may in a few months be jumping with life like the short-wave frequencies. The Navy has announced plans to build a 2,000,000-watt-or-over VLF transmitter in Australia and NATO is putting up another big rig in England. Like the Navy VLF stations at Cutler, Me., and Jim Creek, Wash., the new transmitters are designed for communications with ships and submarines. Meanwhile, the Air Force has carried out research showing VLF to be immune to such man-made ionosphere disturbances as high-altitude nuclear explosions, which wreck SW communications. The reason, of course, lies in the fact that VLF communications are by groundwave instead of skywave (see THE INCREDIBLE BASEMENT OF RADIO, November '61 EI).

Signals transmitted in the visible light and infrared spectra are not limited to line-of-sight use, the Naval Research Lab has found. Both types of signals have been transmitted as much as 200 miles at night. The over-the-horizon shots were possible because tiny particles in the low atmosphere scatter the signals, reflecting a portion back to earth.

A New Jersey company, United States Radium Corp., has patented a type of **radioactive lantern** or flashlight. The lights use radioactive tritium gas (or krypton gas) in the bulbs, producing a bright beam of light for a long period of time. When marketed commercially, the lights will carry the brand name of Isolite.

Pilot Radio, maker of radios and hi-fi components since 1919, has been acquired by **Jerrold Electronics** of Philadelphia. Jerrold also has picked up Harman-Kardon (hi-fi) and Taco (TV antennas) in recent months.

Successful orbit of amateur radio satellite **OSCAR** (THE HITCHHIKING HAM, March '62 EI) set amateurs to designing OSCARS II and III.

Electronic Marketplace

The Winner . . . H. H. Scott, it turns out, saddled the winner in a little race of interest mainly to those in the hi-fi trade. The stakes were the marketing of the first stereo FM tuner kit. Scott's winning (by a few days) entry was the LT-110 multiplex kit.

One of the nagging questions faced by kit manufacturers was what to do about the hard-to-align multiplex section. Scott's solution was to build and

align the critical section and mount it on the chassis, along with the pre-wired front-end. The builder merely puts together the rest of the components and connects them to the already-mounted units. Only the simplest additional alignment is needed.

The LT-110 uses the time-switching type of circuitry. Claimed IHFM sensitivity is 2.2 microvolts. Kit price is $159.95. H. H. Scott, Inc., 111 Powdermill Rd., Maynard, Mass.

Soundly Controlled . . . Zenith's latest Space Commander remote TV control takes the ups and downs out of televiewing. From across the room you can turn on the set, change channels, adjust volume control to three levels and kill the sound while the picture stays on (during windy commercials). These com-

Marketplace

mands are transmitted by a hand-held control via ultrasonic pulses.

The little command-signal generator has four pipes that produce varying tones from 37.75 to 41.25 kc. The ultra-

sound is picked up by a special microphone on the TV set and fed to a transistorized circuit containing stepping relays and a motor, which do the tuning. Zenith has 8 Space Commander models at varying prices. Zenith Radio Corp., Chicago 39, Ill.

Shelter Special . . . Allied is pushing its new battery-powered DX'er receiver kit as fallout shelter equipment. The transistorized regenerative set runs on four penlight cells and tunes the broadcast band plus a section of the shortwave band from 7.5 to 17.5 mc. Controls on the front panel include an antenna

Marketplace

trimmer and regen knob. Price is $19.95. Allied Radio, 100 N. Western Ave., Chicago 80, Ill.

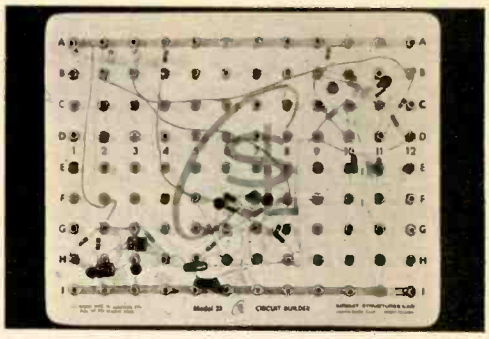
Ten Thousand Microfarads . . . That's the amount of filtering capacitance you'll find in EICO's new battery eliminator and charger (model 1064) and it's what makes the instrument's DC output ripple-free. The 1064 can be used for servicing or experimental work with transistors, battery rejuvenation, etc. The unit delivers 6 volts at 20 amps or 12 volts at 10 amps. It's fully adjustable and metered. Price for the kit is approximately $44; wired, around $53. EICO, 33-00 Northern Blvd., Long Island City 1, N. Y.

Breadboarding Deluxe . . . If you're the type who dreams up some novel circuit and then forgets it before you get it built, the 23-CSL Circuit Builder may be for you. With this gadget you can have the project hooked up, wired and operating while it's still fresh in your mind. No soldering, spring clips or jumper wires are involved in the quick assembly, re-design and disassembly.

Here's the secret. The 9½ x 12½-inch

Marketplace

board has 108 gold-plated cells. Inserted in each cell is a rubber core designed to hold as many as seven wires of varying sizes in firm contact with the metal cell



liner. The unit is priced at $15. Circuit Structures Lab, Box 36, Laguna Beach, Calif.

Teach Yourself . . . If you're itching to get your hands on a transistorized something-or-other but lack basic knowledge of transistors, here's your chance to learn by doing. Heathkit's new EK-3 transistor education kit gives the newcomer an opportunity to assemble

a two-transistor receiver, a wireless broadcaster, an audio amplifier and a test oscillator. A special textbook makes it easy to sail through the course and you end up with a little intercom (the last project) to show for it. The kit goes for about $17. Heath Co., Benton Harbor, Mich.

Marketplace

All About Tapes . . . *Tape-Log* is the title of a new catalog devoted solely to pre-recorded four-track stereo tapes, listing over 1,500 tapes by number, title, performers and price. It includes the complete libraries of 38 major tape producers, with new releases added each

issue. The log is published four times a year at 60¢ a copy or $2 for a one-year subscription. Available from hi-fi dealers or directly from the publisher, Danken Associates, 8244 Vista Del Mar, Playa Del Rey, Calif.

Music Center . . . A full stereo FM tuner, with a transistor/nuvistor circuit, a 40-watt all-transistor stereo amplifier and an automatic clock timer are combined in one compact cabinet to form the Knight All-In-One Music Center. Optional equipment, such as a record

player, tape deck and microphone, may be added. The timer turns the equipment on and off at pre-set times. The size is 4⅞" x 13¼" x 8 inches deep. The model number is KN-310MC and the price is $255. Allied Radio, 100 N. Western Ave., Chicago 80, Ill.

Marketplace

QSA? . . . Next time someone asks, "What is the strength of my signals?" (that's what QSA means), you won't have to guess at the answer if you equip your short-wave receiver with the Lafayette TM-59 S-meter. The meter uses a VTVM-type Wheatstone bridge circuit and can be added to any transformer-operated superheterodyne having AVC. The unit employs a single

6C4 tube. About $8. Lafayette Radio, Syosset, N.Y. [*Continued on page* 103]

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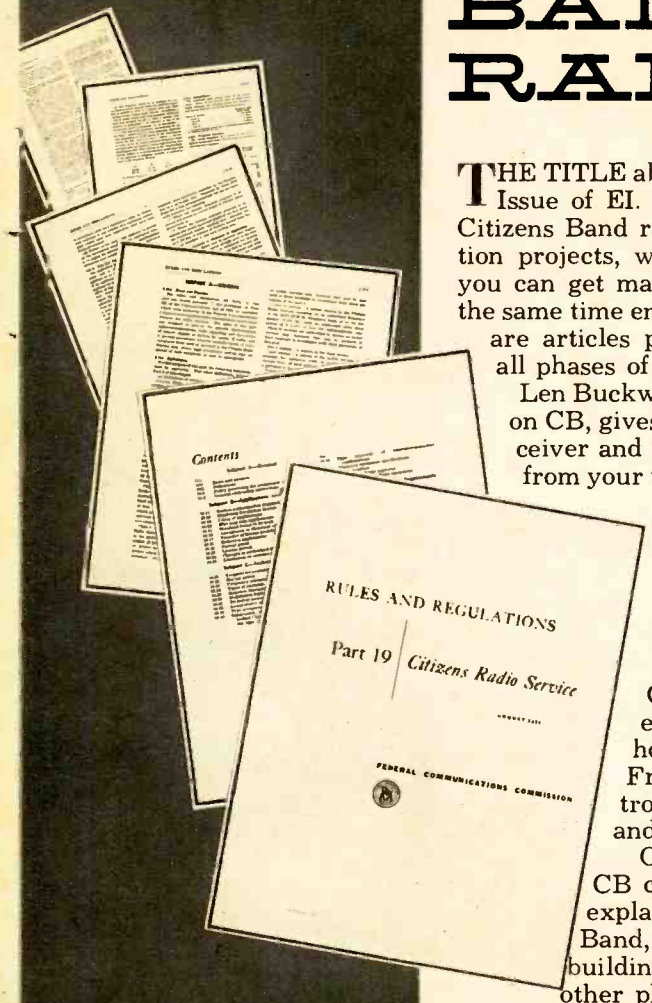
ELECTRONICS ILLUSTRATED
MAY 1962

how to get the most out of

CITIZENS BAND RADIO



THE TITLE above sums up the theme of this Special Issue of EI. By devoting more than 50 pages to Citizens Band radio, including ten exciting construction projects, we have attempted to show you how you can get maximum usefulness out of CB, and at the same time enjoy yourself. Gathered together here are articles prepared by the foremost writers on all phases of CB.

Len Buckwalter, 1W5733, EI's Contributing Editor on CB, gives you a basic guide for buying a transceiver and tells you how to get maximum power from your transmitter. Herb Friedman, 2W6045, a prolific EI contributor, advises you on choosing your antenna and contributes a valuable article on CB servicing. Tom Kneitel, 12Q1747, nationally noted for his CB activities, gives you a blueprint for setting up your first station. Charles Tepfer, 2W4223, prominent electronics writer and editor, tells you how to build four CB antennas. And Fred Maynard, 11Q0846, veteran electronic applications engineer, designed and built EI's Tiny-Talkie.

Other authors tell you how to form a CB club and how to make it worthwhile, explain operations on the License-Free Band, give you how-to instructions for building a variety of accessories and cover other phases of Citizens Band radio.

As you've probably discerned already, this issue covers CB from beginning to end . . . from assessing your needs and buying your equipment to operating and servicing your gear so that the inherently useful Citizens Band is of maximum service to you.

We are proud of our Special Issue on Citizens Band radio and we believe it represents a major contribution to the efficient use of the service. We would remind you that *every* issue of EI includes top-flight CB

[*Continued on page* 100]

CB SPECIAL

CB SPECIAL

HOW TO BUY A TRANSCEIVER

To get the kind of equipment that best suits your particular needs, you must know what to look for.

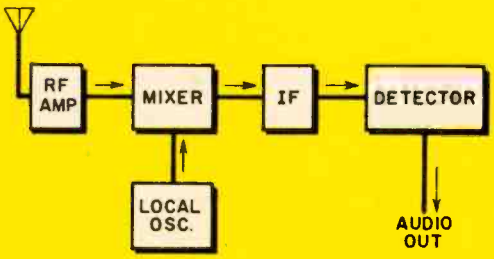
By Len Buckwalter, 1W5733

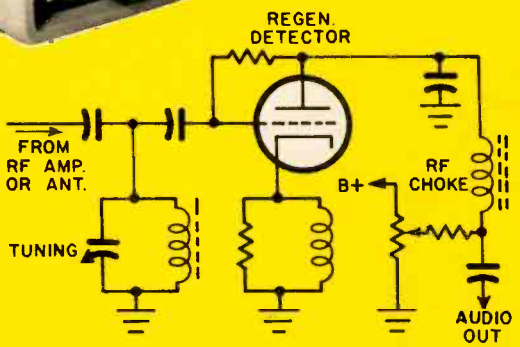
THE CITIZENS BAND marketplace offers more variety than you'd expect to find in an oriental bazaar. From the simplest four-tuber for cousin Lem down on the farm to elaborate multi-channel rigs for tough city conditions, there's a transceiver for every application.

Choosing the right unit begins with two questions: Under what conditions will it operate? Which features do you require? The answer to the first is a personal one determined by you. To help answer the second, here are some major factors which account for the differences in equipment.

Let's face it—all popular CB radios except handie-talkies have the same transmitter power: five watts input to the final stage. Small differences that do exist are meaningless in terms of range.

In the receiver sections, one must split hairs in discussing *sensitivity* (ability to pull signals out of background





Superheterodyne receiver (left) has local oscillator and mixer; superregenerative circuit (typical schematic at right) is cheaper but less efficient. EICO 762 transceiver above is superhet type, costs $69.95 as kit.

noise) from one rig to the next, regardless of price.

But in the receiving section we do come to a basic split that perhaps makes for the most important consideration of all. The major difference between CB units occurs in the type of receiver circuitry—superregenerative or superheterodyne. Both are fairly equal, as just mentioned, in terms of sensitivity. But, the superregen takes second place in *selectivity*.

The stronger a station is in a superregen receiver, the more space it takes up on the dial. Twist the tuning knob over several channels and you still won't be able to reject this type of interference. Broad receiver response to powerful signals of interfering stations can punch a temporary, though large, hole in your tuning range.

But the superregen has earned a well-deserved niche in CB radio. You can't beat it on a price-vs-performance basis. These sets fall into the attractive around-$50 range. Especially in sparsely populated areas where CB is not too active, they perform admirably. Remember, too, that a possible method of avoiding an interfering station is simply to wait until it stops transmitting. FCC rules hold that CB stations must limit their transmissions to the shortest practicable duration. And then it's your turn.

The more costly superhet largely overcomes the problem of interference from stations operating on adjacent channels. It has several more tuned stages which sharpen the response, or bandpass. However, don't look to the superhet to cut out interference on your own channel. In spite of high selectivity, all stations on the same channel are admitted equally into the receiver.

Among features which improve the performance of the superhet is its number of stages. Greatest variation is in the intermediate frequency (IF) strip. All channels are converted to an amplifying IF frequency for circuit efficiency, but sets with more than a single IF stage offer improved selectivity.

For ultimate performance, there is the dual-conversion model. Not only does it have several IF stages, but it juggles the received signal in a manner which rejects images. These are stations operating out of the Citizens Band but, under certain conditions, are amplified in the IF strip of the more basic single-conversion receiver. Look for the dual-conversion feature if you wish to get top receiver performance.

When planning your CB layout ask yourself whether you will need to communicate on more than one channel. Multi-channel performance frees you from being tied to a single transmitting frequency. If the basic channel is

Large press-to-talk bar is handy feature of the Allied Knight-Kit C-27 transceiver; kit costs $79.95.

Five-channel operation is offered by Lafayette HE-15A, which lists at $59.50, factory wired.

Superregen tuning knob gives approximate channel markings. Heathkit CB-1 (kit) sells for $42.95.

blocked by other signals, you can flip to one or more alternates. Many sets permit a choice of five transmitting channels and there are now rigs on the market that will give you all 23 channels.

At present there is a move to reserve channels for specific communications: marine, distress, Civil Defense, traveling, etc. If your interests cover more than one, get a multi-channel set.

Many business concerns find multi-channel operation boosts efficiency by letting them talk to one group of stations to the exclusion of others, such as trucks on one channel, automobiles on another.

Most receivers are continuously tunable over the 23 CB channels. This is fine for single-channel work but it creates a problem in multi-channel systems. The dial marking on most sets is only approximate. Changing channels quickly can be a hit-or-miss affair. Imagine riding in a mobile unit and trying to find your master station, which might have switched to an alternate channel. Unless the signals are strong, you can't re-tune precisely.

Crystal-controlled superhet receivers provide a neat solution. Instead of a smooth tuning control, a multi-position switch selects the channel with positive snap action. Any chance for error is eliminated, since the crystals in the receiver are highly accurate tuning devices. Crystal control enjoys wide acceptance in commercial communications equipment, especially when tuning must be done by non-technical people. CB sets which feature this function usually include the continuously tunable dial also. Superregen receivers cannot be crystal-controlled.

Without a noise limiter in a superhet, mobile reception is often obliterated. Auto and boat ignition systems are vigorous generators of noise in the 27-mc Citizens Band. Reducing this interference at the source (spark plugs, distributor, etc.) only attacks the noise produced by *your* vehicle. The noise limiter in a CB unit cuts down electrical interference radiated by other vehicles. Don't look for a noise limiter in the superregen. It's not needed because this type of circuit is self-limiting.

Another source of noise is countered by the squelch control. Communicating via CB is often on a non-schedule basis. Messages are transmitted at unpredictable times. Long standby periods with the receiver volume turned up is a source of distraction and annoyance from atmospheric noise and hiss.

The squelch circuit kills all sound in the speaker until a signal is received. The squelch circuit then is immediately disabled, and it remains off for the duration of the other station's transmission.

These are the key features found in CB units today. There are some others that require no explanation but should be considered. Power supplies are packaged in various combinations of 6, 12 and 117 volts. The shape and mounting style of a CB set can affect its position under a car dashboard. If push-to-talk operation is desirable, be sure your set has this feature.

Transceiver kits are now pretty much bug-free, and they offer a way to acquire CB equipment at a modest cost. All of them come with the frequency-determining section in pre-built form. All you have to do is add the other components as supplied by the manufacturer. Most construction manuals make this easy.

Choosing CB equipment with features to cover the application you have in mind can result in an economical purchase that gives you an efficient system of communications.

CB Hit Parade

Pictured below and on the preceding three pages are the current best sellers among transceivers, and others with features that are much discussed by CBers.

RCA Mark VII Radio-Phone has continuously-tunable superhet receiver, crystal-controlled transmitting and receiving on any 4 channels, push-to-talk mike, built-in squelch. Mounting bracket. $189.50. RCA, Harrison, N. J.

Hallicrafters CB-3 Littlefone has 8 crystal-controlled transmit-receive channels, output indicator on front panel, push-to-talk, squelch, noise limiter. Operates on 117 VAC, 12 VDC. $149.50. Hallicrafters Co., Chicago 24, Ill.

Poly-Comm N has a Nuvistor RF stage, dual-conversion IF (455 kc) for increased selectivity; 4 crystal-controlled transmit-receive channels, automatic gain control, adjustable squelch. $189.50. Polytronics Lab, Clifton, N. J.

Realistic TRC-27A has provision for 3 crystal-controlled transmit-receive channels, push-to-talk with dynamic mike, pi-network output, adjustable squelch and automatic noise limiter. $89.95. Radio Shack, Boston 17, Mass.

Cadre 500 is an all-transistor set with 15 transistors and 7 diodes; 5 crystal-controlled transmit-receive channels, squelch control on front panel, automatic noise limiter. Weight is 6 lbs. $199.95. Cadre Industries, Endicott, N. Y.

Browning 23/S-Nine transmitter offers 23-channel operation, built-in SWR indicator, push-to-talk, speech clipper. Price is $144 with one crystal, $189 with 23 crystals. Matching receiver is model R-2700. Browning Labs, Laconia, N. H.

Kaar TR327 features 4 crystal-controlled channels, has an antenna loading control on front panel and an S-meter indicating level of received signal. $189. Another version has broadcast band. Kaar Engineering, Palo Alto, Calif.

Gonset G-15 Communicator is a new model with dual-conversion receiver, 4 crystal-controlled transmit-receive channels, an adjustable squelch, push-to-talk mike and an S-meter on the front panel. $199.50. Gonset, Burbank, Calif.

Courier I has a triple-conversion receiver with 262-kc final IF stage for high selectivity, 4 fix-tuned receiving channels, 12 transmitting channels, Nuvistor converter, squelch and noise limiter. $189.50. E.C.I., Mount Vernon, N. Y.

Continued on next page

CB Hit Parade

Continued from preceding page

The Viking Messenger features 4 crystal-controlled transmit-receive channels, squelch control on the front panel, noise limiter, push-to-talk. Set measures 5⅝ x 7 x 11⅜ inches deep. $144.95. E. F. Johnson Co., Waseca, Minn.

Executive Model 100 has dual-conversion receiver (455-kc IF), 12 transmit channels, 2 crystal-controlled receive channels, crystal filter to cut interference and adjustable squelch. $199.50. Intl. Crystal, Oklahoma City, Okla.

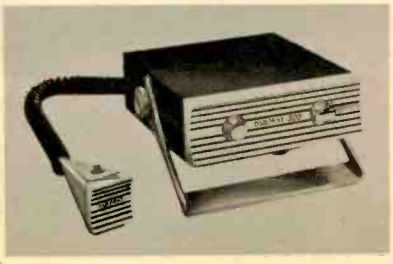
A new type of boom microphone for mobile operation mounts on ceiling of car, swivels down near driver's head. A foot-operated push-to-talk assembly similar to dimmer mounts on floor. AC Spark Plug, Milwaukee, Wis.

CB-4 Littlefone is a new 100-mw handi-talkie with 7 transistors and a diode. It weighs in at 1½ lbs., has 38-in. telescoping antenna. List price, $89.95. Hallicrafters, Chicago 24, Ill.

Model 520 antenna tester is an in-line instrument (it may be left connected in the transmission line) that gives you an SWR figure, your actual RF output and your reflected power. Price is $42.95. Seco Electronics, Minneapolis, Minn.

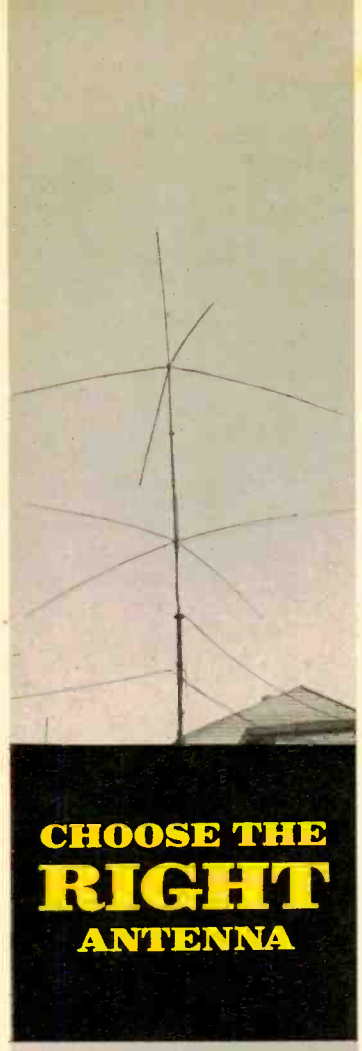
The Olson RA-442 transceiver has 5 crystal-controlled transmit channels, superhet receiver, built-in S-meter and output power indicator, front-panel squelch control and a noise limiter. $89.50. Olson Radio, Akron 8, Ohio.

CB loading coil to make shortened mobile whips perform like resonant quarter-wave antennas is encapsulated in epoxy. It fits standard whip threads. Two models, for whips of 92, 96 in. $5. Creative Products, Cincinnati 36, Ohio.

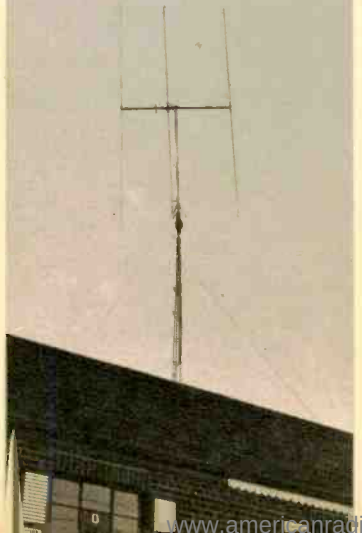


All-transistor Osborne 300 transceiver has 9 transistors, 4 crystal-controlled transmit-receive channels, noise limiter, mounting bracket. It measures 1⅞ x 6 x 7 inches and weighs 3¾ lbs. $149.50. Osborne Electronics, Hawthorne, Calif.

CB SPECIAL



CHOOSE THE RIGHT ANTENNA



By Herb Friedman, 2W6045

AN IMPORTANT fact that many Citizens Band licensees realize only vaguely is that the effectiveness of their rigs is determined mainly by the antenna. The best receiver cannot reject co-channel interference, nor can a hot transmitter be heard if the signal has difficulty clearing the antenna.

But a good antenna *can* reject co-channel interference and *can* make a five-watt rig put out a signal equivalent to 40 or 50 watts. No antenna can do everything for you but it is possible to get one that combines enough desired characteristics to suit your requirements.

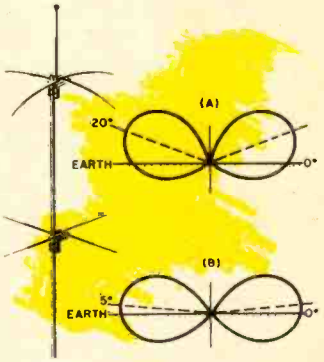


Fig. 1. Vertical radiation pattern of Ground Plane antenna (A); with an isolating skirt (B).

The *Ground Plane* antenna (see Fig. 1) is the least expensive and easiest to mount. It has a quarter-wavelength (about 9 feet) vertical radiator and four radials at its base. These are connected to the coaxial cable shield and through the mounting clamp to the grounded mast.

The GP is non-directional, radiating equally in all directions. Because of re-radiated currents induced in the mast and transmission line, it has a vertical radiation angle (wave angle) of about 20°, meaning the radiated energy is directed upward that much from the earth.

A 20° wave angle is low, but not low enough for optimum CB use. To lower it to a more usable 5°, an isolating skirt is

added. This consists of four additional radials a quarter-wave below the main radials. The skirt reduces the effects of antenna currents in the mast and transmission line. (Note that the GP antenna's radiation patterns are used as the standard reference for all antennas.)

The *Coaxial* antenna (see Fig. 2) costs about twice as much as the GP

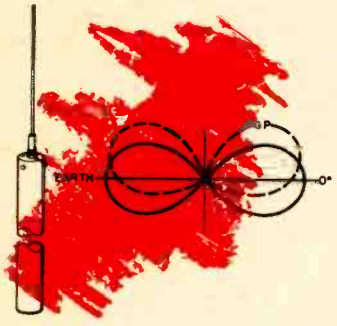


Fig. 2. Vertical radiation pattern of Coaxial antenna with Ground Plane pattern as reference.

but mounts easily and is unobtrusive. It has a quarter-wave radiator mounted on a coaxial skirt (or lower radiator). The transmission line's hot lead connects to the top radiator, the shield to the skirt. The skirt acts as a shield around the transmission line, sharply reducing the effects of antenna currents. A properly designed coax has a vertical radiation angle close to 0°. It is non-directional horizontally. The coax does best in open country and from high base antenna locations.

The *Non-Directional Beam* antenna (see Fig. 3) is merely a vertical radiator

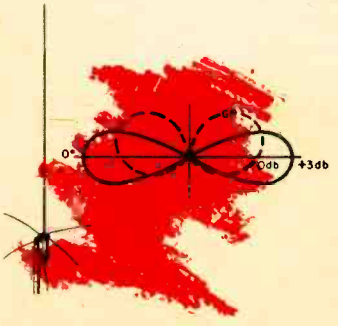


Fig. 3. The vertical radiation pattern of the Non-Directional Beam antenna: note gain of 3 db.

with short radials at the base, but it is different in that the radiator is longer than a quarter-wave. The design may vary a little according to the manufacturer but all accomplish the same thing: they compress the vertical signal, resulting in a signal pushed out at the sides. This pushout gives you a gain of about 3 db (in comparison to the GP's 0 db), making five watts do the work of ten. The N-D beam's obvious advantage is its gain.

The *Directional Beam* antenna (see Fig. 4) concentrates a major portion of

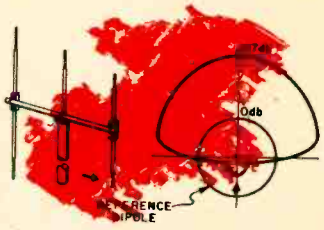


Fig. 4. The horizontal radiation pattern of the Directional Beam shows a forward gain of 7 db.

its radiated energy in one direction. The energy pressed into the forward direction is taken from the rear and side radiation. In a typical high-quality model consisting of a coaxial center element (which is the same as the plain coax antenna) plus reflector and director elements, the forward gain is 7 db, making a five-watter do the work of 25 watts. As a side effect—because energy is removed from all directions except forward—receiving sensitivity to the rear and sides is reduced sharply. By careful adjustment of antenna direction, you can use this characteristic to phase out an interfering signal.

Directional beams normally are vertically or horizontally polarized (in a vertical beam the elements are vertical to the earth). Since there is a loss in signal when working cross-polarized (horizontal antenna vs vertical antenna), it is best to use the same polarization in both base and mobile units. In practice, a horizontal antenna is less susceptible to noise.

It is not recommended that horizontal antennas be turned on end to form verticals. When you do this your transmis-

sion line runs too close and parallel to the beam's radiating element and you have trouble because of re-radiated antenna currents induced in the transmission line.

Directional beams come in various sizes from three elements up, the bigger ones offering more gain and a narrower signal beam. One typical six-element beam offers a gain of 11 db, making five watts the equivalent of 62. But, of course, you pay for that gain in your purchase price.

A beam that differs from the usual design is the *Cubical Quad* (see Fig. 5), which uses lightweight wire loops instead of the usual tubular elements. A

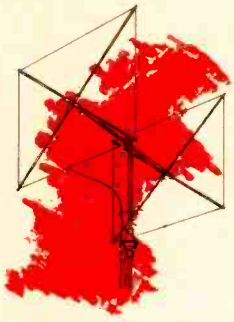


Fig. 5. Cubical Quad antenna uses wire loops for elements. It is polarized in both planes.

quad offers up to 10 db gain, meaning five watts are equivalent to 50. It is claimed that the quad radiates in both polarizations, but there is some disagreement as to whether the claim is valid. We are inclined to believe it is. There simply are not enough data available to give quad radiation patterns.

It is often said that choosing a *Mobile* antenna is as critical as picking out a base job. This is not necessarily true but you do have additional factors to consider: loss of trade-in value on your car due to holes, the use of a short antenna if you pass low overheads frequently and inconspicuousness.

Mobile whips range from the full-length (108 inches) quarter-wave through short, loaded models to miniatures for top or cowl mounting. Don't be confused by the many models available. Differences are more a matter of mounting convenience than electrical efficiency. Just remember: *the longer the whip, the more efficient it is.*

The best antenna and the best mounting spot would be a 108-inch whip bolted in the center of your roof. Unfortunately, this is impractical unless you live in the desert. Next best for all-around performance is a whip on the rear bumper. It is possible to improve the performance of this standard rig by lengthening the whip, raising its area of high current and high radiation (see

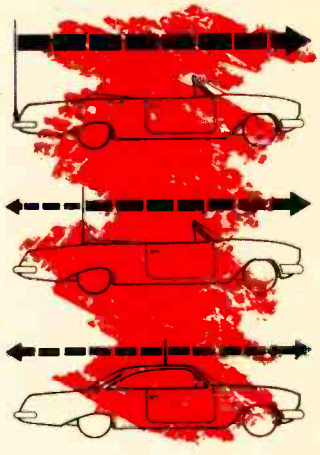


Fig. 6. Relative strength of radiation to the front and rear as mobile whip moves to car top.

MORE FROM YOUR MOBILE WHIP, September '61 EI).

A car's body has a great effect on mobile signals. The area of maximum radiation is toward the car's longest physical length from the antenna. Fig. 6 shows how the maximum radiation pattern is toward the front with a bumper-mounted whip. When the antenna is moved to the rear deck there is some radiation to the rear but more to the front. A roof-top mount gives equal radiation in each direction.

Although those ring and slot and cone and hoop antennas are interesting, especially from the standpoint of experimentation, they are unproved as yet. On the other hand, the characteristics of whips are well known and when you install one you can be pretty sure about what it will (and won't) do. It's still the best bet for day-to-day use.

CB SPECIAL

YOUR FIRST STATION

An expert's advice for the beginning CBer.

By Tom Kneitel, 12Q1747

AFTER you have decided to go into Citizens Band radio and your transceiver is sitting in its carton on the kitchen table, you begin wondering where to locate your shack and how to arrange it.

The operating location should—first of all—be a convenient place. If you spend most of your time downstairs, for instance, don't haul your equipment to the second floor so you have to charge up the stairs every time you get a call on the air. A desk or table is the best place to put your rig—not too near the edge, where it can get knocked off. The immediate area around it should be open so the set can receive ventilation through the air ducts in its cabinet.

Never stick your equipment on any makeshift location, and stay away from such hot spots as radiator covers. High temperatures can wreck a transceiver in short order.

The drawing at the end of this article shows a neat shack arrangement that makes for efficient communications. It represents a kind of composite of several well-arranged CB shacks I have seen.

The clock is a must item for your log entries and to keep the length of your messages within legal limits. Locating your telephone nearby is a big convenience (if you can swing it with your wife). The shelf above the desk holds the many books you are going to want and need. In the way of test equipment, you will find a signal strength meter and a dummy load antenna the handiest. Perhaps you'll want to add an SWR bridge, EI's CB Signal Generator and other gear later. Spare tubes should be a requirement in every shack. Minimum tools include screwdrivers, pliers, wire cutters and strippers, soldering gun or iron and a small penlite.

Once you have your shack set up, you're ready to tackle the antenna problem. Another article in this issue deals in detail with antenna selection. Probably best (and lowest priced) for general communications are the ground plane and coaxial types. In mounting, keep your antenna clear of nearby buildings, trees, TV antennas and phone and power lines. These absorb and re-

flect your signal and can add noise.

Final link in the transceiver-antenna chain is the coaxial lead-in. Various cables are available but the one you select should be of the same impedance as the antenna. Two widely used types are RG-58A/U, which costs about 5½ cents a foot, is rated at 50 ohms impedance, is thin and flexible and easily handled; and RG-8/U, which costs about 13 cents and is rated at 52 ohms. The former is good for short lead-ins, the latter for runs upwards of 100 feet.

The lead-in should be as short as possible, the coax must not be kinked or spliced, and you should use coax connectors at both ends.

After you have been on the air a while, you can expect to have some trouble with component failure. Tubes are the most likely to go first. For that reason, it's a good idea to have a supply of duplicates ready for plugging in at the first sign of difficulty.

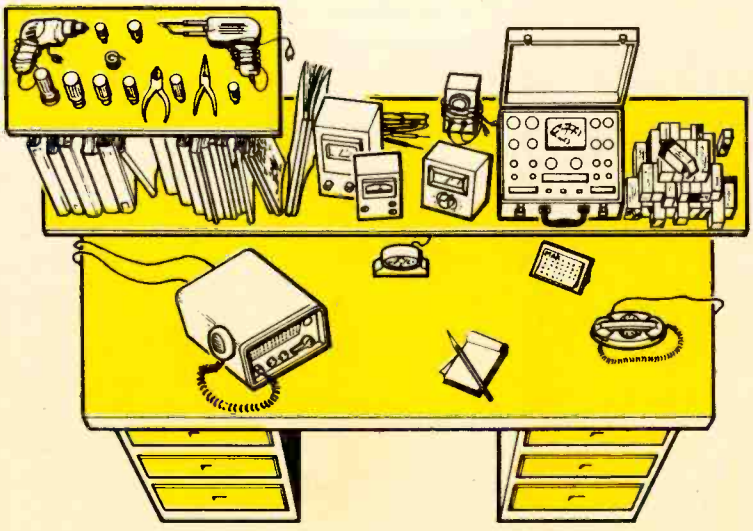
In this little operation, you simply turn the set on and take a look at the tubes. If any have an unnaturally bright glow or none at all, you've probably found the culprit. If all tubes appear normal, tap each one lightly with a pencil eraser. Then try replacing the tubes one at a time until the set operates (tubes that read good even on a tube tester *can* be fouling up the works).

If tube-changing doesn't help, you can examine the mike, lead-in, power cord and other obvious points where there might be failure. After that, if you're still off the air, you need to go deeper (see CB SERVICING MADE EASY in this issue).

Your transmitting crystals should be checked for frequency drift once a year. This must me done by a commercial radiotelephone or radiotelegraph licensee. You can find one in the classified phone book under the heading, Radiotelephone Equipment Service.

In the way of general maintenance, you should keep your shack as clean as possible. About every three months take the cabinet off the transceiver and either blow or vacuum-clean the dust out of it. Your antenna should be taken apart once a year or so for a thorough cleaning. Use an all-purpose liquid cleanser to get the grime off the insulators, connectors and radials. If your antenna is mounted on a metal mast, it should be coated with corrosion-resistant paint. A wooden mast can be weatherproofed with spar varnish.

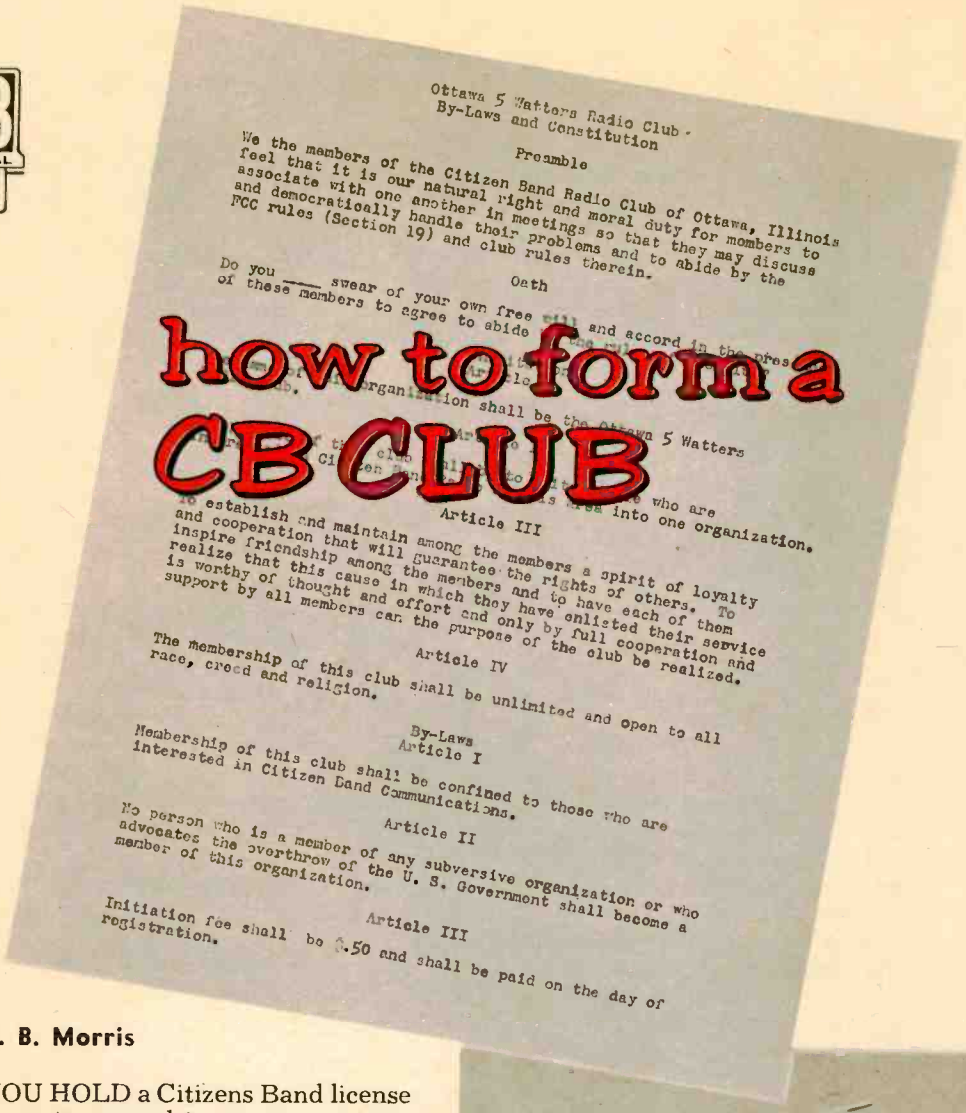
These hints for setting up and maintaining your CB equipment can make operations easier for you. But whether the Citizens Band gives you what you expect from it is determined entirely by your efficient *use* of the service. In that category, you are pretty much on your own.



A bird's-eye view of an efficient CB shack shows transceiver on desk at left, clock in center and phone and pad at the right. Spare tubes, test equipment and books are on shelf. Tool rack is mounted above the shelf.

CB SPECIAL

how to form a CB CLUB



Ottawa 5 Watters Radio Club -
By-Laws and Constitution

Preamble

We the members of the Citizen Band Radio Club of Ottawa, Illinois feel that it is our natural right and moral duty for members to associate with one another in meetings so that they may discuss and democratically handle their problems and to abide by the FCC rules (Section 19) and club rules therein.

Oath

Do you ____ swear of your own free will and accord in the pres
of these members to agree to abide

Article III

To establish and maintain among the members a spirit of loyalty and cooperation that will guarantee the rights of others. To inspire friendship among the members and to have each of them realize that this cause in which they have enlisted their service is worthy of thought and effort and only by full cooperation and support by all members can the purpose of the club be realized.

Article IV

The membership of this club shall be unlimited and open to all race, creed and religion.

By-Laws

Article I

Membership of this club shall be confined to those who are interested in Citizen Band Communications.

Article II

No person who is a member of any subversive organization or who advocates the overthrow of the U. S. Government shall become a member of this organization.

Article III

Initiation fee shall be $.50 and shall be paid on the day of registration.

By H. B. Morris

IF YOU HOLD a Citizens Band license or are interested in getting one you almost certainly have heard about CB clubs. Scattered across the country are more than 300 Citizens Band groups with anywhere from a dozen to more than 200 members each. Some of them are active, vital organizations with scores of activities. Others were miscreants to begin with and now totter into oblivion. Seldom has a field of interest fostered so many clubs so fast as has CB, and seldom have so many faded so soon.

Yet there are worthy goals for CB clubs, and if they are properly organized and run they should be excellent organizations that hold the interest of their members and help improve the CB

Banner guides CBers to big Eyeball QSO held at Norwalk, Conn. Clubs usually direct these fetes.

service for all the licensees.

Are you interested in joining a CB club? If you are, the chances are good that there is one in your area, especially if you live in a large community. (See our offer of a free list of CB clubs on the third page of this article.) However, if there isn't a club within a reasonable distance, you and a few fellow CBers can form your own. And you'll have the blessings of the Federal Communications Commission, which favors formation of clubs interested in helping police the Citizens Band. They would rather see CBers keep their own house clean than issue a bunch of restrictive new rulings.

Actually, starting a club is almost *too* easy. This is one reason why so many fizzle and die. Remember that the urge to share your interest in CB with others is enough to bring a group together, but it will never hold them. Over the long haul you'll need better reasons.

The goals of any club should include promoting and improving the CB service, enlightening members on FCC regulations, setting up self-policing on the band and extending technical assistance to those who need it. Clubs also can set aside channels for specific purposes (calling, boats, travel, etc.) and coordinate emergency communications.

Any CB club also must have some sort of social activities that include wives and girl friends. Dances, picnics and other outings are popular. But a CB club organized for *purely* social (or hobby) purposes is doomed to failure.

"Eyeball QSO's" and other special annual or periodic events are enjoyable and keep interest high. Specific ways to make a CB club *worthwhile* are discussed in another article in this issue.

One of the ways a CB club benefits both members and the service lies in the fact that a unified voice carries more weight with local and federal authorities than do individual voices. Members get their collective viewpoints heard and, on the other side, officials learn the desires of CBers (and good ones *do* want to know).

If your club is to be successful it must be run on a formal basis. Let's say that the basic idea is first discussed by three or four CBers. From this informal group should emerge plans for the first general meeting at a place convenient for all. Don't overlook any means of publicizing the idea to assure a good showing. On-the-air talk is bound to spread the word rapidly, but also post notices in places CBers frequent: electronic parts stores, equipment retail houses, boat marinas, etc. Send typed announcements (releases) to local papers and radio stations.

CB manufacturers often display at (and help pay for) big club events. Browning booth is shown.

Guaranteed to be a popular club activity is a Swap Shop for selling and trading used CB gear.

Make it clear that the first meeting will include election of *temporary* officers. This dispels any feeling that the club will be controlled by a self-appointed few. Best way to conduct the first (and future) meetings is according to the time-tested Robert's Rules of Order (get a copy at a book store or library).

Call the meeting to order on time and after a brief explanation of the purpose of the assembly, ask for nominations for a temporary chairman (who is just that —temporary). He gets things rolling by selecting a temporary secretary to record proceedings and then appoints a committee to work out the first draft of a club constitution and bylaws.

During the first meeting there are many topics for consideration: a club name, a permanent meeting place, dues, suggestions for the constitution and discussion about what the club's major activities will be. Every person should have an opportunity to air his views.

Much detail work will be done by committees in such areas as monitoring, Civil Defense, technical assistance and publicity.

Too much emphasis cannot be placed on working out the constitution. It must serve as a solid foundation, determining how the club is structured and how permanent officers are elected, among other things. One way of getting ideas for a constitution is to look over what other clubs are using. Most organizations are happy to extend a helping hand.

FREE LIST OF CB CLUBS IS AVAILABLE FROM EI

Before trying to form a new CB club, make sure there isn't an existing one in your area that you haven't heard about. For a free list of all major CB clubs in the country, send a stamped, self-addressed envelope to EI, Dept. C, 67 West 44th St., New York 36, N. Y.

All this parliamentary procedure might sound like an unnecessary chore, but without it your meetings can deteriorate into a mass of petty arguments and squabbles.

At your second meeting you should elect permanent officers, vote on a club name, etc., and later will come plans for a monitoring setup, a newsletter and other activities. But your first concern is that first meeting. It can be the key to success or failure for your new club.

Finally, look beyond the basic business of the club for ways to keep interest at a high level. Try to have a feature event at every meeting—talks by club members, a lecture by an outside authority, movies, a swap shop or an equipment auction.

Good luck!

Tri-State Radio Club set up radio control point near entrance to jamboree at Fort Mountain, Ga.

A Norwalk (Conn.) CB Association QSO attracted licensees from New York and all of New England.

make your club WORTHWHILE

CB SPECIAL

Your CB group can be a vital part of community life if it takes up outside activities in the right way.

By Edwin Frederick, 2W4580

A CITIZENS BAND club is likely to be one of two types: a social and hobby organization dedicated to putting away a few cups of coffee, chewing the fat and having a couple of laughs with the gang, or it may be a useful club that plays a vital part in community life. In the long run, you'll find that those that play together *don't* stay together. It is the useful clubs that remain active and successful.

Another article in this issue discusses the formation of a CB club and the planning of an all-around schedule of intra-club activities. We are concerned here with ideas for making a club *worthwhile* in its relations with other organizations and the community.

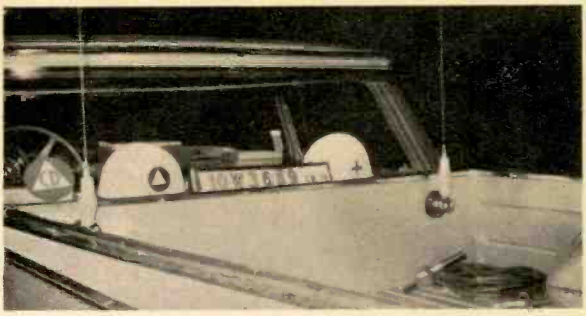
The CBer of today is more likely to be interested in public service than was his counterpart of two or three years ago. In those days there weren't many CBers and it was enough just to sit around and talk about this marvelous new band. But now the horizons have widened, CBers are numerous and their equipment has improved to where they can be of use to their communities.

As a starter, your club should decide which fields of public service attract its members—patrolling highways during bad weather, assisting police in handling crowds, working with Civil Defense, etc. The only limiting factor is the amount of work members are willing to contribute.

The key leaders in any kind of public service are two officers who normally are appointed rather than elected. One usually bears a title like emergency coordinator, CD liaison officer, rescue director or public safety coordinator. The other is the public information director. Let's consider the first man:

It is the emergency coordinator's duty to keep in touch with local authorities regarding their needs and his organization's ability to meet those needs. He must keep a dossier on each member, including name, address, business and home phones, call sign, type of equipment and occupation. He must know when members are out of town and not subject to call, and he must know the special skills of his members—locksmiths, auto me-

Many members of the Lubbock (Tex.) CB Club wear distinctive lettered uniforms on emergency duty.



A glance tells you the owner of this car is a CB licensee who is active in Civil Defense work.

chanics, doctors, plumbers, electricians and so on.

If your organization decides to help motorists during blizzards, tornadoes, floods and other disasters, the emergency coordinator should first talk with the highway patrol or state police, telling them about his organization and its proposed method of operation—the roads they can patrol, the equipment the vehicles can carry (radios, flares, first-aid kits, etc.) and so forth. Your club *never* should take to the highways for mercy missions without clearing the operation with the proper authorities, who may have special requests, such as certain roads to patrol or certain isolated families who should be called on.

Regardless of arrangements, you will want to have your base stations on the air at all times during emergencies. One station must be selected as control station, which will issue *all* orders to mobile units.

If you decide that your cup of tea is holding back crowds at parades, helping with clothing pickups and other functions involving the public, your coordinator should work with the chief of police.

Communications during these tasks will be mainly mobile-to-mobile (handi-talkies are useful). Base stations usually relay messages.

Many misunderstandings exist about the role of CB in Civil Defense. Contrary to what you may hear, CBers are *not* allowed to conduct radio roll-calls in the name of a Civil Defense drill. They must be sworn-in CD members to begin with, and their CB operations are used only as a supplement to a branch of CD other than communications. Your club representative must find out where the CD people can use workers who just happen to have (as a bonus) two-way radio to aid them.

Club members may turn up in the auxiliary police, the messenger service, the medics, fire patrol or transportation units. Above all, do not demand (or expect) to have CBers placed in the communications division of a Civil Defense setup solely on the basis of their owning CB gear. But if members of your club are involved in CD work, their radio equipment is bound to be put to use in times of emergency.

Typical decals used by CBers on their vehicles. Decals of helpful clubs get police recognition.

Remember that your basic purpose here is not to jockey your CB equipment around. It is to be a Civil Defense worker who aids his community.

The public information director (or press officer) has the job of letting the public know about the club, its activities and its good deeds. He maintains contact with the newspapers and radio stations and should be able to express himself well.

Before each club function he should prepare short press releases (with careful attention to spelling, punctuation and grammar), stating when and where the meeting will be held and its purpose. His own name and phone number must be on the release as the source of further information.

The releases should be received by the news media a day or two before the function (weekly newspapers require more advance time). The press officer should find out whether the news media want him to call them after the function to tell them what happened, or to write a press release on the subject.

During emergency operations, he should phone in any news about the CB club's participation.

Between club functions, the press officer can work up ideas for feature stories about how some members use their equipment in unusual ways, strange occupations that go with the CB avocation, elaborate base-station layouts and the like. He should first determine whether his media want just ideas for their own writers to work up, or whether they prefer full-length stories.

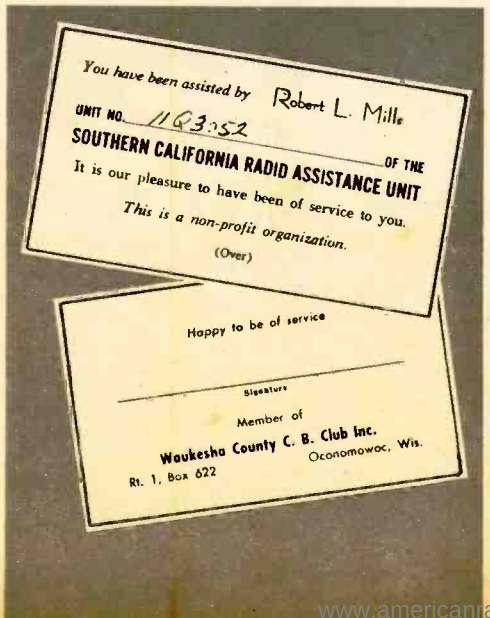
In other public relations areas, all club members share the responsibility of spreading the good word. Such things as window decals, we-helped-you cards to be given to motorists, lettered jackets and other paraphernalia all help to publicize the club.

Latest innovation in this line is complete uniforms—usually fatigues with insignia and lettering. Though flamboyant, they have a useful purpose. They keep your clothing underneath clean when you're doing the dirtier type of emergency work.

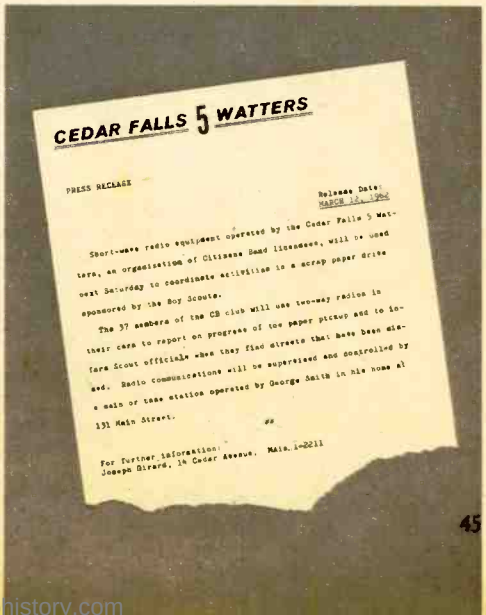
In general terms, you should guard against your club's going stagnant. Its members should be aware of the community's changing needs and be willing to keep pace with those changes. And keep the community aware that the club's members are available to serve them when they are needed. Don't be afraid to toot your own horn. When your club does a good deed, let the whole community know about it.

If your club is truly useful to the community, it will be a group you can be proud of.

We-helped-you cards, handed to motorists who have been assisted, make friends for CB clubs.



A good press release is on letterhead, is short and it tells whom to call for more information.



CB SPECIAL

TINY TALKIE

Smallest build-it-yourself CB transceiver features three transistors in low-cost circuit.

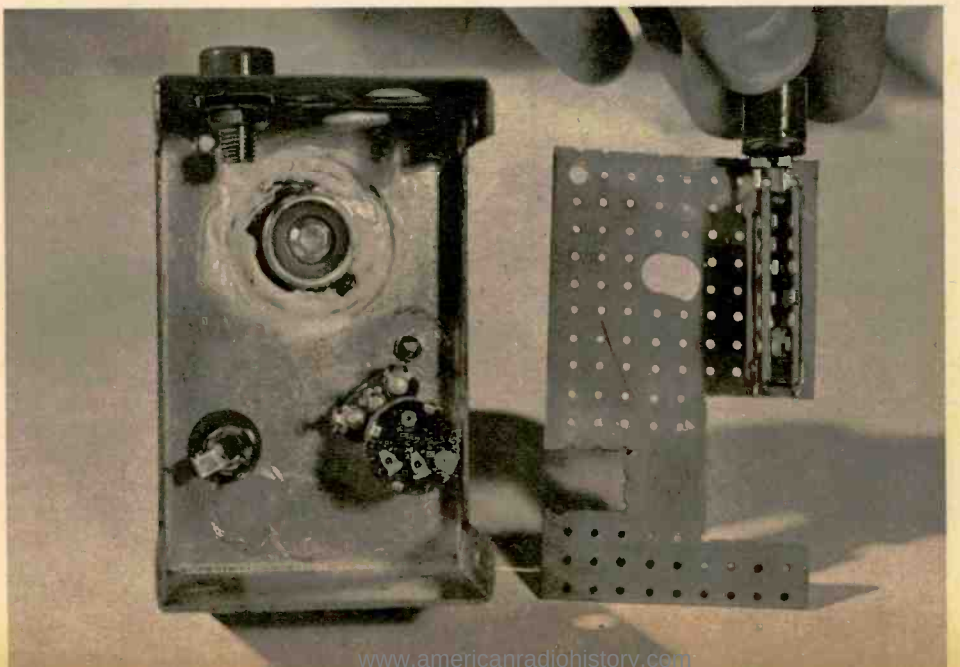
By Fred Maynard, 11Q0846 Motorola Semiconductor Products

FEW COMMUNICATIONS devices in history have gained popularity so quickly as the handi-talkie, the hand-size transceiver born of World War II equipment. For short-range contacts between fishing parties, hunters, antenna installers, power linemen, construction workers and the like, handi-talkies have proved invaluable. And they require no FCC license.

EI now presents the build-it-yourself Tiny-Talkie, a transmitter-receiver that is so small (3¼x2⅛x1⅝ inches) it fits into the palm of your hand. Like its bigger brother, the Tiny-Talkie can be used in a wide range of applications, fits into a pocket and does not need an FCC ticket (see THE LICENSE-FREE BAND in this issue). You just glue the Certificate of Compliance included in this article on the back of the Tiny-Talkie and you're on the air.

The Tiny-Talkie has a 100-milliwatt maximum input to the RF out-

Cabinet with parts mounted. Make sure the perforated board fits in cabinet before starting to wire it.



PARTS LIST

Resistors: ½-watt, 10% unless otherwise indicated
R1,R4—100,000 ohms
R2—10,000 ohms
R3/S2—15,000-ohm miniature potentiometer with SPST switch
R5—1,000 ohms R7—220 ohms
R6—470,000 ohms R8—2,200 ohms
Capacitors: Miniature ceramic types unless otherwise indicated
C1—3.5-12 mmf ceramic trimmer (Centralab 827-B)
C2,C8—7-35 mmf ceramic trimmer (Centralab 827-D)
C3,C6,C10—.001 mf C4,C7,C11—.005 mf
C9—5 mf, 25-volt miniature electrolytic
L1,L4—15-microhenry subminiature RF choke (J. W. Miller No. 70F155A1 or same series as National below)
L2,L3—1.2-microhenry choke (J. W. Miller No. 70F126A1) or 1.3 microhenry (National B20407-4)
Q1,Q2—2N741 transistor Q3—2N1192 transistor
S1—DPDT spring return miniature toggle or push-button switch (Lafayette 4PDT SW-92 shown)
Microphone—Carbon 1,500 ohms (Available @ $1 postpaid from Dart Electronic Devices, 6409 New Utrecht Ave., Brooklyn 19, N. Y. Model 33-PA)
XTL—CB miniature transmit crystal (channel 2-23) ± .005% tolerance, third overtone
J1—Banana jack with insulating washers
J2—Miniature phone jack with insulating washers
B1—Two 6.5-volt mercury batteries (Eveready E-165 or equiv.)
Misc.—2,000 to 3,000-ohm magnetic earphone; 38-to 42-inch telescoping antenna; 3 transistor sockets; 3¼"x2⅛"x1⅝" Minibox (Bud CU-2101-A)

The above parts (less batteries, flea clips and perforated board) are available as a package from Allied Radio, 100 N. Western Ave., Chicago 80, Ill. Stock No. 74M999. Price is $20.95. Allow postage for 3 lbs.

put (Q1) and can be used for virtually any legal purpose. Its range runs up to about 1,000 feet, depending on conditions.

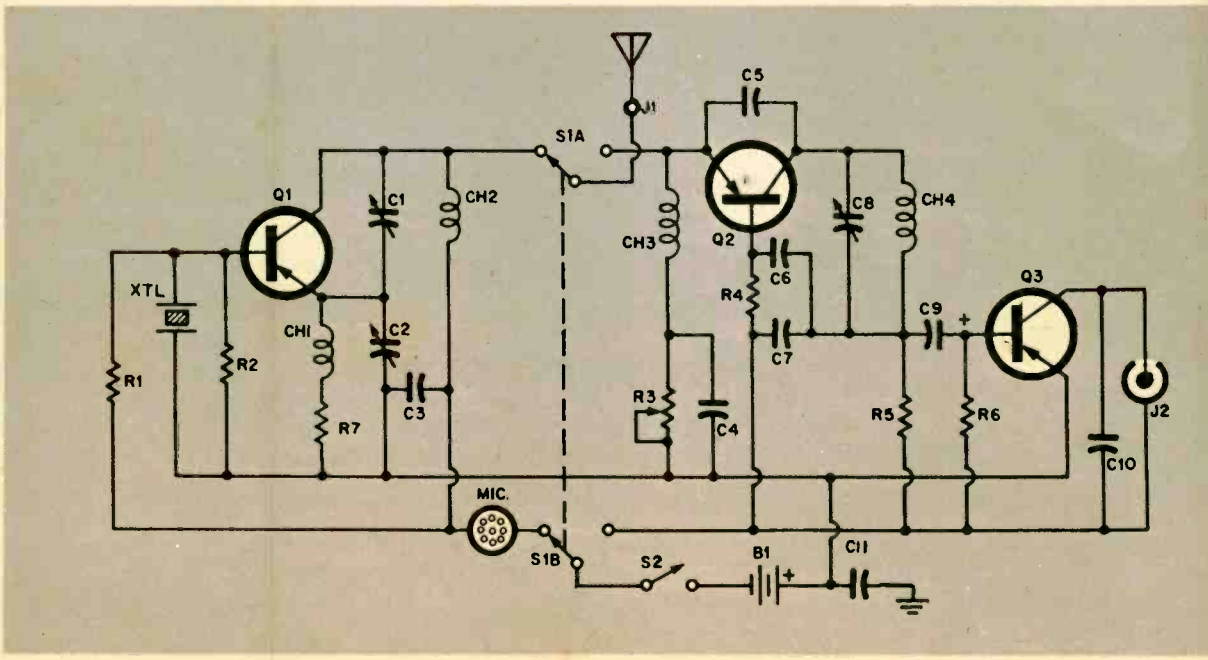
Using an ingenious three-transistor circuit, the Tiny-Talkie can be constructed at about half the cost of a larger commercial handi-talkie (see special offer in the Parts List).

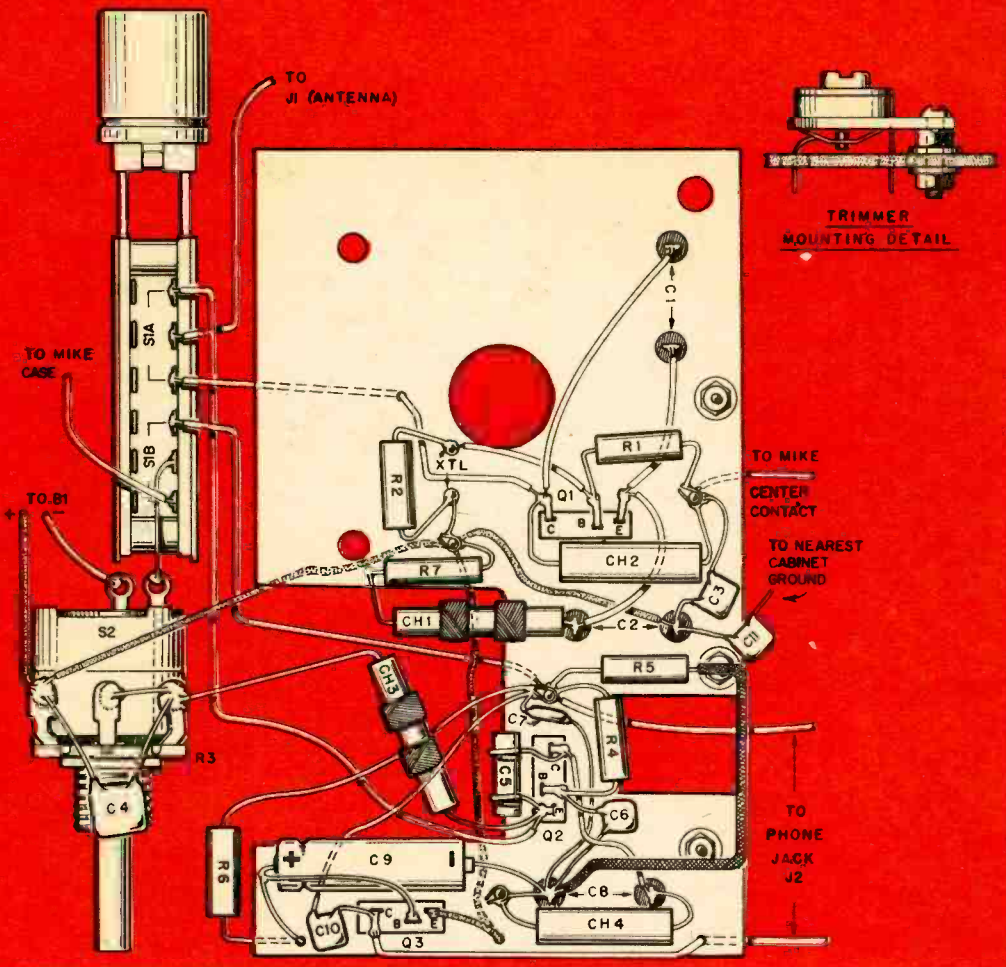
If desired, you can substitute some standard-size components (for C1, C2, C8, S1, CH1 and CH4) and construct slightly larger units for only $25 to $30 a *pair*. The battery also is a size-determining factor. Nine-volt mercury batteries are the smallest but have limited life. A 12-volt supply improves the range and 15- to 18-volt batteries do even better, although these increase the overall size of the unit.

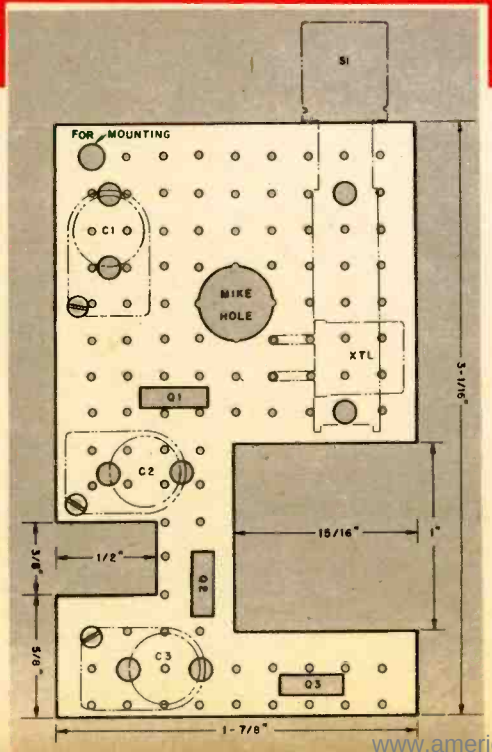
Construction. Follow the pictorial carefully. As in all high-frequency circuits, it is important that leads be short, direct and well separated.

Using the photos as guides, drill ⅜" holes in the Minibox for jacks J1 and J2. Drill a ¼" hole for pot R3. With a Greenlee socket punch or equivalent, make a 1½" hole to mount the carbon

Complete schematic of Tiny-Talkie. Transistors Q2 and Q3 make up receiver; Q1 serves transmitter.







Bottom side of board (above) faces rear of front panel. Switch shown as S1 is one of the several suitable types. Slight parts rearrangement may be necessary if other type switch is used. For clarity, some leads are shown longer than necessary. In practice, keep leads as short as possible.

Location of the major parts are shown on actual size template. Use a hacksaw blade and file to shape the board to the required dimensions.

mike. Epoxy cement is used around the hole's perimeter to hold the microphone in place. It need not be insulated from the case.

Mount pot R3 loosely (it will be tightened later after its lugs are positioned when the perforated board is in place) and mount J1 and J2, using fiber shoulder washers.

The location and size of the hole for S1 will depend on the type switch used. The one shown is Lafayette's SW-92, which requires a ½" hole.

Cut out a piece of perforated board to the approximate dimensions shown. Make sure the board fits the Minibox, clearing J2, R3 and the microphone's rear contacts. The board should be about ⅜" away from the front panel and parallel to it.

Using the photos and template as guides, drill and file 3/32" holes for the lugs of trimmer capacitors C1, C2 and C8 and rectangular holes for transistor sockets Q1, Q2 and Q3. If switch SW-92 is used, employ shoulder eyelets or sleeves to mount it about ¼" above the perforated board. This spacing is necessary since the crystal (XTL) is mounted beneath it. After S1 is mounted, determine the location of the hole that must be drilled for its button.

For mounting XTL, use two pin clips removed from a seven- or nine-pin tube socket. Bend the socket pins 90 degrees, crimp the lugs and force them through adjacent holes in the perforated board. The spacing will be correct for a miniature crystal. Do not solder to the crystal pins. Don't mount the crystal yet.

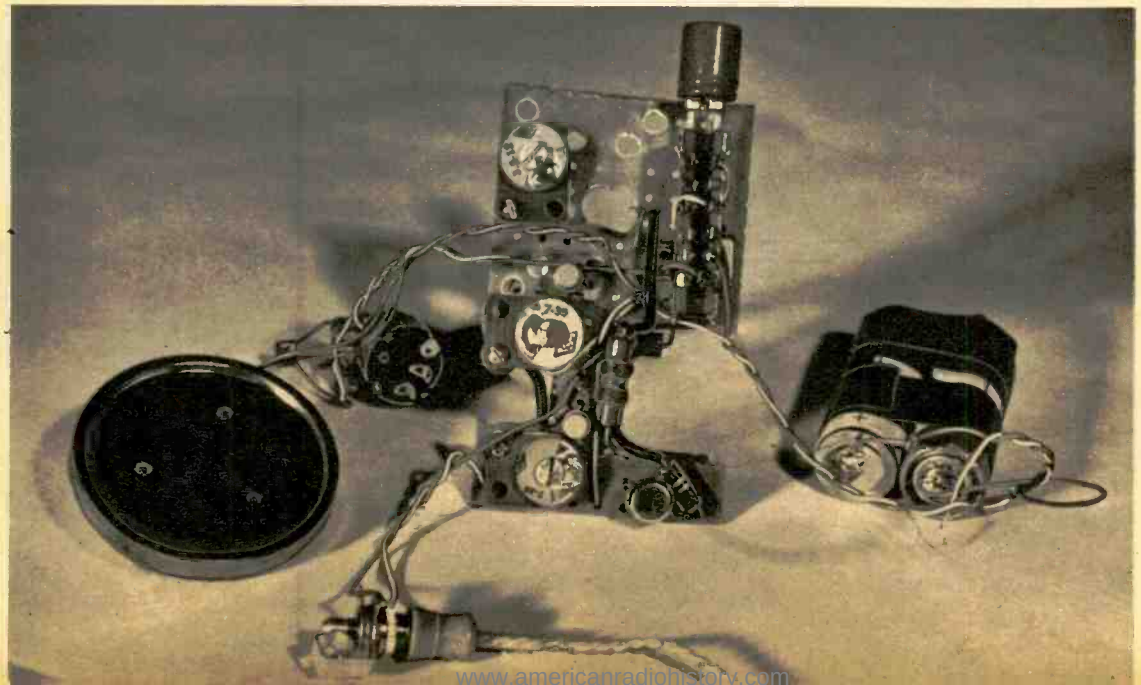
Mount the flea clips in the positions indicated and mount C1, C2 and C8 about ⅛" above the board as shown. Drill three holes in the back of the Minibox opposite the screws of trimmers C1, C2 and C8 so they can be adjusted with the cabinet back on.

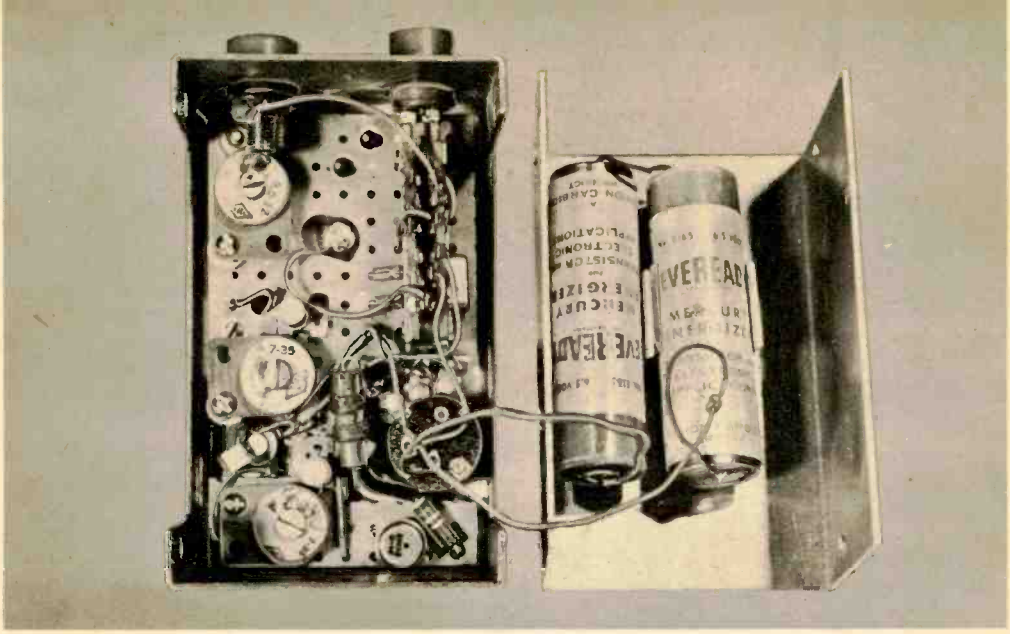
Using thin insulated wire, such as Alpha No. 407A, proceed with the wiring. Take care not to overheat parts or insulation. Use thin spaghetti or insulation stripped from other wires on the component leads. Keep all parts against the perforated board or you may have trouble getting the board to lie flat in the case.

After the board wiring is completed, run 5-inch leads for connection to R3, J1, J2, the mike and the battery holder. This will allow you to check the circuit's operation before the board is installed and may save trouble later.

Transmitter Adjustments. Plug in

Complete unit is laid out for testing before permanent installation in its miniature aluminum cabinet.





Completed Tiny-Talkie chassis installed in cabinet. Batteries are mounted in clips on cover.

the crystal (any *transmitting* crystal for channels 2-23), transistors and earphone and connect the microphone and R3. When installing battery B1 be sure that its polarity is correct. Attach a three-foot length of wire to the antenna lug on S1 and strap S1 (with electrical tape) in the *talk* position.

You can check the circuit for oscillation by putting a milliammeter in series with a battery lead. A 6-ma reading is about right.

Peak the transmitter output by adjusting C1 and C2 with an alignment tool while monitoring the RF output with a field-strength meter. As an alternative, you can use a #48 pilot lamp as a dummy antenna. Connect the lamp between the antenna and the positive terminal of B1. In subdued light, adjust C1 and C2 for brightest bulb glow.

Receiver check. Release S1. You should hear a sizzling in the earphone at most settings of R3. This is the characteristic noise of a superregenerative receiver and assures you that it is operating. When a signal is received the noise is reduced or disappears.

Final Assembly. Mount the circuit board in the box and secure it with a 3-48 x ½" screw and nut through the front panel. A ¼" to ⅜" spacing sleeve is used between the board and the panel. Disconnect the long leads installed for testing, cut them to length, and reconnect them. Position R3 and tighten its mounting nut. Repeat the transmitter adjustments before closing the case to compensate for detuning from capacitive and other loading effects of the metal box.

Field testing. The Tiny-Talkies, if used as a pair, must be tuned to each other. The best way is to work outdoors with a friend. Separated 50 to 100 feet, one person should talk into his unit while C8 and R3 on the other unit are adjusted for best reception. When both are tuned you should be able to walk farther apart and still maintain contact. It may be necessary to make further receiver adjustments as distance is increased.

Theory of Operation. The circuit shown in the schematic consists of two sections. To the left of S1 is the transmitter, which has a crystal-controlled oscillator/modulator Q1. The receiver, to the right of S1, includes a stable superregenerative detector (Q2) and audio amplifier (Q3). The antenna and battery are switched from one circuit to the other.

The transmitter utilizes Heising modulation and achieves 30% modulation. This figure tends to lessen the effective power but good modulation

[*Continued on page* 103]

CB CORNER

By Len Buckwalter
1W5733

citizens band news and comments

A CHAT WITH THE FCC . . . Some of the Federal Communications Commission's views on Citizens Band radio, expressed informally and off-the-cuff, were gathered by this department in a chat with Paul W. Gilligan, Assistant Engineer-in-Charge of the FCC office in Boston. Far from sounding like the fine print of Part 19, Gilligan had some lively comments about CB. They covered everything from a "3,000-mile" license to the practices of some CBers who police the band with a tape recorder.

Gilligan's big point: Many violations on the band are not intentional but stem from the CBer's being unaware of the responsibilities tied to the license. The "3,000-mile" ticket pointed this up. A young chap appeared at the Boston office to file for a new license and triggered off a comedy of errors. It developed that he was operating in the area with a borrowed call. Its prefix was No. 11, which indicates California. Shocked was Gilligan's word to describe the fellow's reaction when told that you can't have a base station 3,000 miles away. Of course, the license borrowing wasn't too well received, either.

When asked why CB radio was needed, the chap replied: "I might have to take my wife to the hospital and need the radio to receive the message *fast.*" The bewildered fellow was not hauled off to the pokey but was filled in quickly on some basic rules of the band. This is an extreme example, but it emphasizes the point about knowing regulations.

FCC engineer Paul W. Gilligan addressing a group of Citizens Band licensees in New England area.

TVI . . . Gilligan also sounded off about CB interference with television (the files in Boston are bulging with TVI complaints). Much of it is produced by second-harmonic output of the CB transceiver, he says. This energy, in the vicinity of 50 mc, shows up as wavy lines on a television screen. In really bad cases, the voice is heard in the TV's speaker. Gilligan had several suggestions: Don't operate with the case of the transceiver removed. This destroys important shielding that confines some of the harmonic signal. And do a fine-adjustment job on the filter of the unit, following the instructions in the manual. Good grounds also are important, and a filter at the antenna terminals of the TV set may be tried. If you receive a letter from the FCC concerning TVI, answer it! You will be called upon to state what you're doing to correct the condition.

Other observations by Gilligan:

QSL cards for CB are pointless. Why confirm a short-range contact?

Civil Defense activities are fine but must be conducted under the jurisdiction of a local CD director.

Don't take an unreasonable length of time to test on the air. Thirty or 40 seconds should be enough. Use a dummy load when possible.

Help people in distress (stranded motorists, etc.) . . . [*Continued on page* 102]

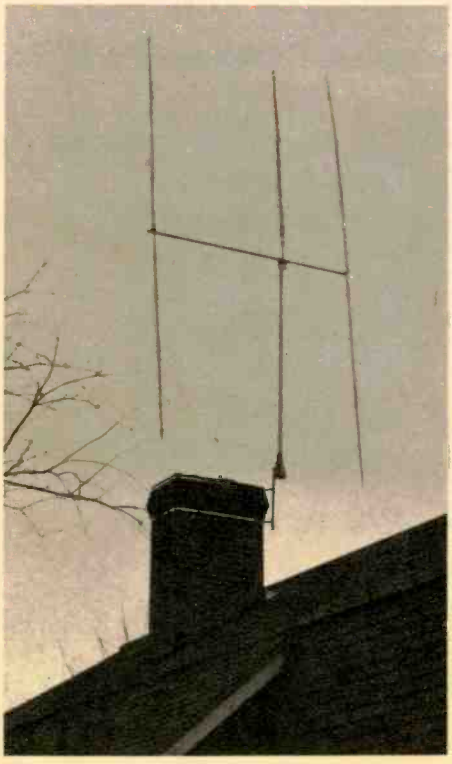
CB SPECIAL

HOW TO BUILD 4 CB ANTENNAS

Easy-to-follow instructions complete in this issue!

- **Directional Beam**
- **Ground Plane**
- **Coaxial**
- **Cubical Quad**

by Charles Tepfer, 2W4223



THERE ARE two basic approaches to Citizens Band base station antenna design. One aims at concentrating every watt possible in a narrow radiation pattern. The other is willing to sacrifice some gain in favor of omnidirectionality. But, no matter what your needs are, you can save a pile of dough and multiply your effective radiated power with one of the antennas described below. Once you have the materials, any of the four designs shown will take only a few evenings of work with hacksaw, drill and plane.

Since antennas really are tuned circuits, the size of their elements are relatively critical. EI's antenna designs use no element-shortening (and power-losing) loading coils, which makes them easier to build and more efficient. Strong-but-light stock aluminum tubing and rods are used wherever possible.

DIRECTIONAL BEAM

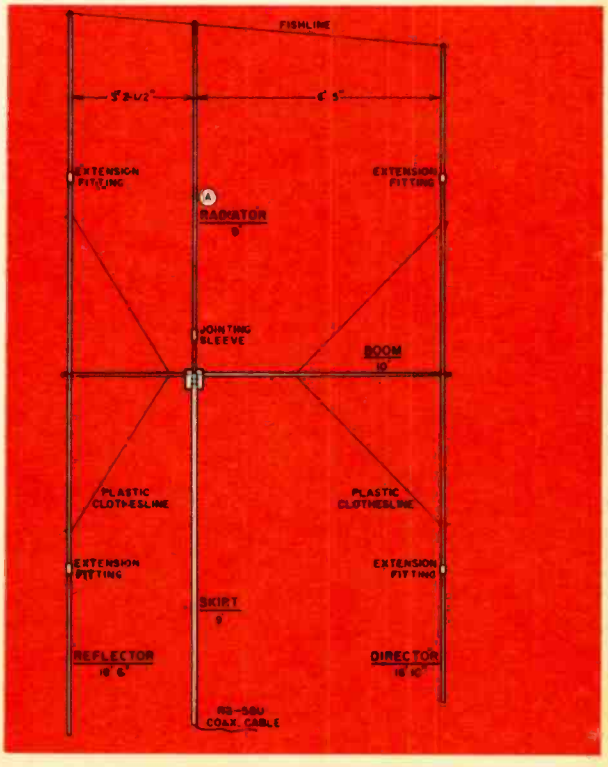
The most efficient base antenna you can build is a directional beam. There are many types but all are multi-element, with two or more sets of arms in the same plane. One element (the *driven* one) is the active transmitter and receiver. The others are parasitic and shape and direct the radiation pattern of the antenna into a beam. The more elements, the sharper the beam. Like a searchlight, beam antennas have high radiation (and pickup) in front and little to the sides and rear. Relative to the standard half-wave dipole, the gain of the beam is 3 to 5 db for the simpler jobs to 10 db or more for rigs with more than five elements.

EI's beam is a full-size, three-element unit. The *driven* element is a nine-foot half-wave coaxial radiator. The other elements are a *director* (16′ 10″), shorter than and in front of the driven element, and a longer (18′ 6″) *reflector* behind it. The elements are mounted vertically to produce vertically polarized signals, matching the polarization of mobile whips and base station antennas of the ground-plane and other non-directional types (most CB antennas fall in these categories).

The coaxial vertical radiating element is constructed first. The solid rod top portion (see Fig. 1, point A) is 9′ of ⅜″ Reynolds do-it-yourself aluminum listed by them as Item 3A. Since Item 3A comes in 8′ lengths, you must add 12″, plus 4″ for the part of the rod that projects into the nose plug—a total of 16″—to its length. Make a 4″ sleeve of ½″ thinwall aluminum tubing and slip this over the joint to hold the two sections together. Fasten it to both sections by drilling 3/32″ holes through rod and sleeve and inserting ¾″ nails, flattening both ends. For a tight fit, wrap a couple of layers of aluminum foil

Author's directional beam before installation. Size may be judged by comparison with the windows.

Fig. 1. Diagram showing length and spacing of beam's elements. See text and pictorial for details.



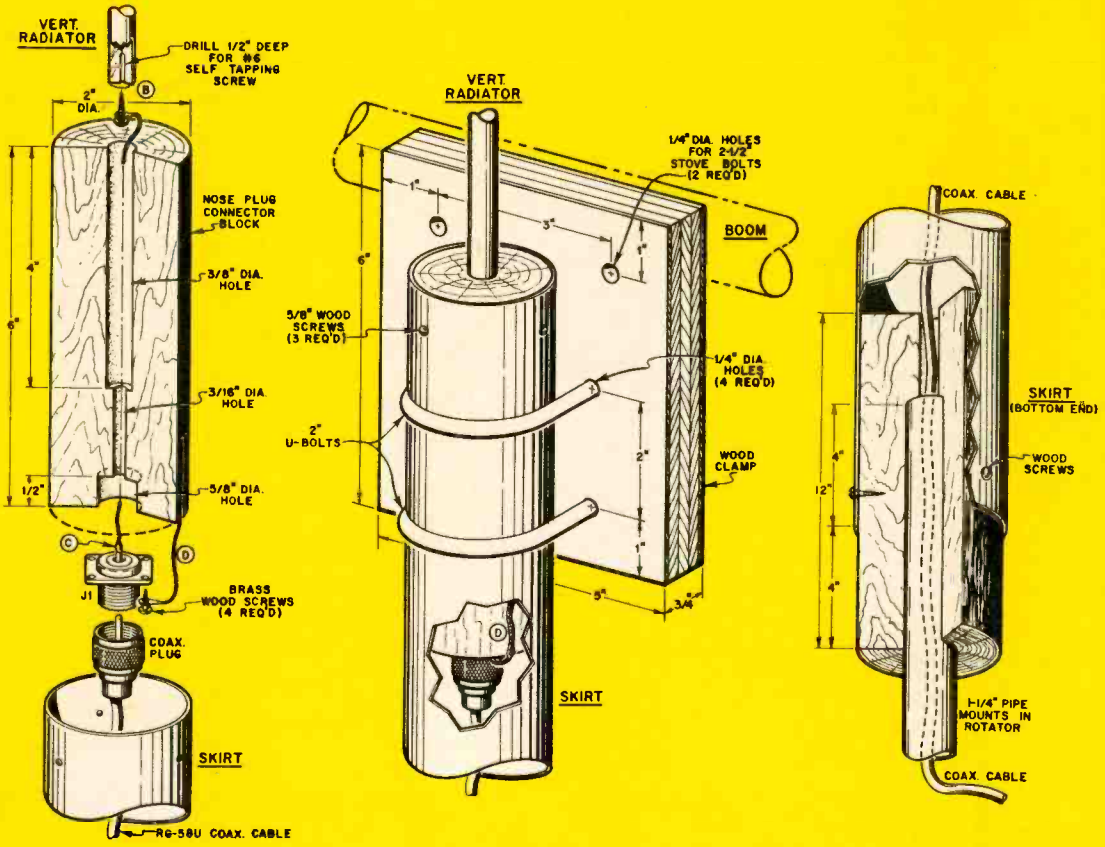
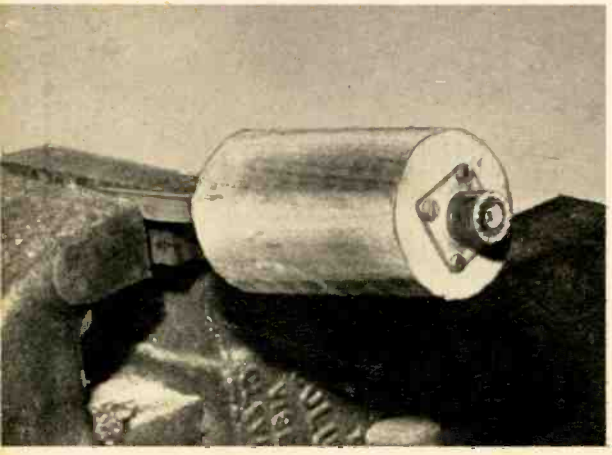


Fig. 2. Construction details of directional beam antenna showing the installation of the two skirt plugs.



Wooden plug to be installed in the top of the skirt. Note mounting of the coaxial connector.

around the rod ends before inserting them in the sleeve.

Using a ⅛″ drill, make a half-inch deep hole (Fig. 2, point B) in the bottom end of the rod. A ½″ #6 self-tapping sheetmetal screw is threaded into the hole. This screw will be used later.

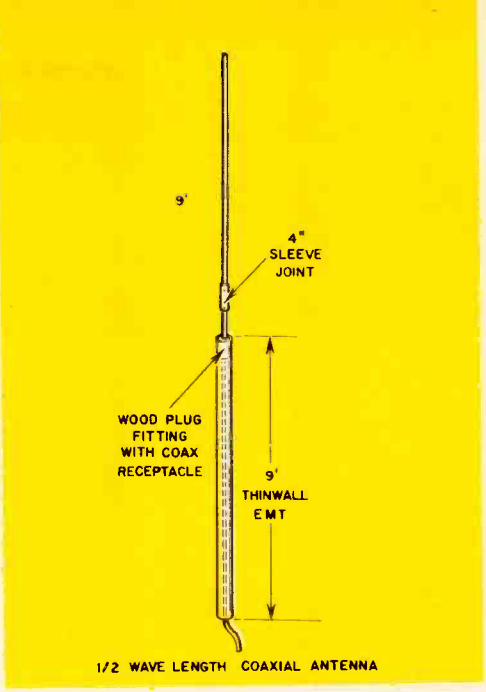
The 2″ inside-diameter EMT thin-wall aluminum tubing for the skirt comes in 10′ lengths, so a foot must be cut off. The top and bottom skirt plugs are trimmed from 4″ x 4″ scrap wood or other insulator that will make a snug fit. Follow Fig. 2 for drilling and dimensions, then give the plugs two coats of spar varnish for waterproofing. Connect a 7″ length of stranded hookup wire to the screw previously placed in the bot-

[*Continued on page* 101]

THE COAXIAL

The half-wave coaxial antenna consists of a quarter-wave vertical element above and in line with another quarter-wave vertical tube which encloses the transmission line. The center conductor of the transmission line is connected, via a coax connector and socket, to the top rod; the shield of the transmission line is connected to the bottom tube (skirt). The latter prevents the transmission line from radiating, keeping the radiation of the antenna close to the earth for maximum effectiveness.

The construction of this antenna is the same as for the driven element of the 3-element beam except the bottom plug may be omitted. This is an omnidirectional antenna and requires no rotator for wide coverage.

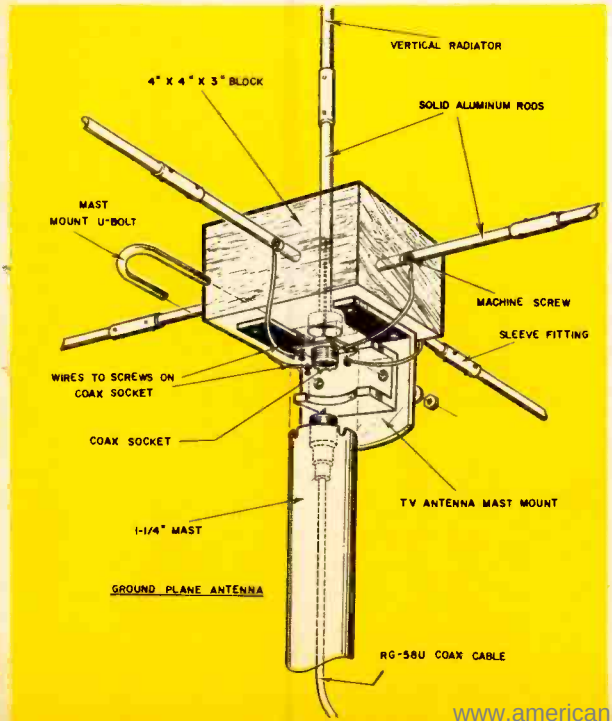


1/2 WAVE LENGTH COAXIAL ANTENNA

THE GROUND PLANE

This popular omnidirectional antenna requires comparatively little room. The four horizontal equal-length rods furnish an immediate ground for the vertical radiator and keep the radiation pattern close to the ground.

The wood block which serves as the base for the elements is a short length of 4 x 4-inch stock. Drill ⅜" holes, 1½" deep on the top and four sides, to hold the driven element and radials; drill a ⅝" well on the bottom for the coax socket. Drill a $\frac{3}{16}$" tunnel between the well and the hole on the top for the wire from the vertical radiator to the inside terminal of the coax socket.



Use a right-angle mast mount that has the central portion cut out (one is available for 34¢ from Allied Radio, type 8800-U). Fit the coax socket through this cutout onto the well on the bottom of the block and fasten with wood screws. Connect an insulated wire from each radial to the screws holding the socket to the block. Notch the top of the skirt as shown to allow these wires to pass through.

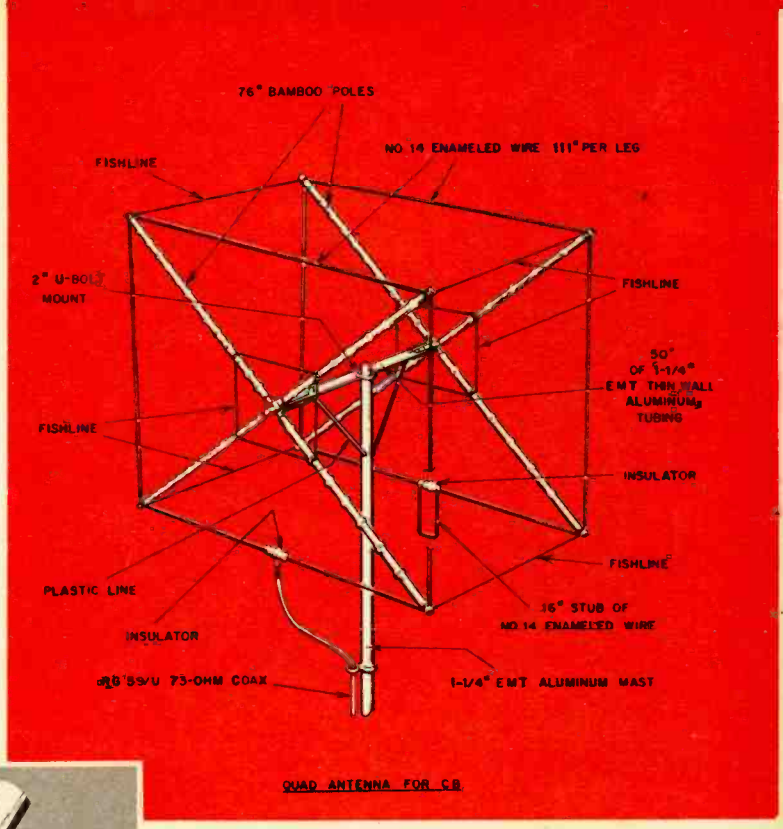
The vertical radiator and horizontal radials are made from ⅜" solid aluminum rod 9' long. Since such rod normally is supplied in 8' sections, sleeve fittings will be required to lengthen the rods. Fit them as described in the Directional Beam construction.

In building any of these antennas, closely follow the dimensions given. Do *not* use metal parts where the plans specify use of wood or other insulator. Use spar varnish on all wood and spray all exposed connections and terminals with acrylic protective spray.

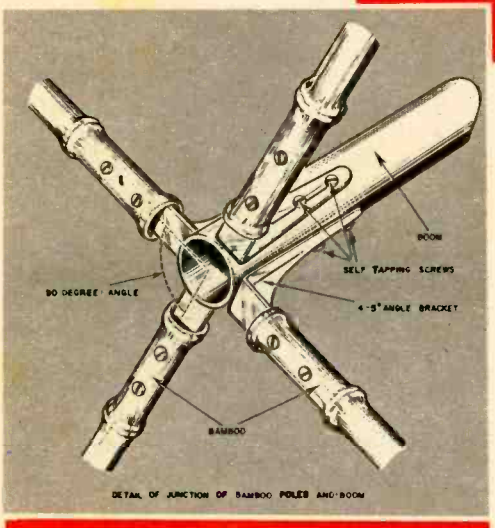
THE CUBICAL QUAD

This unusual-looking antenna acts like a full-wave two-element directional beam with the front loop as the driven element and the rear loop as the reflector. The optimum spacing between the front and the rear loops for highest gain is about 80 inches on the 11-meter band, but 50 inches is a reasonable compromise giving a gain of about 5 db.

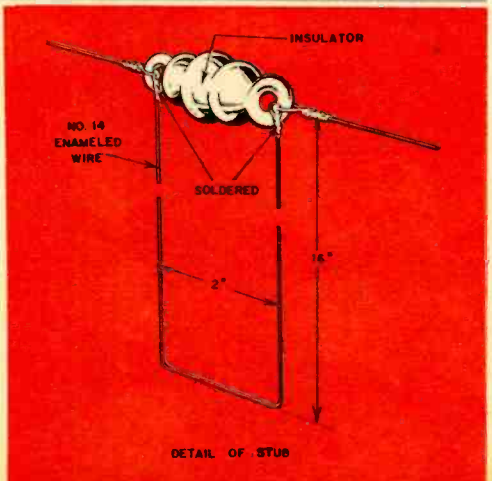
The C-Q requires a rotator to work mobile rigs, but its beam is not as sharp as the first antenna described. Since part of each element is vertical and part horizontal, the C-Q is polarized horizontally *and* vertically.



QUAD ANTENNA FOR CB



DETAIL OF JUNCTION OF BAMBOO POLES AND BOOM



DETAIL OF STUB

Bamboo poles are used to support the loops because the wires must be insulated from the boom and mast, and bamboo is both light and strong. Ordinary fishing poles (without splits) will do, but they must be of equal length. Use a 20-pound test fishline to keep the arms from vibrating and changing the loop spacing.

Use 1¼" EMT thinwall aluminum tubing for the mast and boom. Standard 5" angle brackets (with bolts through the rod and brackets) hold each bamboo rod to the boom. Each rod must be 90 degrees from the adjacent rods. If the bracket will not fit into the end of the bamboo rod, bolt it to the outside of the rod. In either case, wrap picture wire around both the rod and bracket for extra strength. Spray the wire with a rust arrester.

Each vertical and horizontal section of the loop must be equal in length, so don't pull the poles together while wiring the antenna.

The "stub" is used to tune the reflector to 27 mc. About 75 feet of No. 14 enameled or Formvar wire will be needed for the loops.

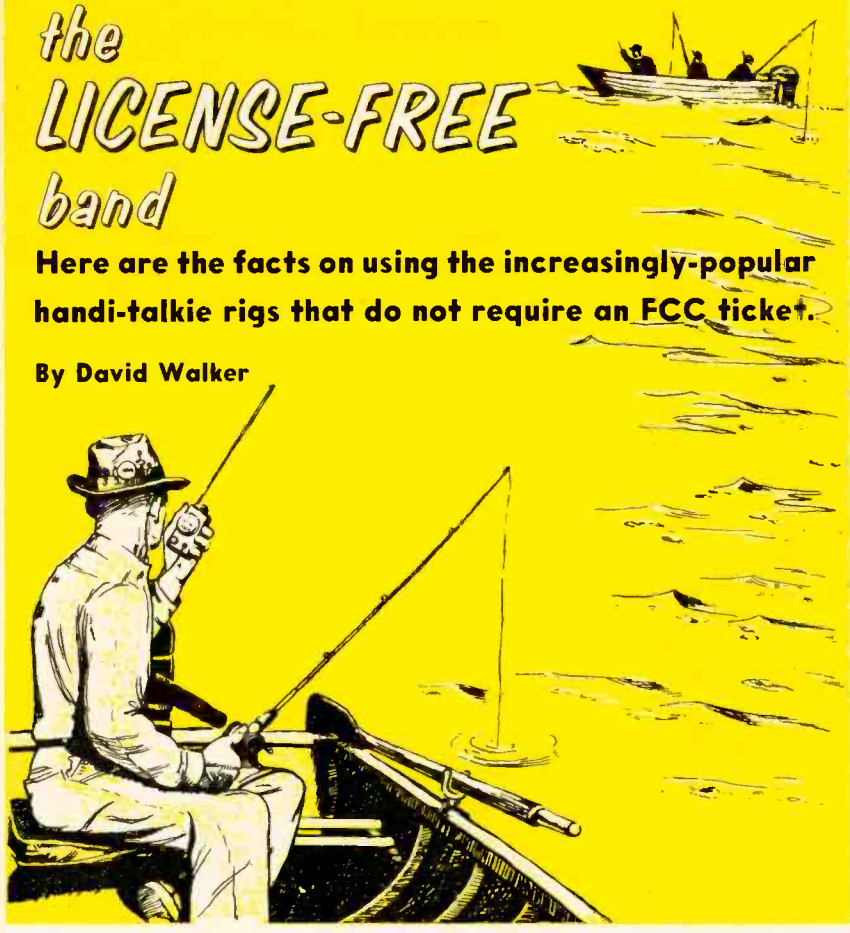
Electronics Illustrated

CB SPECIAL

the LICENSE-FREE band

Here are the facts on using the increasingly-popular handi-talkie rigs that do not require an FCC ticket.

By David Walker



THE FAMOUS BC-611 Handi-Talkie of World War II has come a long way. That power-hungry five-tuber is now a neat transistorized package that fits in your palm. And FCC regulations permit anyone to buy or build one of these little transceivers for almost any purpose, and to operate it without any kind of license.

As a result of these two factors, handi-talkies have become immensely popular. They are being manufactured by the thousands, and in this issue EI presents plans for building your own.

But exactly where do the handi-talkies fit into the radio picture? Can a handi-talkie be used on any CB frequency, or anywhere else ?

Strictly speaking, handi-talkies stand apart from the CB service as "low power communication" devices, regulated by Part 15 of the FCC rules (CB is regulated by Part 19). All restricted radiation devices are taken care of by Part 15—wireless mikes, phono oscillators, garage-door openers, etc.

There is more than one License-Free Band (one falls in the broadcast frequencies, for instance) but the one we're mainly concerned with here is separate from, but overlaps much of, the Citizens Band. It begins at 26.97 mc and runs up to 27.27 mc, as compared to the 26.965-27.255 mc spread of CB (see chart). Since the overlap begins between CB channels 1 and 2, you can use any regular CB crystal, except for channel 1, in handi-talkie rigs. Actually, crystal control is not required, but it is advisable for useful operation.

Other technical regulations state that handi-talkie power is limited to 100 milliwatts and the antenna must be a single element not over five feet in

length—hence telescoping monopoles.

Anyone—citizen or alien, young or old—may use a handi-talkie for any legal purpose without filling out a single FCC form. You can chat idly by the hour and call CQ to your heart's content. There are just a couple of reservations.

The unit must bear a Certificate of Compliance that says it meets Part 15 requirements. Such certificates are attached to wired units at the factory but can be filled out and mounted by those who build their own. The second catch is that license-free rigs can talk only to other similar units. If they contact a licensed CB station, they fall under the regulations of Part 19 and licensing, station identification, etc., are required.

In practice, handi-talkies usually are used in mixed systems that include CB units. They then pick up a second certificate, FCC form 452-C. Most are technically qualified for class D operation, having crystals of .005% frequency tolerance and other CB features.

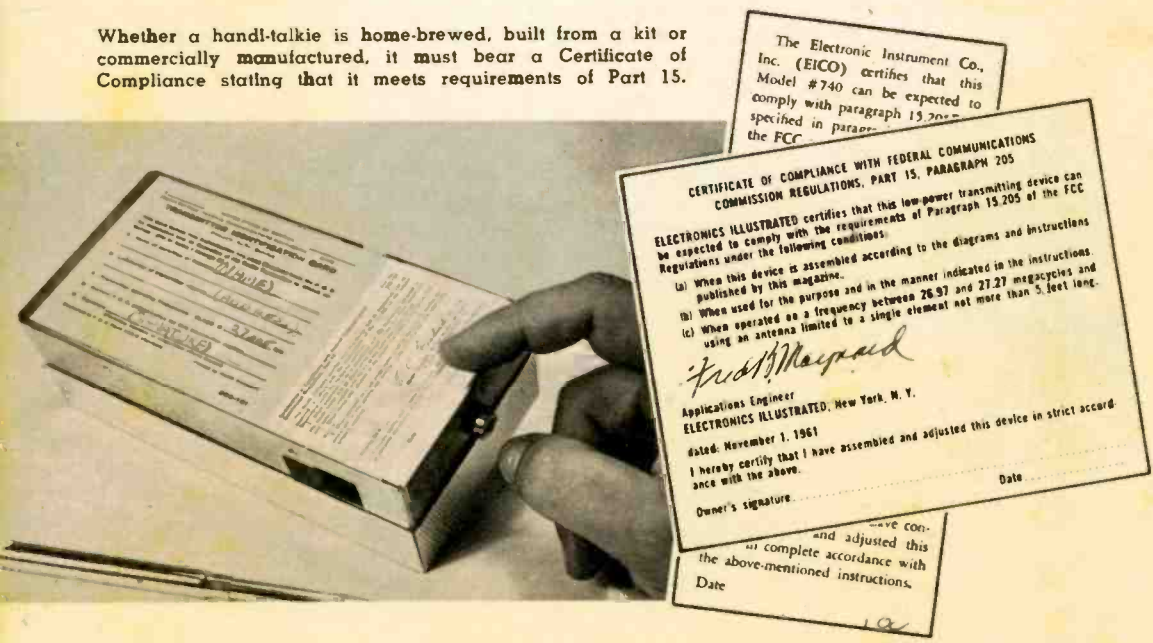
The range of handi-talkies varies greatly, being easily affected by local interference. In a relatively quiet area you can count on about a mile, which is tripled over water. In a mixed system of CB base station and handi-talkie the range is greater because of the increased power and the improved antenna at the base station.

The License-Free and Citizens Bands are not the same but the two do overlap on most frequencies.

Aside from amusement and experimentation values, handi-talkies have serious uses. They increase the versatility of almost any setup. Our lead art shows EI Tiny-Talkies (the smallest units we've seen yet) being used by two fishing parties. They also are employed by hunters, power line and transmitting tower repairmen, TV antenna installers, on construction jobs and in many other applications.

They answer a need that is not met by any other equipment—a reliable communications system that you can slip into your pocket.

Whether a handi-talkie is home-brewed, built from a kit or commercially manufactured, it must bear a Certificate of Compliance stating that it meets requirements of Part 15.



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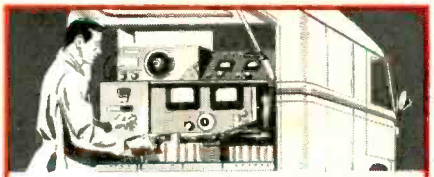

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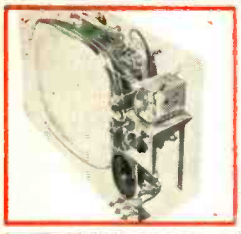

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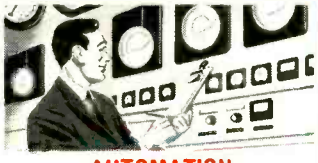

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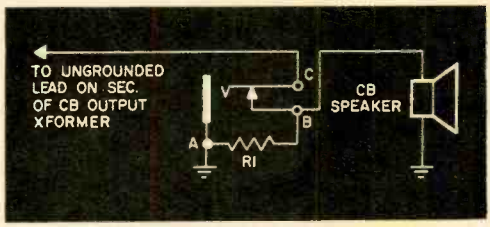
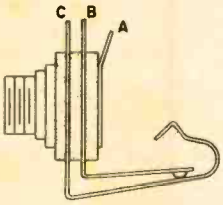
AN EARPHONE for your transceiver



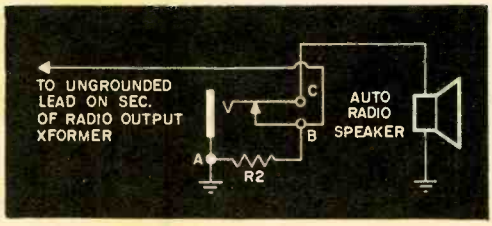
UNLIKE communications receivers, most CB transceivers do not have an earphone jack. This is regrettable considering the QRM on the band. Think of the convenience of being able to monitor CB without disturbing family or friends and being able to read a signal over the background noise in your immediate environment. High quality miniature earphones are available from a number of distributors and some even include a miniature matching jack. The jack is so small that you will have no trouble finding an open area close to the speaker on your rig's panel in which to mount it. If connected as shown in the diagram, plugging in the earphone will automatically disconnect the speaker.

You can use any impedance earphone (8 ohms to 100,000 ohms), but with an earphone other than the 8-ohm type it's a good idea to install a 47-ohm, 1-watt resistor (R1) as shown to prevent damage to the unloaded output transformer.



The volume heard in the earphone will be controlled by the transceiver's gain control. However, because of the efficiency of these earphones you will need a lot less gain when substituting for the speaker. Never have the gain turned up high when plugging in the earphone as you may damage the earphone—or your ear.

CB Thru Your Car Speaker

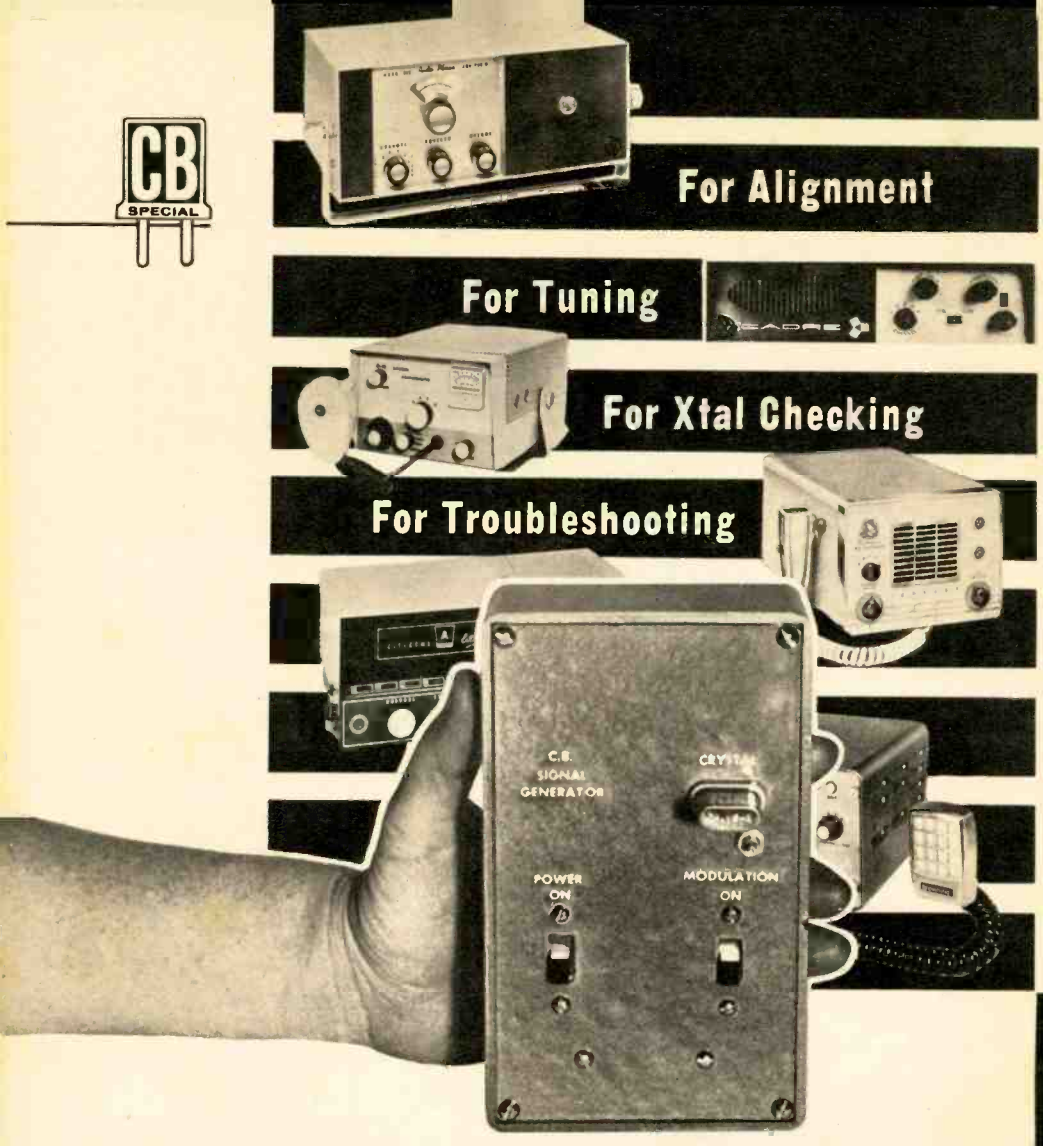


WITH THE same jack installation shown above on your CB rig and the hook-up at left added to your auto radio speaker you can feed the output of your CB transceiver directly into your car radio's speaker. Simply connect the two jacks by a jumper wire with a standard miniature phone plug on both ends. The wires need not be shielded and may be of any convenient length. The greater fidelity and sensitivity of your auto radio speaker will be of decided advantage in helping those hard-to-hear mobile messages get through. Normal operation of the auto radio is restored when the plug is removed.

Both the adaptions shown assume that one side of the speaker voice coil of your auto radio and transceiver is grounded. The jacks themselves have their A terminals grounded because they are mounted to the panels without insulating washers.

The car radio need not be switched on when you're using its speaker for the CB transceiver. Since the output transformer of the auto radio will be unloaded if the set is accidentally switched on, R2 (about 47-ohms) will prevent damage.

—Morris Moses



CB SIGNAL GENERATOR

by Herb Cenan

BECAUSE THE Citizens Band occupies such a narrow spread of frequencies it is difficult, if not impossible, to get a standard RF generator to produce a signal accurate enough for CB work. The 23 CB channels together occupy only a hair-width space on the dial of a standard signal generator.

But you'll have no trouble putting a narrow-band signal right where you want it with EI's CB Signal Generator. This crystal-controlled instrument was designed *especially* for CB use. It employs standard CB crystals to provide the on-the-nose signals you need when recalibrating tuning dials, aligning RF amplifiers or in general troubleshooting.

It will cost about $8 to build our signal generator, not counting the crystals. But you can use your own overtone transmit crystals for frequency calibration. Lacking these, you can buy overtone crystals almost anywhere for the change in your pocket.

To aid in signal identification and to allow for signal spotting with the antenna connected, the generator has a built-in tone modulator which puts out a raucous signal easily distinguished from normal QRM.

Construction

The CBSG is built with easily obtainable components (even the tapped oscillator coil is a stock item) and can be adjusted without instruments.

The front panel of a standard Bakelite case serves as a chassis. Before mounting any components cut all the required holes. The battery clamp is a piece of scrap aluminum bent for a snug fit around the battery.

Prepare Q2 by cutting the center shield lead short; likewise, the black lead of oscillator transformer T1. With the exception of coil L1, mount all components on the panel, then mount L1 with a lockwasher between the panel and coil form. Since L1's threads are delicate, do not tighten the mounting nut too much. T1 is mounted directly on a terminal lug. Pass a piece of bare wire through one of T1's frame tabs and wrap the wire around the terminal lug (see pictorial) used for battery positive. When the wires at this terminal are soldered, T1 will be mounted rigidly.

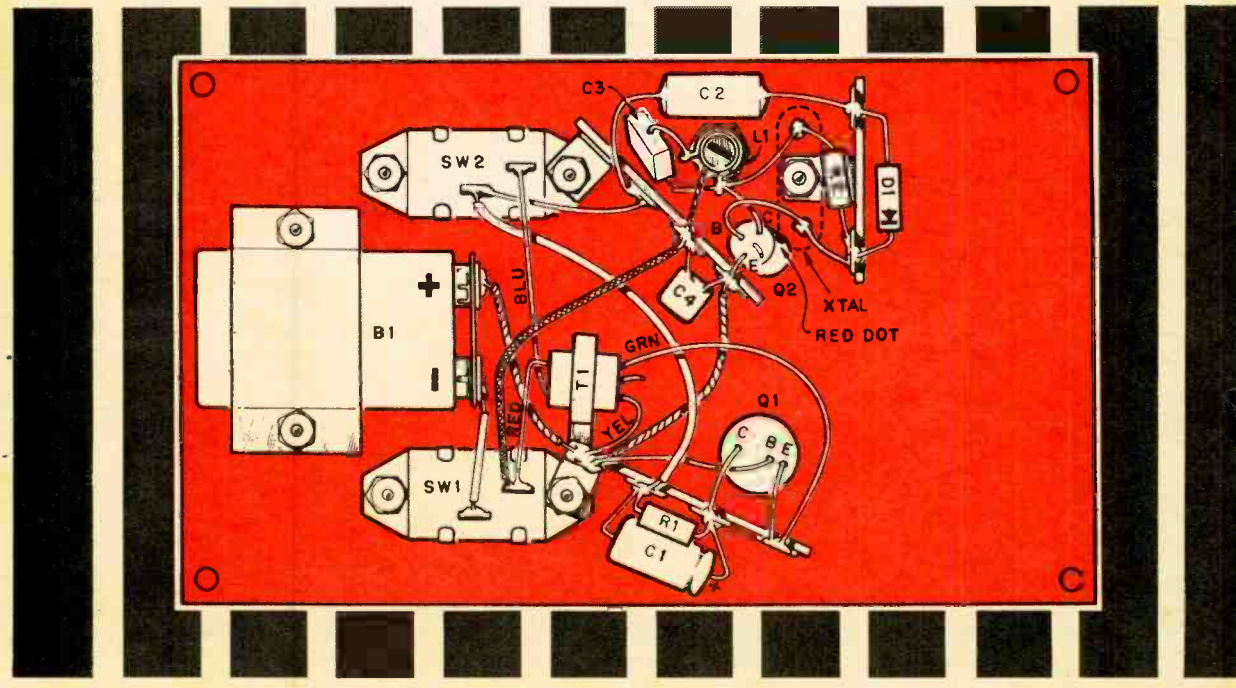
Wire in all components (observe polarity of C1 and D1) except the negative battery lead to SW1. To avoid heat damage to the transistors and diode, attach an alligator clip to the leads before soldering them into the circuit.

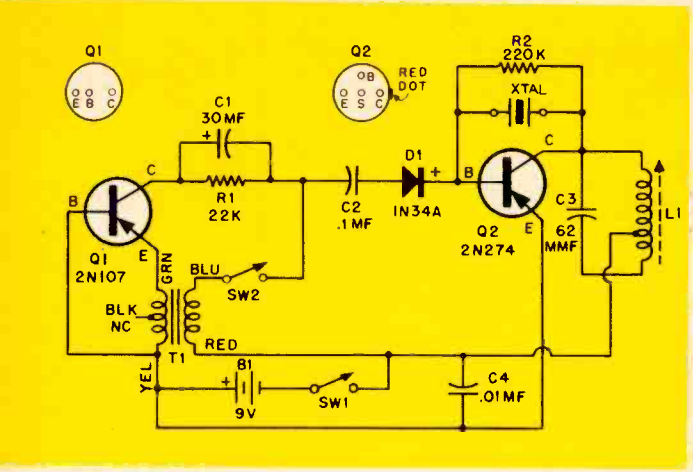
Adjustment

Set SW1 and SW2 to the *off* position. Set L1's slug full counter-clockwise. Connect a milliammeter of approximately 0-10 range between the free battery lead and SW1.

Turning on SW1 will result in a 3-4 ma reading. If the meter reads reverse-off-scale, interchange the meter connections. Plug in a crystal and with an alignment screwdriver rotate L1's slug clockwise until the meter dips. It is possible that at the beginning of rotation the meter will rise slightly but this is not the adjustment point. Proceed with adjustment until the meter definitely

All components are mounted on the panel of a standard Bakelite cabinet. The layout is not critical.





PARTS LIST

R1—22,000 ohms, ½ watt
R2—220,000 ohms, ½ watt
C1—30 mf, 15 VDC miniature electrolytic
C2—.1 mf, low voltage miniature
C3—62 mmf, 200 VDC silver mica
C4—.01 mf, low voltage miniature
L1—Oscillator coil (Lafayette HP-62)
T1—Subminiature transformer, 10,000 ohm primary, 2,000 ohm CT secondary (Lafayette TR-98)
Q1—2N107 transistor Q2—2N274 transistor
D1—1N34A crystal diode
XTAL—Overtone transmit crystal, see text
SW1,SW2—SPST slide or toggle switch
B1—9-volt battery, Burgess 2U6 or equiv.
Misc. Bakelite case and panel (6¼"x3¾"x 2"), terminal strips, socket to match crystal, etc.

A kit of the parts listed above (less crystal) is available from Lafayette Radio, 111 Jericho Tpke., Syosset, N. Y. Stock no. SP-254, $7.78. Include postage for 1½ lbs.
A Lafayette overtone crystal, stock no. HE-830, is $2.25 (specify channel desired)

Modulator transistor Q1 may be switched off by SW2. Oscillator Q2's frequency is set by xtal.

dips. After SW1 is adjusted, turn on SW2. The meter will rise about .4 ma indicating the modulator is working. If the readings are excessively high (or low) check for an open or shorted connection. If everything checks out, remove the meter from the circuit and solder the battery lead directly to SW1.

If you do not have a meter available the CBSG can be adjusted by using a transceiver (or receiver) of accurate calibration. Place the CBSG near the receiver's antenna jack and set the receiver to the frequency of the CB crystal. Turn on both SW1 and SW2. From full counter-clockwise, adjust L1's slug until the tone is heard in the receiver—rotate the slug a quarter turn past the setting where the tone first is heard. (L1's proper setting occurs approximately midway between full-in and full-out.)

Once the oscillator is tuned it will work with all overtone crystals. However, if you have aligned the CBSG by the receiver method with one crystal it is possible that overtone crystals of a different manufacture may not oscillate. In that case rotate L1's slug a quarter turn in either direction to start oscillation.

Using The CBSG

Recalibration of a tuning dial which has drifted is an easy task for the CBSG. Place it near the transceiver's antenna jack and turn the power on. If your transceiver is S-meter equipped, tune the receiver until you get a reading on the S-meter. The CBSG will produce up to an S-9 signal, depending upon its distance from the transceiver.

For easy spotting, turn on the CBSG's modulation. The easily distinguished signal has sidebands extending over several channels. This makes the signal easy to spot when the receiver has drifted far off calibration. To recalibrate, set the receiver to the CBSG's operating frequency with gain turned up full. Then adjust the receiver's oscillator trimmer or slug until the tone is at maximum or the S-meter peaks. For the most accurate adjustment move the CBSG away from the antenna jack so you work with the weakest possible signal fed to the receiver.

RF Peaking

In a similar manner the receiver's RF amplifier can be peaked while being fed from the antenna (the best way). Place the CBSG near the unit's antenna and tune in the signal; adjust the slug or trimmer on the antenna input coil and RF amplifier's plate circuit for maximum tone or S-reading. Even with strong QRM, the distinctive tone of the CBSG can be spotted easily.

E l b u i l d s a

CB SPECIAL

HEATH GW-10 TRANSCEIVER

THE NEWCOMER to Citizens Band radio, shopping around for his first transceiver, is faced with almost too much of a good thing. How does he choose amongst the multitude of rigs available in every price range?

If you are interested in a transceiver for your car and are the build-it-yourself type, the Heathkit GW-10 can be a good choice. One of the most compact sets available, it is only 15 inches wide (including the side-mounted mike), 4½ inches high and 5¾ inches deep, including knobs.

Heath's under-dash mounting procedure is one of the easiest around, guaranteed not to strain either your dash or your temper. Only two screws through the GW-10's slotted cover are required and the unit is light enough that no fire wall brace is required.

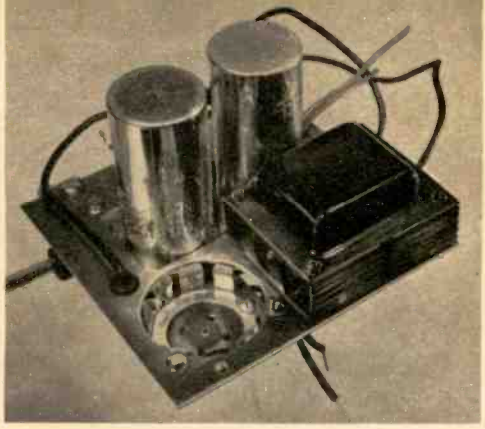
The GW-10 is available in two versions: the GW-10A, which incorporates a 117-volt AC power supply, and the GW-10D, which has a vibrator power supply for 6- or 12-volt DC operation. We built the GW-10D. The transmitter section, consistent with FCC regulations,

is controlled by third overtone quartz crystals selected by a three-position crystal selector switch. The receiver section is unique in that it has *two* local oscillators. One is crystal-controlled and hence fix-tuned to a single channel according to what receiving crystal you install. (If you have enough crystals you naturally can tune any channel.) The second oscillator may be switched in to provide continuous tuning across the entire band (see the schematic).

An automatic series gate noise limiter minimizes impulse-type interference, such as ignition, lightning, etc. An adjustable squelch that silences the receiver during standby and a push-to-talk mike button are two nice features of the unit.

Construction. The construction manual and pictorials are clear and easy to follow. But the compactness of the unit may cause trouble for the newcomer to kit building. In order to get everything in, component leads must be kept short and carefully dressed. A pencil type soldering iron is mandatory, and care must be taken to prevent burned insulation or heat-damaged components when soldering.

Tuning Up. We followed a combination of the Heath instructions and the data given elsewhere in this issue for transmitter tune-up. The receiver alignment is straightforward and should present no problems. We departed from the manual on only one point. Since it often is difficult to tune in a CB station and get a constant signal,



Vibrator power supply subassembly for mobile use. GW-10 has option of 6, 12 VDC or 117 VAC.

we used EI's CB Signal Generator (described elsewhere in this issue) for accurate receiver calibration and alignment.

If you are neat, follow the manual faithfully and take the little extra care and time this kit requires, you will wind up with an excellent CB transceiver which, at $62.95 for the kit, easily holds its own with the higher-priced factory-wired units.

The New GW-11

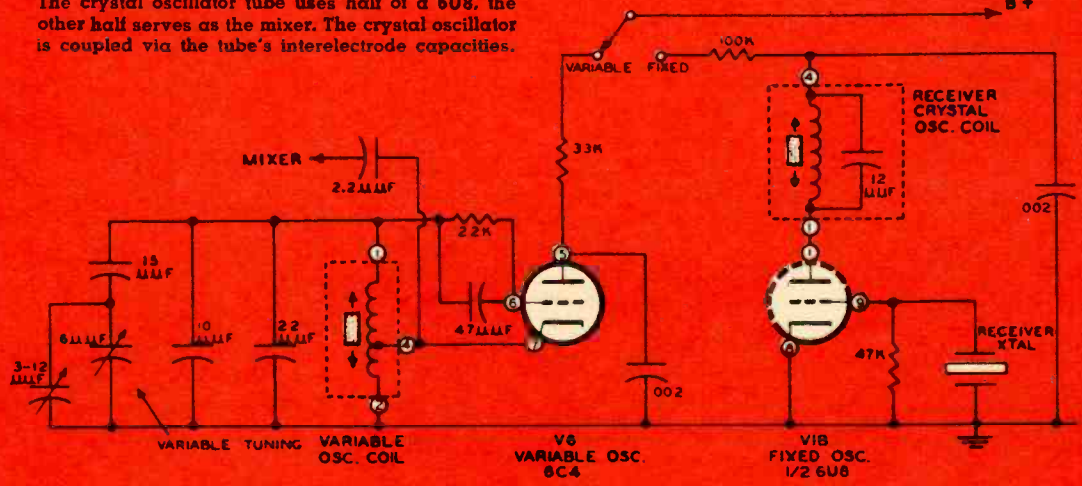
Advertised, but not yet available at the time of this report, is the new Heath GW-11. Physically identical to the GW-10, the GW-11 preserves all the fine mounting provisions of the GW-10.

New features include electronic switching of the antenna (thus eliminating a relay and its possible troubles), a tuning meter mentioned above and a new RF power output stage.

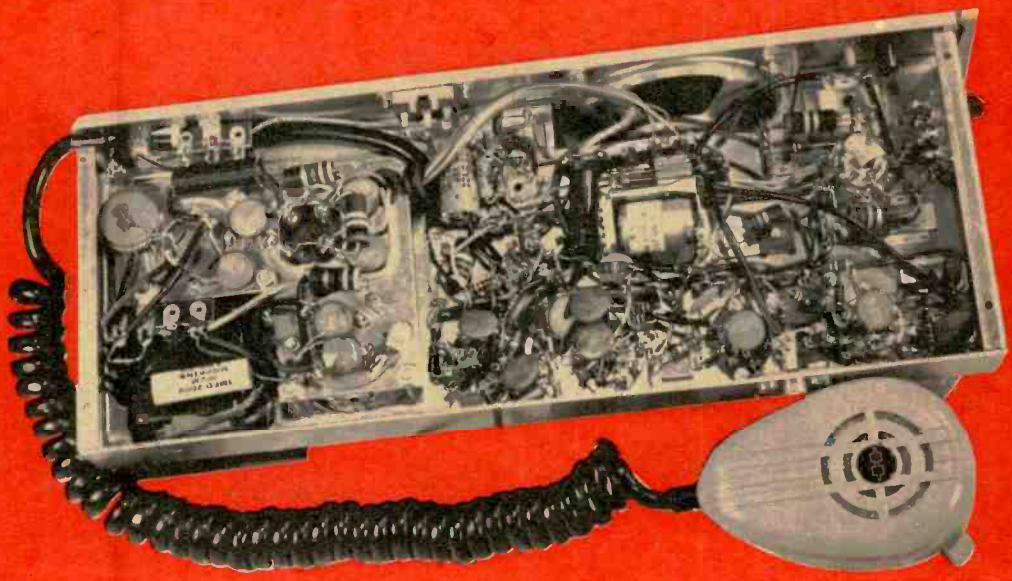
The new output circuit deserves discussion. In the GW-10, a single 6AU8 triode-pentode tube serves as both the oscillator and RF output. In the GW-11 the triode section of the 6AU8 continues in the role of oscillator but the pentode section that previously was the RF output now serves as an RF driver. The recipient of this souped-up drive is a newly incorporated 5763 commercial-type power tube. Used far below its maximum rating, the 5763 in this application provides high reliability. The price of the new rig in kit form is $66.45.

We wonder, considering the potential of the 5763 tube, whether Heath in the near future doesn't intend to bring out a 6- and 10-meter ham transceiver based on the GW-11.

Partial schematic of receiver oscillator. Note choice of variable or crystal controlled tuning. Output of both oscillators is fed into a separate mixer tube. The crystal oscillator tube uses half of a 6U8, the other half serves as the mixer. The crystal oscillator is coupled via the tube's interelectrode capacities.



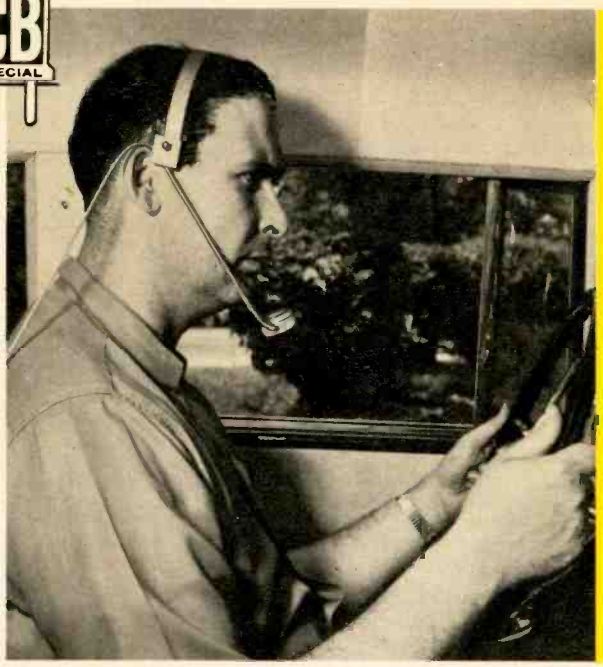
Underchassis view of the completed transceivers. The compact design requires careful construction.



Completed unit before installation in its case. In-line fuse holder is seen near the mike.

Plenty of leg room remains after underdash installation. Because of unit's light weight, no fire wall brace is required.

CB SPECIAL



for CB'ers and Hams

A SAFE MOBILE MIKE

For messages on the move and safety, too . . . build EI's under-$5 boom microphone.

By F. David Herman

IF you have to transmit while traveling, EI's boom microphone adds some safety to a not-so-good procedure.

First of all, you drive with both hands on the wheel. The microphone remains a fixed distance from your mouth, regardless of which way you look, and you have a special push-to-talk switchbox at your fingertips. With the specified switch, the transmitter can be either locked in the ON position or a spring return can be used for a quick break.

Construction. The microphone boom assembly is built of scrounged components: a ladies headband hair clip, a couple of pieces of scrap plastic, nine inches of $\frac{3}{16}$" copper tubing and a hard plastic screw-on bottle cap.

A half-inch from one end of the hair clip drill a 6-32 hole (#28 drill). Drill another 6-32 hole through the two plastic pieces as shown. Clamp the two pieces together and drill a $\frac{3}{16}$" hole angled through the pair for the copper tubing. The block serves as a swivel to permit adjustment of the microphone position.

About 6½" from one end, bend the copper tubing in an arc. Make certain you do not crimp the tubing because the microphone cable must be able to pass through it.

If you have one of the modern, small, ceramic microphones, you can remove the element for use in the boom. Or you can purchase a small replacement element.

Drill a $\frac{3}{16}$-inch hole in the side of the bottle cap which serves as a base for the microphone element. Drill slowly to avoid shattering the cap. The parts are then fitted together with epoxy cement.

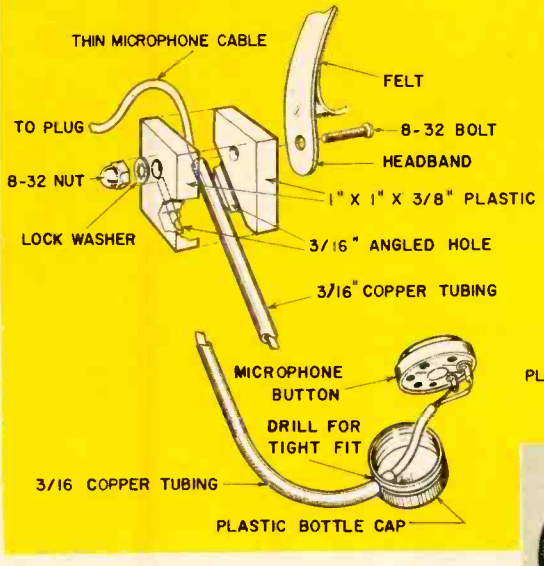
Attach the boom to the headband with a 6-32 screw, lockwasher and either an acorn or thumbnut.

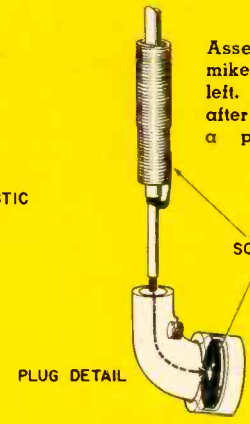
Pass an eight-foot length of extra thin

[*Continued on page* 102]

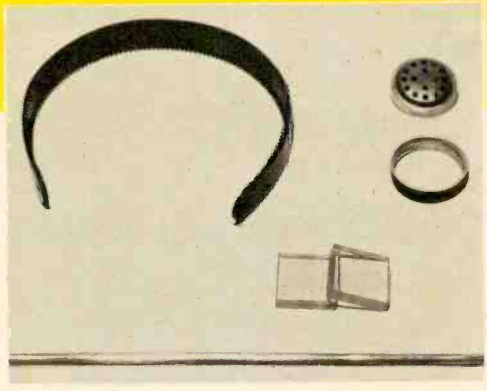
PARTS LIST

SW1—Switch, 4PDT three-position spring-return (Lafayette SW-68)
PL1—Plug to match transmitter input jack
PL2—Microphone connector (Amphenol 75MC1FA)
J1—Jack to fit PL2 (Amphenol 75PC1M)
Minibox, 3¼"x2⅛"x1⅝"
8 feet thin microphone cable (Alpha type 1702, 0.125 OD)
Microphone Cartridge available from Custom Electronics, 2929 Fulton St., Bklyn, N. Y., $3.50 postpaid
Misc. hardware—See text and pictorials

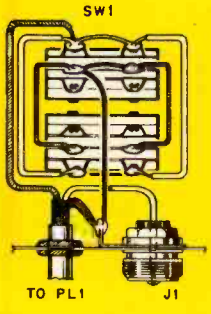


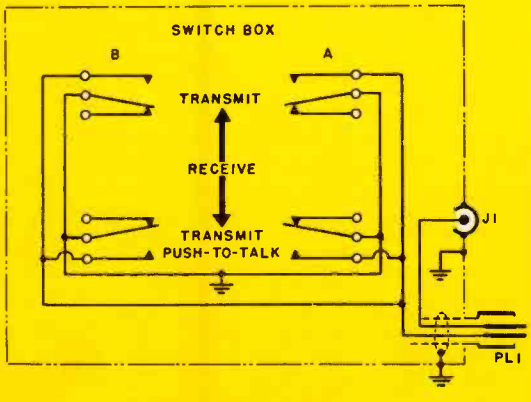


Assembly details of the boom mike components are shown at left. A coat of spray paint after completion gives mike a professional appearance.



Raw material of the boom assembly includes a woman's hair clip, a couple of pieces of plastic, a microphone cartridge and a plastic bottle cap.





Wiring of S1 as viewed from rear. Section B of switch may be used for other circuits.

Mike boom connects to push-to-talk switch box. Large suction cup bolted to Minibox forms a convenient stable means of mounting on the dash.

IS your Citizens Band rig developing the aches, pains and complaints common to all aging electronic equipment? Although CB hasn't been with us too long, for many rigs overhaul time has come—or is long past due! As a CBer, you can save yourself quite a few dollars—and add to your fund of technical experience—by servicing your own rig.

Because most CB sets get along nicely without sophisticated circuitry, a few relatively inexpensive instruments and homebrew gadgets will handle almost every problem you'll come across. Of course, there are several worthwhile specialized CB service instruments and later in the series we will take a look at the job they can do.

Preliminary Tests. As in all electronic servicing, there are a few basic checks that should be made first. All cables and connecting wires should be inspected for breaks, fraying and possible shorts. In the case of mobile power cables, check the wires where they enter an inline fuse holder since vibration can cause the wire strands to break at the fuse terminals. And, of course, check the fuses. If a new fuse blows, carefully check the tubes for shorts. If the fuse blows only on mobile, check the vibrator and buffer capacitor. More on this section of the transceiver and its troubles later.

Since tube failure is the most frequent cause of equipment failure, a com-

plete tube check should precede any servicing. Remember, however, that the tube testers aren't infallible; if a tube tests good but the meter pointer moves erratically when the tube is tapped, try a new tube from a spare set. RF, IF and oscillator tubes have been known to test good and still not do the job in a specific circuit.

The above checks cover most equipment failures. Anything more complicated means trouble-shooting. Fear not. The nature of a transceiver with its separate circuits simplifies the pinpointing of trouble and localization is 90% of any service job.

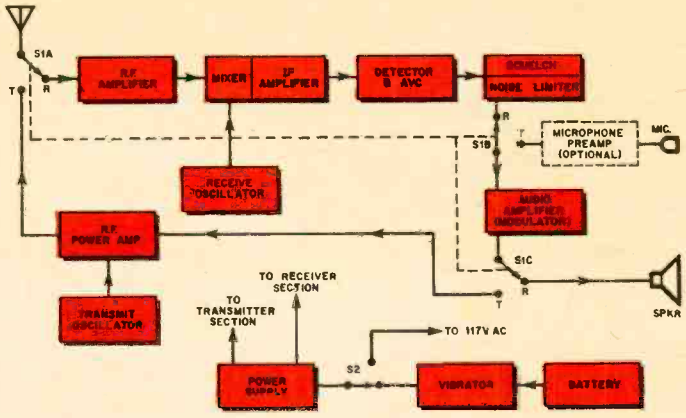


Fig. 1. Block diagram showing switching of a typical transceiver.

Figure 1 shows the interrelations of the various circuits in a transceiver. With the exception of the power supply, the failure of a particular section does not prevent the other circuits from functioning. This is what makes transceiver servicing relatively easy. Now let's take a look at some common trouble symptoms and see how they can be handled.

Receiver Inoperative. First, check to see if the transmitter also is defective. Plug in the RF dummy load lamp recommended by the manufacturer (or a power output meter) and turn on the transmitter. A dead transmitter indicates that the section common to the receiver and transmitter is defective. That section is the power supply.

Two types of supplies are in common use—the voltage doubler and the full-wave rectifier (Figs. 2A and 2B). With transceiver power off and a VTVM or VOM set to the OHMS range, connect the common lead to the chassis and the other probe

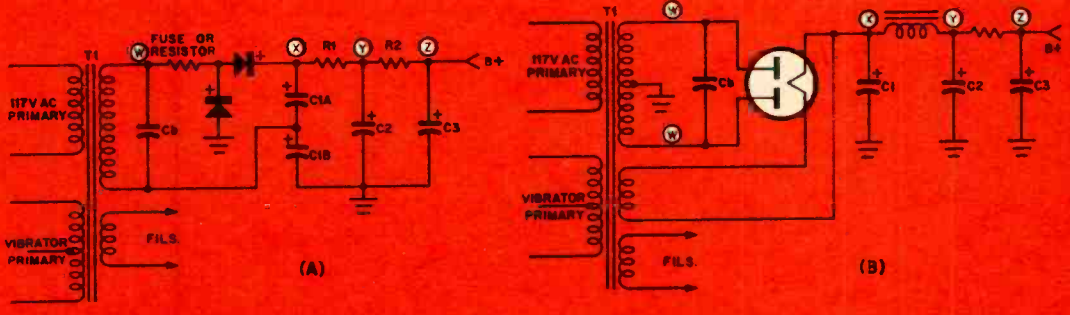
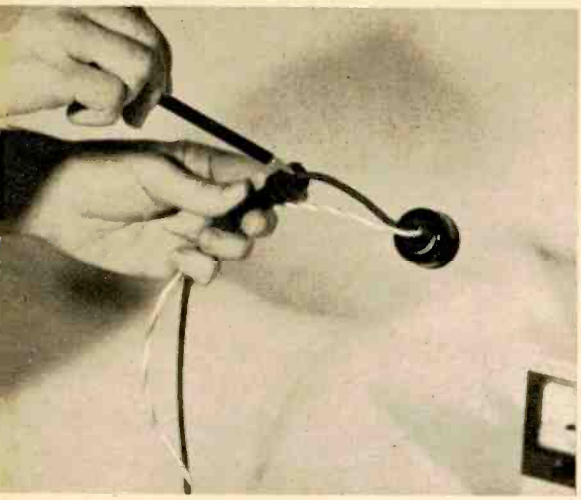
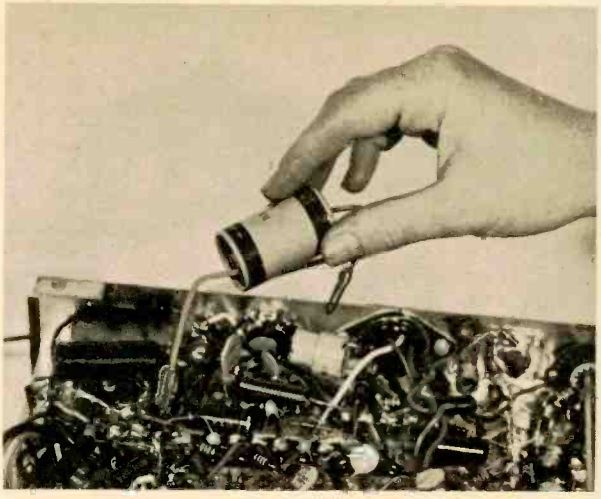


Fig. 2. Two types of standard CB transceiver power supplies. Doubler circuit (A) uses silicon diode rectifiers; full-wave circuit (B) has a rectifier tube.

In-line fuse holder is a prime suspect to check for broken wires or a bad electrical contact.



The quickest way to check an electrolytic for low capacitance is to shunt it with another unit.



to points X, Y and then to Z in Figs. 2A and 2B. At each point, the meter needle will kick and then settle down to a high value, usually over 150,000 ohms. If the meter reads a low resistance, electrolytic capacitor C1, C2 or C3 probably is shorted or leaky. Temporarily disconnect the leads at the positive terminals of each capacitor and check it with your ohmmeter. Where a resistance filter is used such as in Fig. 2A, a shorted C2 or C3 will tend to overheat or burn out R1 and/or R2.

If one section of a multi-section can is defective, replace the unit since a defective section is a good indication that the others will go shortly.

If the capacitors check out, set the meter to its 300-500 VDC range, connect the common lead to ground and the DC probe to B+ (point Z). Turning on the transceiver should result in the DC reading indicated in the transceiver's service manual. If there is no DC indication, move the probe to X. If there's no DC at X the high-voltage secondary winding of T1 is open, a fuse in series with the secondary is blown or the silicon rectifiers (Fig. 2A only) are defective.

To check the possibilities, set the VTVM to a 300-500 VAC range, connect the common lead to ground and the probe to W. If AC is present at W but no DC (B+) at X, the rectifiers are defective, or C1B may be open. If no AC is present at W check the wiring, fuses, C1B and the switch feeding transformer T1. If the power wiring is okay, T1 is defective.

Severe Hum in Loudspeaker. The first check in this case is to turn the set's volume control down but not off. If the volume control doesn't appreciably affect the hum, it's a good bet that your transceiver has an open filter capacitor (C1, C2, C3 in Fig. 2). Since failure of any filter capacitor can cause the hum, each one must be tested individually. Using clip leads or the test capacitor shown, connect a capacitor of equal or higher capacity and voltage rating across the suspected unit. When the hum is eliminated or diminishes substantially, you've found the culprit. Note that this test will work only with capacitors which are open or have lost capacity. Shorted or leaky units will cause other symptoms and are checked as in the *Receiver Inoperative* section.

Fuse Blows on Mobile Only. The fact that the transceiver operates on the AC line indicates a problem in the mobile power supply. In modern CB transceivers, the power transformer has extra windings for the vibrator. Therefore, first check the vibrator. If it tests okay, the difficulty is most often buffer

An RF signal generator will also supply an audio tone for signal tracing after the detector stage.

capacitor Cb (see Figs. 2A, 2B). Cb is subjected to high peak voltages and must be replaced with an *exact* duplicate in rating and capacity. In fact, it's a good idea to replace Cb whenever you replace the vibrator.

Once we eliminate the power supply as the possible source of breakdown, troubleshooting becomes easy because the operating sections can make the defective sections stand out like a sore thumb.

No Reception. Since this fault could be due to several defects, let's first check the RF output. The logic of this will become clear shortly. Connect a visual RF indicator (dummy load lamp) or a CB power meter to the antenna jack, turn on the transmitter and speak into the microphone. If the load lamp lights—indicating RF output—but does not change in intensity with modulation (a power meter will wiggle with modulation), this indicates a fault in the audio section. Since the audio section is common to the transmitter and receiver (see Fig. 1), the lack of reception is due to the same defect. Notice that before the transmitter was tested, the lack of reception *could* have been due to a fault in *any* part of the receiver.

To further localize the trouble, an audio signal from an RF signal generator or other instrument is used as an audio signal source. (Even an FM tuner will serve.) With the transceiver off, connect the signal source's ground lead to the transceiver chassis. Connect the hot lead through a .05 mf, 600-volt capacitor to the plate (Z) of audio output tube V1, Fig. 3. A signal, although weak, should be heard in the speaker. Silence indicates a defective output transformer (T2), speaker or C4.

Check the speaker first. Set your meter to the low-ohms range and connect the leads across the speaker terminals. At the instant of contact a click should be heard in the speaker. If the speaker passes the click test, check for an open winding in T2 or a short in C4.

If the output transformer and speaker

[*Continued on page* 105]

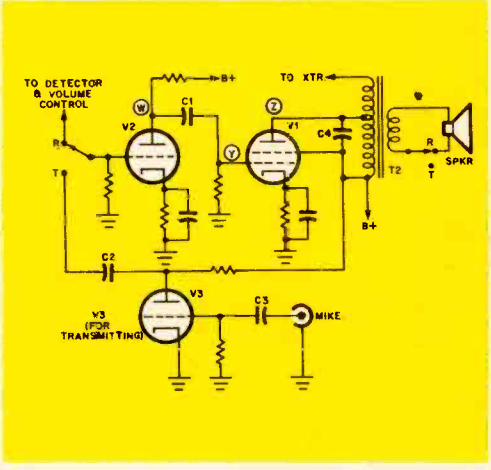


Fig. 3. Typical audio stage. With T-R switch on receive, mike preamp (V3) is out of the circuit.

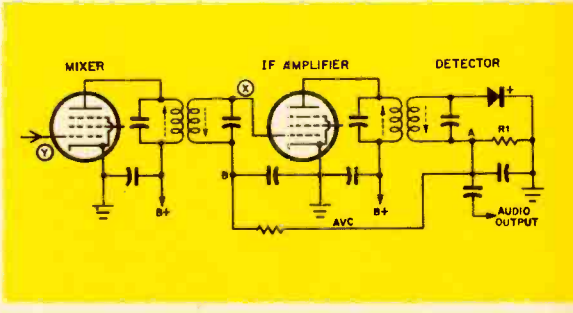
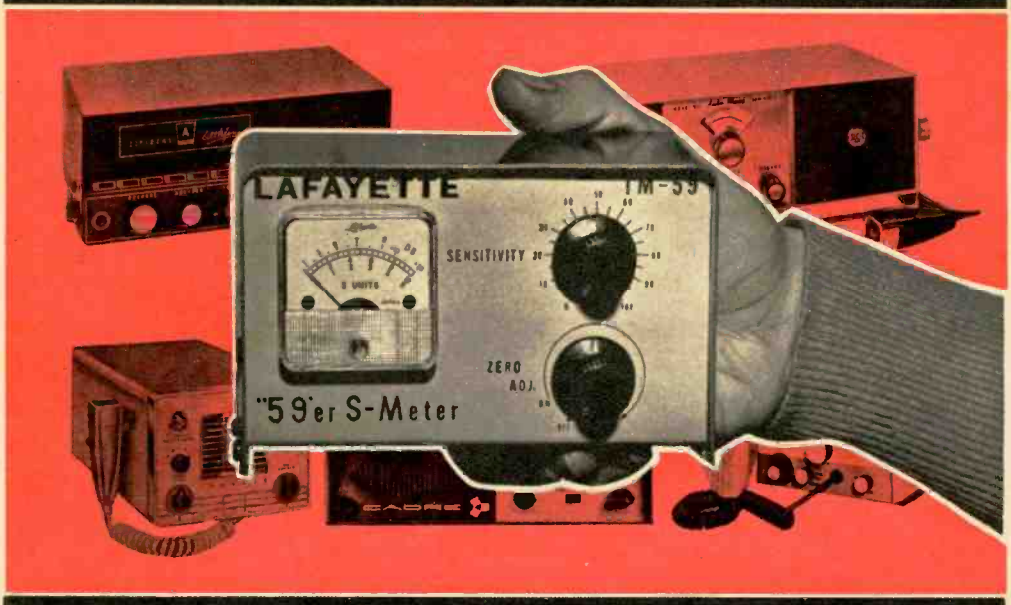


Fig. 4. Mixer, IF and detector stages. There may be several IF's or combined tube functions.

CB SPECIAL

You have your test equipment built in when you . . .

ADD AN S-METER



By Bert Mann

FOR a $10 investment you can build into your Citizens Band transceiver a major part of the test equipment necessary to insure peak performance. An easily installed vacuum-tube S-meter will enable you to align your receiver, calibrate the tuning dial, tune up your mobiles and assist other stations making antenna adjustments.

Because the S-meter circuit shown is essentially a VTVM, connecting it to your transceiver's AVC circuit will cause no undesirable effects.

The current drain of the S-meter is low. It can be connected to any CB unit without fear of power supply overload.

Several mail order houses sell a meter movement with a scale calibrated in S-units. If you own one of these meters you can add the tube driver circuit as shown. However, the complete vacuum-tube S-meter unit shown in the lead photo can be obtained for not much more than the cost of the parts (see Parts List).

Installation. Mount a four-contact jack or socket at any convenient spot on the transceiver chassis, preferably near the last IF transformer. Wire the jack as shown. The filament lead (4) is wired to any 6-volt point; or a 12-volt point through R6. The instruction with the Lafayette TM-59 calls for 39-ohm resistors in series with 6C4's filament for 12-volt operation. Longer tube life, particularly in mobiles, will result if you use a 43-ohm resistor for R6.

A handy spot for the B+ lead (1) tap is the B+ side of the audio output

tube's screen grid resistor. If your rig has no screen grid resistor connect the B+ lead to the screen grid terminal. The AVC lead (2) is connected to point A, but it may be easier to find point B, which is located after the AVC filter (Rf and Cf.) Rf usually has a value of 1 to 3 megohms and Cf is usually a .05 mf capacitor. While AVC systems have some differences, they all have Rf and Cf. Ground (3) goes to the nearest chassis ground point. This completes the receiver wiring.

The cable from the S-meter should be connected to a plug (PL1) matching the socket (J1) installed on the transceiver.

Adjustment. Disconnect the transceiver's antenna and short-circuit the antenna jack with a piece of wire. Rotate *Zero Adj.* control R5 for zero meter indication. Reconnect the antenna, tune in a *strong* signal and adjust sensitivity control R3 for an S-9 reading. With S-9 as a normal strong signal setting, close mobiles won't slam the meter needle. Note that when the meter is first turned on the needle normally goes full scale, then falls to zero.

Using the S-M. As a true indicator of received signal strength and RF and IF gain, the S-M can serve in a number of roles.

● Alignment. In conjunction with the CB Signal Generator described else-

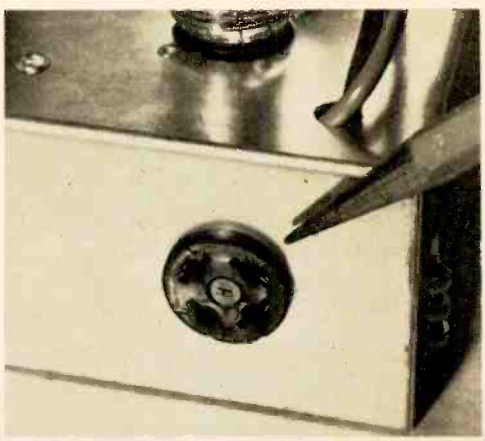
[*Continued from page* 104]

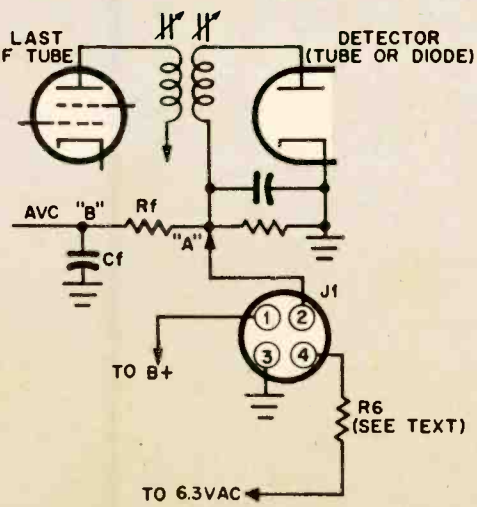
PARTS LIST

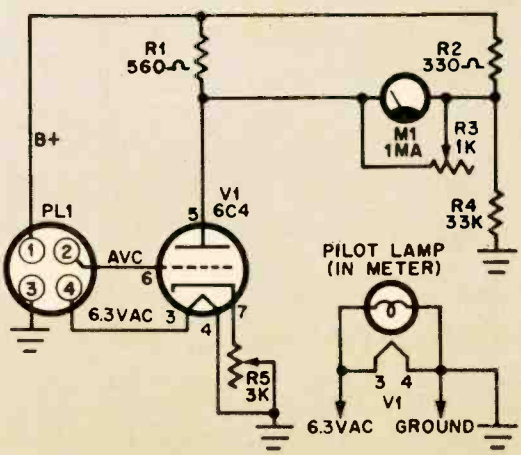
Resistors: 10% tolerance
R1—560 ohms, 1 watt
R2—330 ohms, 1 watt
R3—1,000 ohm potentiometer
R4—33,000 ohms, 2 watts
R5—3,000 ohm linear potentiometer
R6—39 or 43 ohms, 2 watts (see text)
M1—0-1 ma S-meter
V1—6C4 tube
PL1—Amphenol 71-4S
J1—Amphenol 78-S4S

Complete S-Meter—Stock #TM-59 (Lafayette Radio)

Four-contact socket J1 is installed on chassis at a spot convenient for internal connections.







S-meter schematic is at right. Power and AVC take-off points in transceiver are shown at left.

CB SPECIAL

Flyweight TRANSMITTER for model rockets

By G. Harry Stine
President, National Association of Rocketry

OUR YOUNG ROCKETEERS, having learned to build and shoot their rockets safely are now interested in instrumenting their birds. Most basic instrumentation is a telemetry system which transmits data from a rocket in flight to a receiving station on the ground.

EI's Flyweight Transmitter is an excellent basic telemetry system particularly suited to model rockets. It is simple to build, inexpensive, weighs only 1⅛ ounces including battery and can transmit data supplied by a variety of transducing elements or sensors.

The Flyweight Transmitter also is rugged enough to withstand flight after flight because it's constructed on a sliver of perforated board that fits snugly into the ¾-inch tube of a recoverable model rocket. The transmitter's 50-milliwatt power rating makes it eligible for the license-free part of the Citizens Band—channels 2 through 23 (see THE LICENSE-FREE BAND in this issue), and a miniature CB crystal can be used in the circuit. EI supplies the Certificate of Compliance (see cut).

1. The antenna, a length of wire through rocket nose plug, is attached to transmitter's output.

2. Transmitter, with battery hooked up and its circuit operating, is inserted in rocket tube.

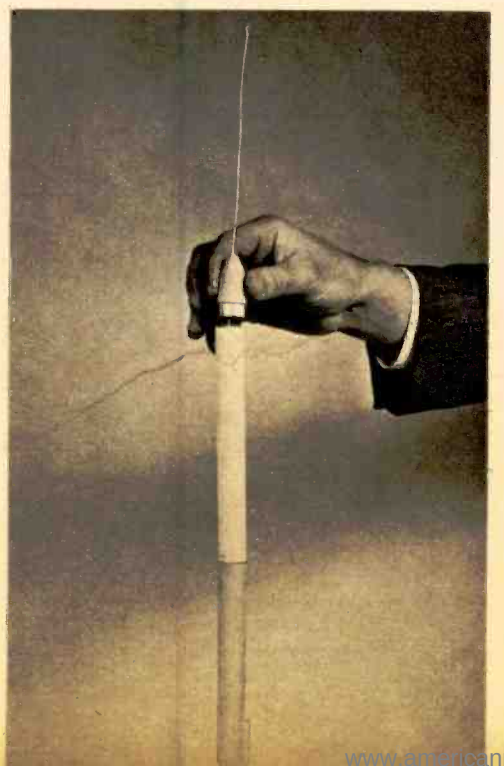
Hams, of course, can operate this transmitter on any amateur band. It has been tested with good results on both 10 and 40 meters. A strong signal has been received at a distance of 1,500 feet on a National NC-303 receiver.

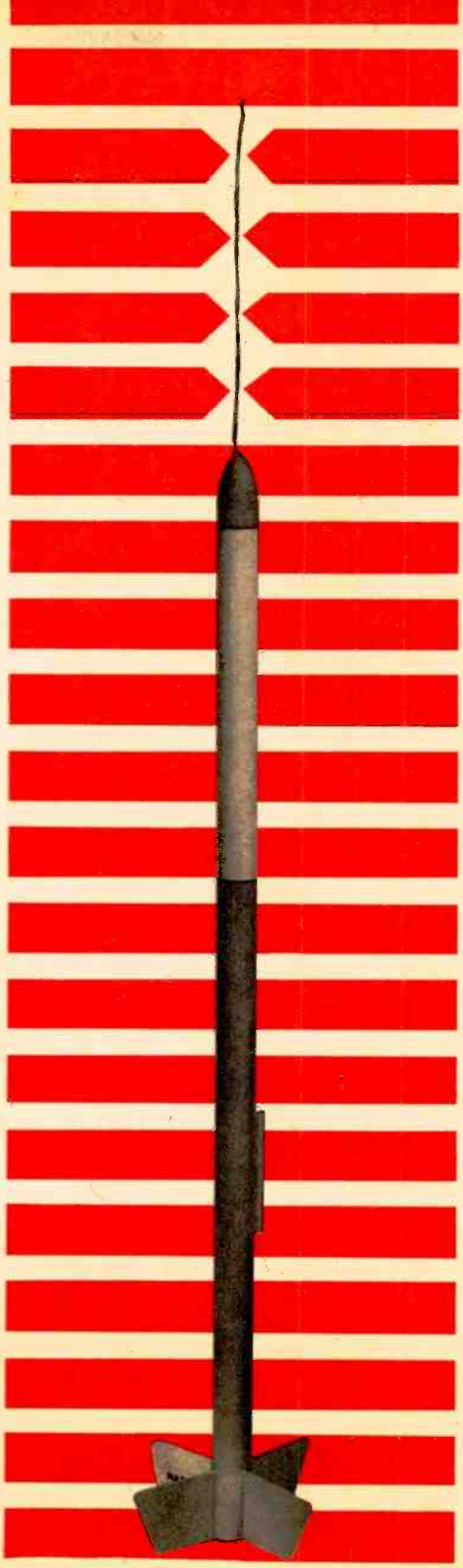
The Flyweight Transmitter incorporates a multivibrator (Q1 and Q2) whose audio output frequency is determined by sensor Rs. The output of the "multi" modulates crystal controlled RF output transistor Q3.

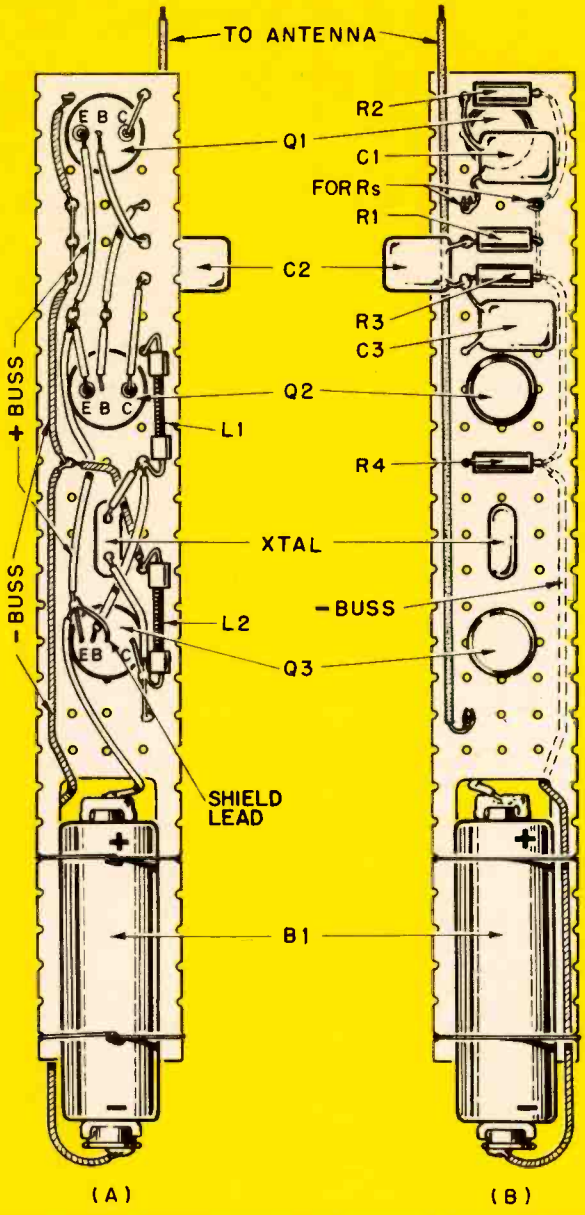
Most of our tests have been conducted with a miniature photo resistive cell as the sensor. Besides light intensity, such a cell can give you the spin rate of a rocket. A small hole in the side of the rocket tube admits a burst of light each time it faces the sun. This causes a rapid shift in tone. Other possible sensors include a thermistor for temperature, an accelerometer or a miniature altimeter.

Wave-trap L3-C4, shown in the schematic only, is optional but may be used to cut spurious radiation. C4 is a 3-30 mmf ceramic trimmer capacitor and L3 is a 1.5 microhenry choke (Miller #4604).

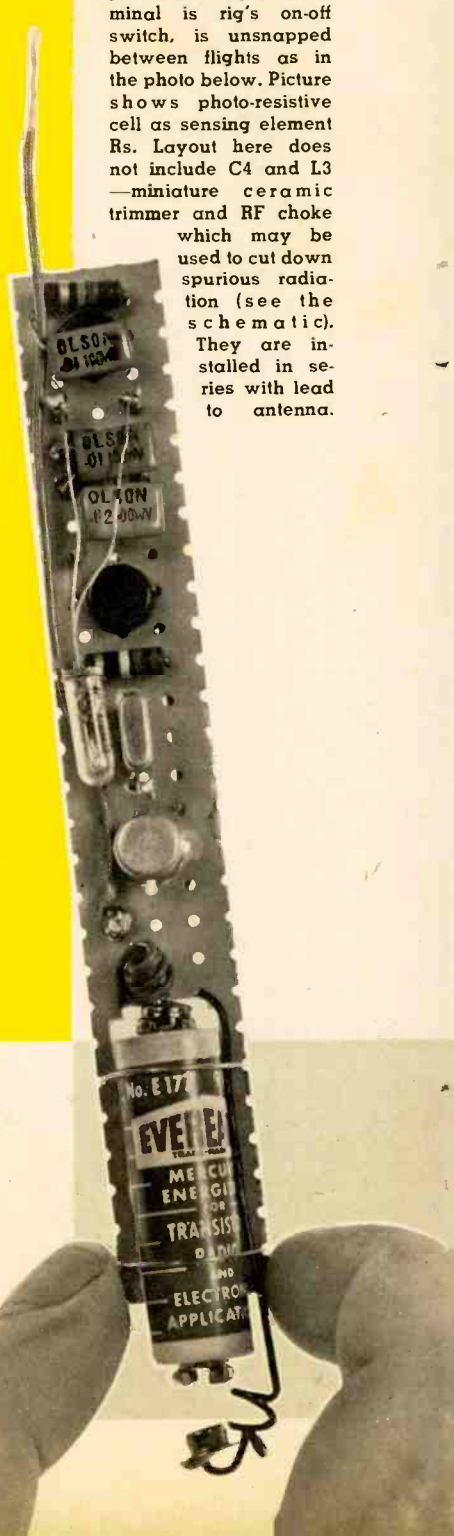
3. As last step, nose plug is fitted snugly in tube and rocket is ready for launching stand.







Pictorials show both sides of transmitter. C2, normally over R1-R3, is folded out for clarity. Wires hold battery in place; the negative terminal is rig's on-off switch, is unsnapped between flights as in the photo below. Picture shows photo-resistive cell as sensing element Rs. Layout here does not include C4 and L3 —miniature ceramic trimmer and RF choke which may be used to cut down spurious radiation (see the schematic). They are installed in series with lead to antenna.



These components work in series and the trimmer is tuned to pass the CB frequency you are using.

A rocketeer should concentrate on just getting a signal from his rocket in flight before trying for meaningful data. Quantitative telemetered signals can be simply listened to, or you can tape record them for later study. To make the signals meaningful, it is first necessary to test any given sensor and plot the results (for later comparison) of

changing temperatures, light intensity, etc.

Although this transmitter may work with any type of *amateur* rocket, it was designed specifically for *model* rockets, a term denoting a certain kind of bird as defined by the National Association of Rocketry. A model rocket is made of non-metallic materials, has a parachute recovery system, weighs only a few ounces (our test rocket with engine *and* transmitter aboard weighed in at 2⅞ ounces!) and uses a commercially-made rocket engine (18 types ranging in thrust up to 50 pounds are currently on the market). Model rocketeers *never* mix fuel or make their own engines. This is why they boast a perfect safety record.

For detailed information on model rocketry and facts about becoming an Association member, write to the National Association of Rocketry, Suite 1962, 11 West 42nd St., New York 36, N. Y.

In constructing the transmitter, cut and sand the perforated board so it slips inside the rocket tube snugly enough to be held in place during flight (if you get it too loose, wedge in bits of sponge rubber for a tight fit). Using the parts as templates, cut holes for the battery, the three transistors and the crystal. Carefully crack the cases off L1 and L2 (if they have cases) with a vise.

Glue Q1, Q2, Q3 and the crystal in place and solder in the other components. Have another person hold the leads with tweezers to conduct heat away from the components. Wires are soldered directly to the crystal pins and transistor leads so exercise care to avoid heat damage.

The transmitter's antenna is an 8- or 9-inch piece of 16- or 18-gauge buss wire stuck through a hole in the nose.

When making a flight, the rocket is prepared first by putting the parachute and motor in place (information is available on this phase from the NAR). The transmitter output lead is attached to the antenna and the negative battery lead is snapped in place to start the circuit operating. The transmitter and nose plug are then inserted in the tube and the rocket is placed on the firing stand and fired.

After recovery, the negative battery terminal should be disconnected to stop the transmitter.

CERTIFICATE OF COMPLIANCE WITH FEDERAL COMMUNICATIONS COMMISSION REGULATIONS, PART 15, PARAGRAPH 205

ELECTRONICS ILLUSTRATED certifies that this low-power transmitting device can be expected to comply with the requirements of Paragraph 15.205 of the FCC Regulations under the following conditions:

(a) When this device is assembled according to the diagrams and instructions published by this magazine.
(b) When used for the purpose and in the manner indicated in the instructions.
(c) When operated on a frequency between 26.97 and 27.27 megacycles and using an antenna limited to a single element not more than 5 feet long.

Robert G. Beason

ELECTRONICS ILLUSTRATED, New York, N. Y.

dated: November 1, 1961

I hereby certify that I have assembled and adjusted this device in strict accordance with the above.

Owner's signature.....

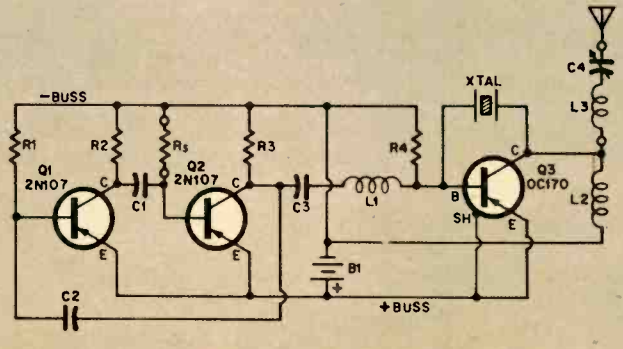
Date.....

Certificate of Compliance, signed and mounted on transmitter, permits license-free operation.

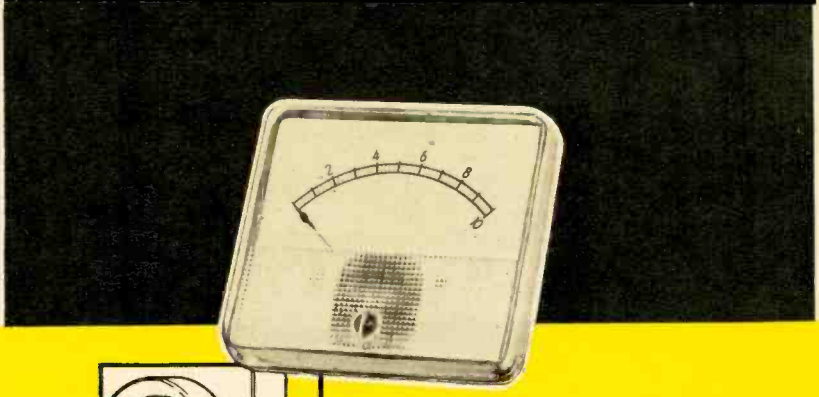
Simplicity of circuit makes Flyweight Transmitter easy to build but parts must be close-spaced.

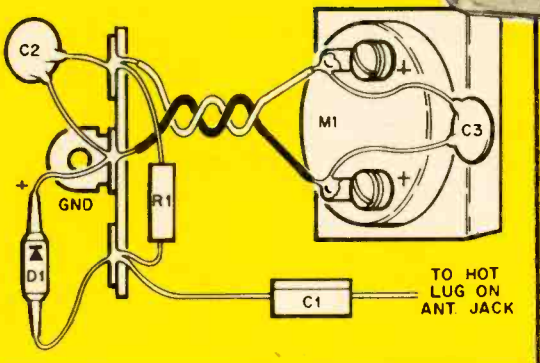
PARTS LIST

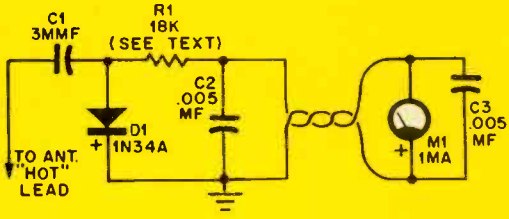
Resistors: ½ watt or smaller, 10%
R1,R4—220,000 ohms
R2,R3—15,000 "
Rs—sensing element (see text)
Capacitors: Miniatures, 10-volt or higher rating
C1,C2—.01 mf
C3—.02 mf
C4—3-30 mmf ceramic trimmer (see text)
L1,L2—1 microhenry choke
L3—1.5 microhenry choke (see text)
Q1,Q2—2N107 transistor or equiv.
Q3—OC170/2N1516 or 2N384 transistor
Misc.—piece perforated board, cut to fit tube (see text), flea clips, battery clips, etc.



CB SPECIAL







ADD A TUNE-UP METER

to peak your transmitter's RF output.

By Chet Stephens

BECAUSE a Citizens Band transmitter has limited output to begin with, it is important that every milliwatt of RF power possible be squeezed into the antenna. This can be done only if the transmitter is tuned to the antenna. Take a tip from the more expensive CB rigs. For under $5 and about an hour's work you can build in a tune-up meter which enables you to see directly the effects of your transmitter tuning.

A sample of the power fed into the transmission line is rectified and applied to meter M1. Since the DC fed to the meter is proportional to the RF power output, you know for sure that when the meter peaks the transmitter is tuned.

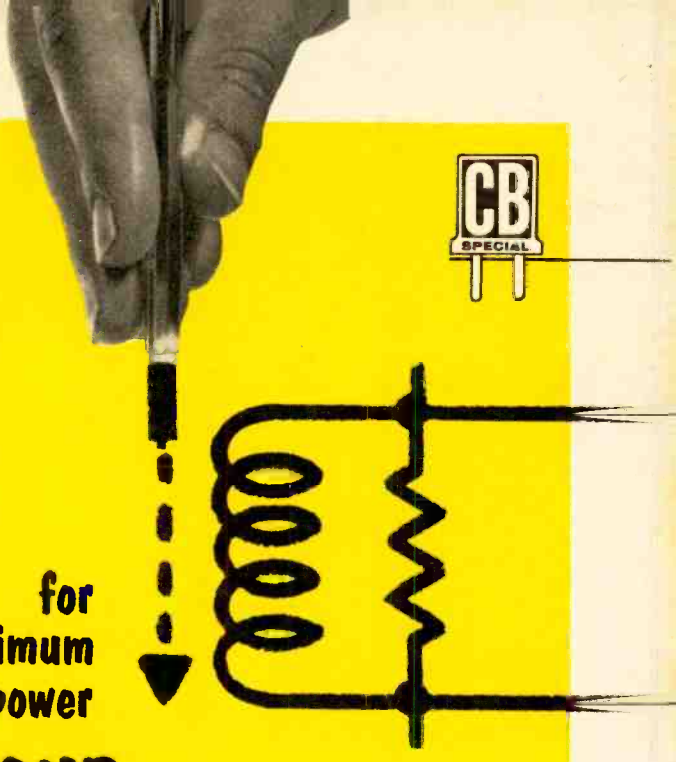
Construction. Transceivers are compact and there isn't much room for extras, so a small, easy-mount meter is used. For the specified meter the mounting hole is cut with a 1½-inch chassis punch.

With R1, D1, C1 and C2 mounted near the antenna jack, the meter leads are not critical as to length or layout. Solder a 3-lug terminal strip (center lug grounded) to the chassis near the jack. Mount all the components and wires to the terminal strip as shown in the pictorial. To protect diode D1 from heat damage, attach an alligator clip to each lead. Then solder in all the components. C3 is connected directly across the meter terminals.

Note: It is possible that a transmission line with a high Standing Wave Radio (SWR) will cause the meter to read off-scale. If this occurs, change R1 to 36,000 ohms. If the meter reads backwards, reverse the leads.

PARTS LIST

C1—3 mmf silver mica capacitor
C2,C3—.005 ceramic disc
R1—18,000 ohm, ½ watt resistor (see text)
D1—1N34A diode
M1—Any 0-1 ma 1½" DC meter movement



for maximum power

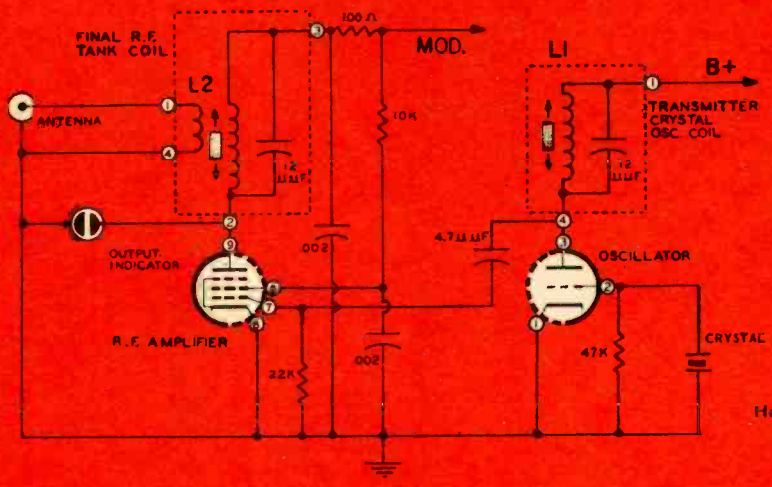
TUNE YOUR TRANSMITTER OUTPUT

By Len Buckwalter, 1W5733

FOR TOP performance, any Citizens Band transceiver must be carefully tuned and adjusted for its individual installation. Who can do this tuning and adjusting? What equipment is needed? What are the critical adjustments and how are they made?

Recent major changes in Federal Communications Commission rules now permit *anyone* to tune the transmitter output portion of a CB transceiver. (Such tuning formerly required a commercial license.) This means a CBer can make periodic adjustments to insure that his transmitter always puts out maximum power. A manufacturer can tune a transceiver's oscillator stage perfectly, but he has no way of knowing the optimum output stage settings for each antenna setup. This will vary with antenna type, location and even the body style of a car in the case of mobiles.

Finding the Adjustment Points. The transmitter's oscillator and radio-frequency (RF) output stages shown in Fig. 1 and 2 are typical of today's CB transceivers. Both oscillator and RF functions usually are served by one dual-section tube, such as a 6AW8 or 6AU8. In the crystal oscillator, the primary frequency-determining element is the crystal, but the most important item insofar as tuning is concerned is coil L1. The inductance of L1 is set by a threaded brass shaft emerging from



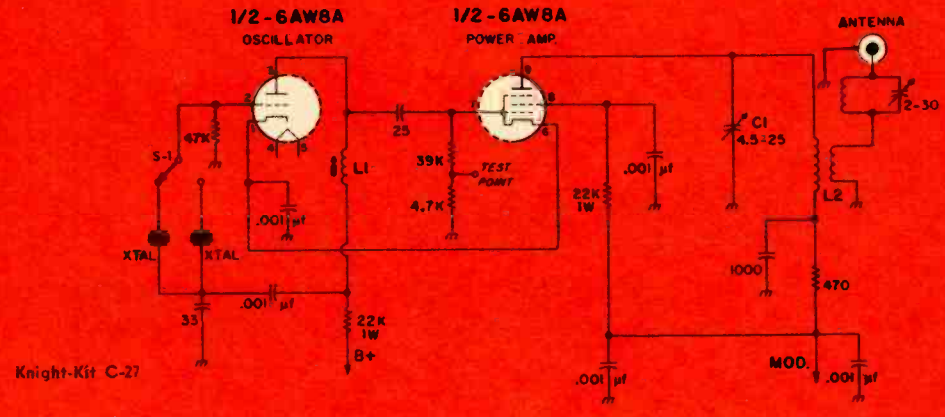
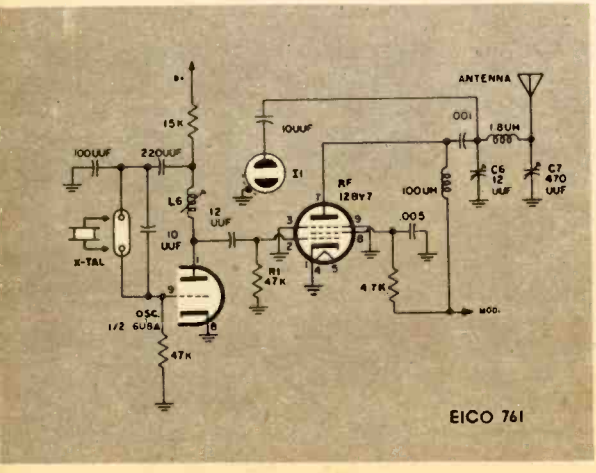


Fig. 1. Partial schematics of two typical oscillator-output stages. Note that in the C-27 a variable capacitor (C1) tunes tank coil L2 instead of the usual slug.

Fig. 2. Capacitors C6 and C7 serve as the tuning elements in an antenna matching pi-network.



the coil form. Tampering with this component can lead to faulty operation and it is the manufacturer's job to preset and seal the oscillator components against tampering.

At the RF amplifier or output stage we find the heart of the problem. The vital component is coil L2 which has considerable influence over how much power is fed to the antenna. It is legally permissible and very much advisable to adjust L2's slug for optimum match between the transmitter and the specific antenna used.

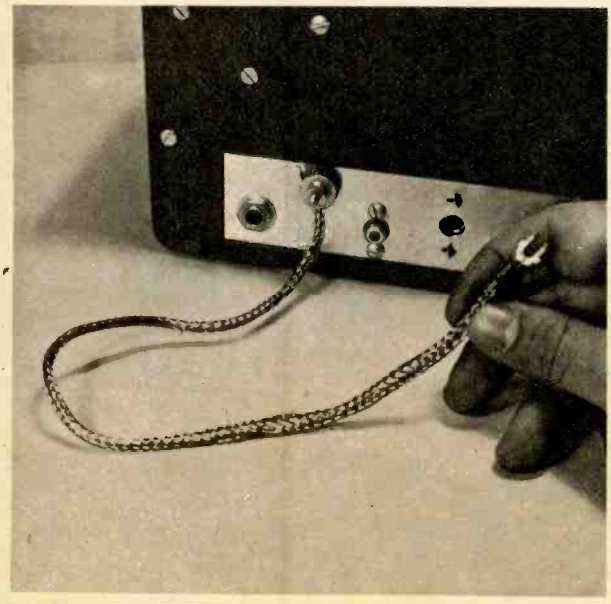
An output circuit variation now coming into favor is the pi-network shown in Fig. 2. Its advantage over the circuits of Fig. 1 is its ability to transfer power into antennas not cut precisely for 27 mc. The pi-network has two tun-

ing adjustments, both variable capacitors. The plate capacitor (C6 in Fig. 2) is always nearest the plate of the tube (in this case, pin 7), and the antenna-loading capacitor (C7) is nearest the antenna side of the output coil.

Meters, tools, etc. Although the adjustment shaft of a transmitter output coil is usually slotted, it's best to use a recessed blade alignment tool (such as the Walsco 2519) as the slot in the soft brass shaft won't take too much abuse. If your rig has a pi-network output, tuning is accomplished with two screw-headed variable capacitors. A standard insulated screwdriver will serve here.

The next item of importance is an RF indicator. It may come as a surprise, but the standard dummy load technique using a #47 bulb as an RF indicator is fine for troubleshooting—but will *not* provide optimum match to an antenna. You need a piece of equipment known as a field-strength meter, wavemeter or radio-field indicator. They all have one important asset: they indicate the RF power *after* it is radiated from the antenna. Thus, you get a direct, although relative reading of transmitter tuning and performance.

Bad grounding causes poor tuning. Connect short heavy wire or braid to water pipe or car chassis.



The value of any indicating device is enhanced if you take a reference reading when the transmitter is known to be operating at maximum efficiency. Then, during routine maintenance at a later date, you have a standard of comparison. It's important that the indicator be the same distance and position relative to the antenna whenever a check reading is taken. For a particularly sensitive indicator try building EI's Transistorized Field Strength Meter (Sept. '61 issue).

Adjusting Transmitter Output. As a starting point, it's a good idea to make sure the transmitter is capable of delivering its rated power. Virtually all CB units have a jack for the insertion of a milliammeter to read the plate current of the final RF tube. Follow the instructions given in your unit's manual, but don't confuse *input* power with *output* power. The FCC allows a maximum power input of 5 watts, and this is what the milliammeter helps to determine. Since the circuit is not 100 percent efficient, output power will always be less than 5 watts, averaging from 3-3.5 watts if the tune-up is carefully performed. This assumes that you are using a standard CB antenna with the manufacturer's coaxial cable (usually 52 ohms).

Ground rules. Optimum tune-up is achieved when the transmitter and antenna are located in their final operating positions. Check the grounds, too. If the rig is installed on a table top, a heavy wire, as short as possible, must be run from the case of the unit to the nearest cold water pipe ground. A long ground wire becomes part of the radiating system and makes tuning critical and unstable.

For an under-dash mobile installation, run a heavy ground lead to the car frame. It is necessary, in most instances, to remove the transceiver case to get to the tuning adjustments. Nevertheless, try to keep all leads short and the transceiver itself as close as possible to the actual mounting position.

It takes two to tune up. Tuning a transmitter output is often a two-man job; one person at the antenna with the

[*Continued on page* 102]

GOOD READING

By John Milder

SCIENCE IN THE CAUSE OF MAN. By Gerard Piel. Alfred A. Knopf, New York. 298 pages. $5

It is doubtful that any review can do this book full justice. On the surface, the volume is a collection of essays and lectures by Mr. Piel, editor and publisher of the Scientific American since 1948. But as interesting and wide-ranging as the essays themselves are, their unifying theme is even more interesting and challenging. For what Mr. Piel is after is a reconciliation of pure science with mankind's other concerns; above all, he pleads for the proper understanding and use of science in a democratic society.

Since science in this century has brought man to the point where he can, with equal ease, destroy himself or build an incredibly full, rich new world, pure science is, he says, a social science, a matter for the concern and understanding of all informed citizens. His plea for world disarmament is underscored by one of the most devastating descriptions—accomplished in less than a paragraph of well-chosen words—of an H-bomb attack ever put on paper.

There is no longer any doubting Mr. Piel's contention that science must become a fully humanistic pursuit. Neither scientists nor any other intelligent citizens can afford to stand aloof while the world drifts toward destruction, governed only by some vague law of inertia. Books like Mr. Piel's—and those of Leo Szilard—deserve an audience made up of everyone who really cares whether our world will survive and move forward.

THE BIRTH OF BROADCASTING. By Asa Briggs. Oxford University Press, New York and London. 415 pages. $10

This is the first of six projected volumes on the history of broadcasting in the United Kingdom. Although the project might seem of fairly limited interest to the American reader, it should draw the attention of at least two groups of readers. For the "radiophile," there is a nostalgic recounting of the magic of the early broadcasting era, when listeners and performers alike felt that they were involved in some kind of sorcery and didn't always believe what they heard. Secondly, in the story of the growth of the British Broadcasting Company there is a good deal to interest anyone who has wondered what American broadcasting would have been like if it had developed non-commercially. Certainly there is ample proof in this volume that *state-sponsored* broadcasting

needn't be *state-controlled*. It's doubtful that the publishers of this volume (and those to come) expect to have a best-seller on their hands, but there is a good deal of interest here for many readers.

Our photo, taken from the book, shows a broadcast from a studio in the early days of broadcasting in Britain. The big box on legs at the right is the microphone. The photo has been retouched heavily.

BASIC RADIO. By Marvin Tepper. John F. Rider, New York. 776 pages. $13.85

Although the six volumes involved here are available separately, they are

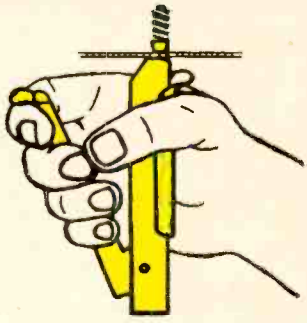
[*Continued on page* 114]

Tech Editor's Test Bench

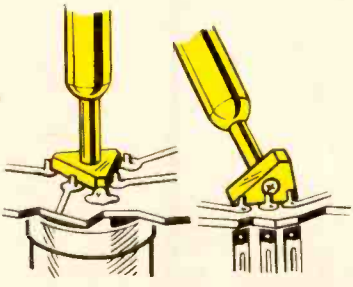
by Larry Klein

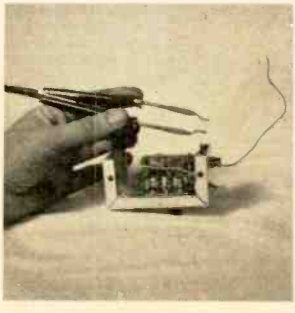
IF YOU'RE an electronic hobbyist, you use tools. Your workbench may include nothing more than a soldering iron, screwdriver and some pliers but if you're like me—to see a new tool is to want it. Along with the junk I've bought in past years, I've found some novel tools which, as the phrase goes, no hobbyist should be without.

Shown on this page are four tools that are unique, not too expensive . . . and they're really useful. Let me introduce them before going on with this discussion. From top to bottom they are a wire-stripper manufactured by the K. Miller Tool Co., an Adel metal-nibbler for cutting holes in chassis and the like, Ungar desoldering tips for a soldering iron and a pair of soldering tweezers made by Oryx of England.



The Strip Act . . . The time is long past when a pocket knife was the recommended tool for stripping wire. All kinds of inventors seemed convinced that it was a better stripper, rather than a mouse trap, that the world wanted. It started with a simple little 39¢ device that screwed on the workbench. It wasn't much for stripping wire but it sure could take a hunk out of your elbow if you leaned on it. Of course you remember the stripper that resembled ice tongs gone electronic. If the insulation was soft, the wire hard and your touch right you just *might* get the job done with the wire intact. Still available is a gripper-stripper that looks like a medieval torture instrument. It grips the wire, slices the insulation and slides it off the wire. To my mind, the gripper-stripper is more of a luxury, assembly-line item. I find that for the hobbyist the Miller stripper is one of the most effective devices yet made. It is equally competent with zip-cord, coax or even 300-ohm flat line. The price is under a dollar. After long-nose and cutting pliers and your soldering gun or iron, this should be the next tool you buy.



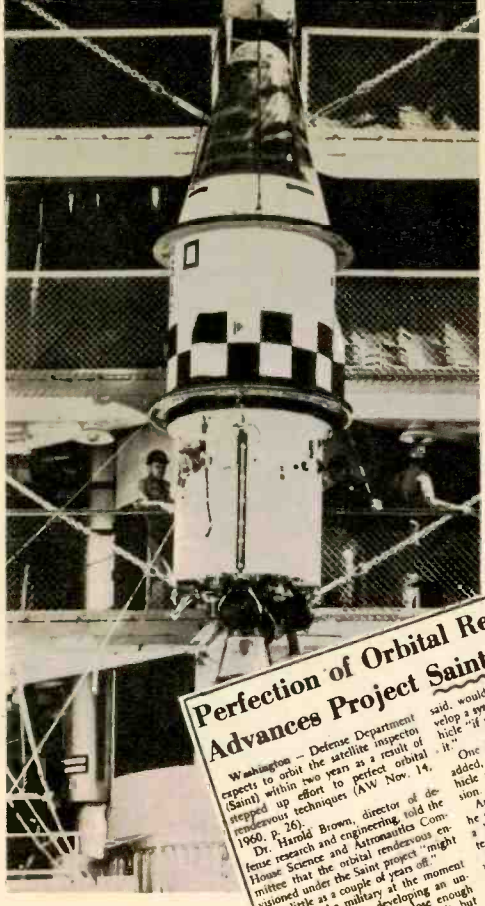


Nibbler Notes . . . In the days before aluminum was common the do-it-yourselfer spent many a noisy evening sawing and chiseling steel chassis. I imagine a lot of projects were AC/DC only because of the effort of cutting out transformer mounting holes. The aluminum chassis makes hole-cutting [*Continued on page* 110]

Once alongside another satellite, a Saint could use its detectors to determine quickly exactly what its neighbor was carrying. This information would be transmitted to earth for a decision on whether to destroy or not. Such will be the Saint's talents that it can tell

[*Continued on page* 112]

Super-secret Saint probably will look much like this Agena satellite vehicle. Trade press and newspaper clippings below show Project Saint has been mentioned occasionally in articles.



Perfection of Orbital Rendezvous Advances Project Saint Timetable

Washington — Defense Department expects to orbit the satellite inspector (Saint) within two years as a result of stepped up effort to perfect orbital rendezvous techniques (AW Nov. 14, 1960, p. 26).

Dr. Harold Brown, director of defense research and engineering, told the House Science and Astronautics Committee that the orbital rendezvous envisioned under the Saint project "might be as little as a couple of years off."

He said the military at the moment is concentrating on developing an unmanned satellite to orbit close enough to another satellite to identify it but

said, would be used to design and develop a system for capturing a target vehicle "if you were within say a mile of it."

One possible way to do this, Row added, is to home in on the target vehicle and then reach it under p sion.

Another method now being he said, is to hook onto it a line over it—much like techniques used by third Asked how much w like to see invested, rendezvous work, re answered $8 millio million requ

over
Au
listic Missile Division for de- Hal-
velopment.

As of now there is no hard- ware ready, even for test pur- poses. The Radio Corp. of America has been given the contract to build the final stage vehicle and the inspec- tion payload.

The system is called "Saint." When the program was set up the letters stood for the words "satellite inspection tech- nique." However, the Ballistics Missile Division now calls it the "Satellite Inspection Sys- tem."

For Inspection Only.

The vehicle would be used only for inspection and would have no "kill" capability, al- though that probably would come later in other vehicles. The Air Force believes it may be possible to bring an inspec- tion satellite to within 100 feet of a known satellite. The Saint vehicle, in the test p be launched

Atlas with Midas II satellite, which uses same test bed as Saint, lifts off at Cape Canaveral.

(possibly) electronic fire-power controls.

One of Saint's most difficult jobs would involve maneuvering into the right position. It could be launched near a suspicious spaceship, but then would be on its own. Best guess as to what would happen next is that the Saint would come in above and just ahead of the second satellite, then decelerate with retrorockets until it was within a few feet.

The problems involved in the rendezvous technique may be solved sooner than expected because of a new Project Mercury research program wherein two-man capsules will have the job of getting together in outer space. Data developed in this program will be available for Project Saint, of course.

A Stereo BOOM FOR FM

EI's build-it-yourself adaptor is a popular project.

LAST YEAR when a system of stereophonic broadcasting was approved for FM radio, some doubters wondered whether this multiplex technique would ever get off the ground. But they were silenced in a hurry. Stereo has given both FM and hi-fi a push comparable to the one stereo records provided for the high fidelity market a few years ago.

By the end of 1962 something like 200 of the country's almost-900 FM stations will be carrying at least some stereo programming. Every major population center will enjoy music-in-depth.

Virtually all equipment manufacturers have come out with adaptors for monophonic tuners, and with tuners containing built-in multiplex units. Both makers and dealers were pleasantly surprised by the way equipment sold. Adaptors and multiplex tuners have been carted home almost as fast as they were built and delivered.

EI was the first publication of any type to publish plans for a build-it-yourself adaptor, coming out with the EI Stereo FM Adaptor in our January '62 issue. The project gained wide popularity. In the first two months after publication we learned of more than 200 readers who were building the EI unit, and there were many others we did not hear about, of course.

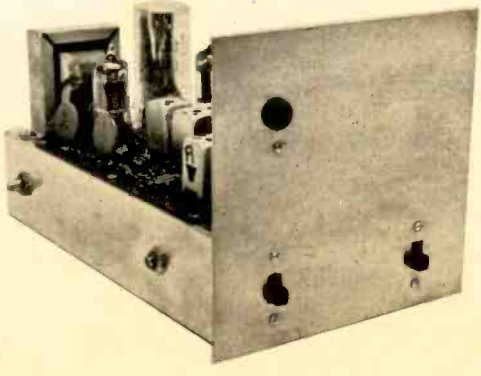
EI's adaptor proved to be a great bargain. Through arrangements with the Audio Workshop, 732 Broadway, New York 3, N. Y., a set of five coils specially aligned for the EI unit, along with a matching pair of diodes, were offered for just $8. (As the stereo market firmed up, the retail price of the package—without special alignment—was set at *more than* $10!) The coils and diodes still are offered by the Audio Workshop but the price (as of March 1, 1962) was increased to $10. It's still quite a bargain for the do-it-yourselfer. A printed circuit board for the EI adaptor is available from the Workshop at a new price of $3.

Back copies of the January issue, containing the adaptor plans (and of the March '62 issue, carrying plans for adding a filter system), are available at 50¢ each from the EI Circulation Dept., Fawcett Building, Greenwich, Conn.

The performance figures for the EI adaptor, we have found, match those of the better commercially-made units and exceed those for many others. Channel separation at 50 and 400 cycles per second is a superb 36 db. At 5,000 cps the separation figure is 28 db and at 10 kc it is 14 db. These figures mean channel A program material at normal listening levels is not audible, or barely so, in channel B.

Distortion in the unit measures less than 0.75%. Spurious 38-kc subcarrier appearing at the output is less than −40 db. Sensitivity also proved better than we expected when we said the unit would work with any FM tuner supplying .5 volts of signal from its multiplex output jack. In later tests, the unit worked well with tuners having an output as low as .15 volts.

EI Stereo FM Adaptor built with printed-circuit board has noise-filter and power switches on its attractive front panel, along with pilot light.



Scrambled-Call DX

Bagging 2 stations with the same call is a neat trick!

By C. M. Stanbury II

THE DISTINGUISHING mark in the world of radio is the system of call signs employed throughout the globe. According to the system, no two stations should have the same call sign. But it happens that GRK is a short-wave transmitter used by the BBC, and GRK also identifies a radio beacon at Grey Air Force Base, Tex. GSH is another BBC station . . . and an FAA weather station at Goshen, Ind. What happened to that call sign system? In a few words, international aeronautics threw a monkey wrench by abandoning call signs in favor of location identifiers for long-wave, VHF and UHF facilities (mainly beacon, control and weather stations). Thus, KROC is easily identified by the people who use it as an FAA control and weather station at Rochester, N. Y. To

The author's QSL cards from the two CBM's verify reception on the same day and at the same hour.

make things doubly confusing, KROC also identifies a broadcast station at Rochester, Minn. Anyway, under the aeronautical system, you get a hint at a station's location along with its call sign.

There are now a dozen or so of these Siamese twins using the same call signs, and that leads to an interesting prospect for DXers—getting QSL cards from *both* stations in matching pairs. If you really want to make it difficult for yourself, log the stations on the same day and at the same hour (or minute). All this nets you some really rare QSL cards.

At the bottom of this page we list nine of the pairs of stations with scrambled calls that can be received best in North America (the KROC's aren't listed).

In order to bring in most aeronautical stations, you'll need a receiver that goes down into the long waves (most likely) or up to the VHF ranges. At night LW signals have a 1,000-mile east-west range and South American beacons come in clearly in the U. S. and Canada.

One of the most likely pairs to start you off is the two CBM's—a broadcaster at Montreal, Que. (940 kc), and an Air Force beacon at Columbus, Miss. (320 kc).

The secret is to zero in on one station so you know exactly where to find it and then go searching for its mate. As a general rule, try for the higher frequencies during daylight and those below 7 mc at night. Once you have a pair hooked, switch back and forth to copy enough program data for a meaningful report. In the case of beacons, note the length of time it takes to transmit the identifier and the period of silence between ID's. Some beacons and utilities require you to prepare your own QSL card for their verification.

SCRAMBLED-CALL DX GUIDE

STATION	LOCATION	FREQ. (kc)	TYPE
CBM	Columbus AFB, Miss.	320	Range
CLT	Charlotte, N.C.	307	Aeradio
CMH	Columbus, Ohio	391	Range
GRF	Gray AFB, Wash.	216	Beacon
GRK	Grey AFB, Tex.	323	Beacon
GSH	Goshen, Ind.	320	Aeradio
HOU	Houston, Tex.	332	Aeradio
HYF	Hayfield Lake, Calif.	329	Beacon
VBG	Vandenburg AFB, Calif.	524	Beacon

STATION	LOCATION	FREQ. (kc)	TYPE
CBM	Montreal, Que.	940	Broadcast
CLT	Havana, Cuba	2760	Marine
CMH	Santiago, Cuba	339 2973	Beacon Aeradio
GRF	BBC, England	12095	Broadcast
GRK	BBC, England	7185	Broadcast
GSH	BBC, England	21470	Broadcast
HOU	David, Panama	1025	Broadcast
HYF	Fort De France, Martinique	314 2966	Beacon Aeradio
VBG	Toronto, Ont.	2182	Marine

THE LISTENER

Notes for the short-wave listener and DXer

By C. M. Stanbury II

TOP STORIES OF 1961 . . . Probably the two outstanding DX stories of 1961 were the issuance of Vostok II QSL's by the Soviet Academy of Sciences (Astrosoviet, Box 88, Moscow) and the demise of Radio Swan. Facilities of the latter have been taken over by a quasi-commercial Miami group, Radio Americas (Box 352, Miami 1). Anti-Castro commentaries (including relays from WRUL) are still prominent, backed by music, news and paying English-language programs.

Among those who heard and verified Cosmonaut Titov in Vostok II, J. Reid Meloy of Rochester, N. Y. achieved extra honors by getting confidential information from the Reds. Mr. Meloy picked up Titov using Morse code on 9019 kc, an unannounced frequency that had been noted previously but not verified by monitors of Vostok I. The 9019 frequency is just 1 kc above the channel used by the Cuban air force. If Titov was in contact with Cuba the ground station was on a different channel because the satellite's carrier remained on throughout its pass.

At any rate, Meloy and those who originally noted this frequency have helped open up new DX territory.

The Lost Cosmonaut . . . Even more spectacular space reception is reported by William Pee, British correspondent for the broadcasting organization which produces and sponsors the program, The World Tomorrow. It is heard around the world on a great variety of stations. Mr. Pee's account, as given on the program, runs as follows:

"One night just before Gagarin's flight, I turned on the wireless and tuned to the space band. First I picked up a signal which I took to be a Russian satellite. The sound was like the usual bleep-bleep, but each tone was slightly longer than usual. The signal was cut and a man's voice began speaking in Russian. The person was agitated. It was obvious he was hysterical. I woke my wife and told her to listen. In my opinion the man we were listening to had gone out of his mind. When the news came of the Gagarin space flight we were puzzled because his flight was a day or two after we heard the signals."

TOP STORY OF '61 was issuance of this QSL card for Vostok II carrying Titov (that's his photo).

This World Tomorrow account received wide publicity, particularly when it was broadcast by WMIE (1140 kc) in Miami, Fla.

While there has been much speculation about a "lost" spaceman who supposedly went up before Gagarin, Mr. Pee's account unfortunately is full of

[*Continued on page* 105]

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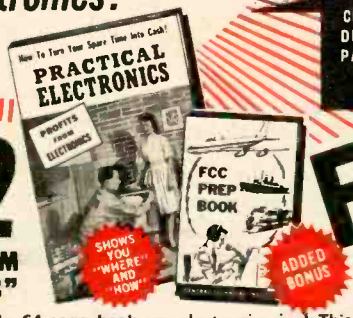

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Superintendent of Communications for the K. C. Southern Railway Company is Central graduate Lawrence D. Fry, with 15 years of railroad communications experience. "Central is a fine school," says Mr. Fry. "I've always recommended it, and have sent several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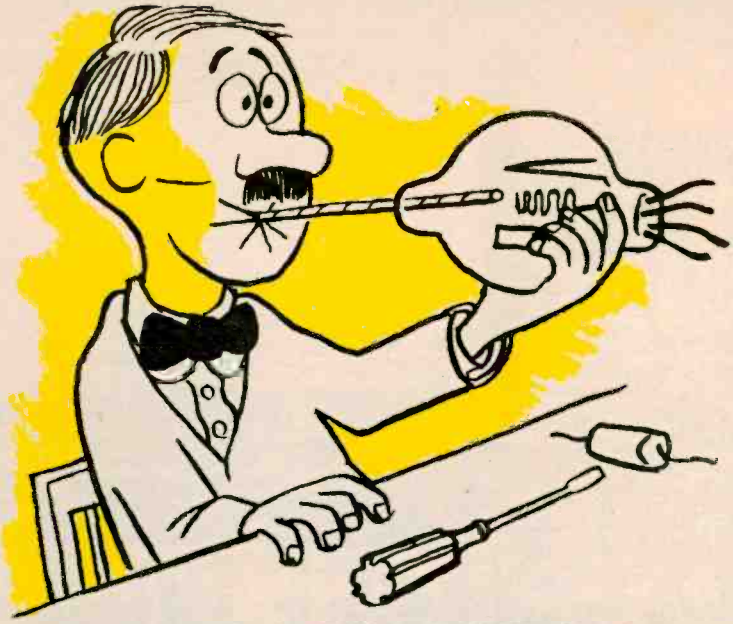


EI's ELECTRICITY Contest

IN THIS ISSUE and the next, EI is publishing the final two winning answers to the question, "What is electricity?" In the following issue will appear the answer given by an authority in the field. As with all other definitions of electricity, neither the expert's nor those of our contest winners are likely to be accepted universally. But the contest has stirred our readers to interesting and constructive thought on the subject.

What is Electricity ?

" Electricity may be considered a medium by which energy can be conveyed from one location to another. The energy being conveyed is that of free electrons, which have broken away from their atoms, after reaching a certain energy level.

Robert W. Johanson
1418 N. Astor
Milwaukee 2, Wisconsin

The Ham Shack

By Robert Hertzberg, W2DJJ

HAM GROUPS . . . Amateur radio has expanded to such an extent that it now supports several varied special-interest and honorary organizations within the framework of the American Radio Relay League. Here are some of the *active* groups worth knowing about:

Quarter Century Wireless Association. Open to amateurs who have held tickets continuously for 25 years or more. Nine chapters scattered around the country. Membership up to 3,000 and still growing. Initiation fee $3, annual dues $2. Secretary is Ralph Barber, W2ZM, 244 Forest Ave., Locust Valley, L. I., N. Y.

Single Side Band Amateur Radio Association. For anyone interested in SSB.

Has gone from 20 members in 1951 to about 1,300 in 1962. $3 annual fee includes excellent bi-monthly bulletin. Address: 12 Elm St., Lynbrook, L. I., N. Y.

Antique Wireless Association. With ham radio now celebrating its golden anniversary, old wireless equipment is becoming valuable to collectors. The Old Timer's Bulletin, published four times a year, is heartwarmingly nostalgic. $3 a year. Write to Bruce Kelley, W2ICE, Main St., Holcomb, N. Y.

The QCWA celebrated its 15th anniversary and the 50th anniversary of ham radio by adopting a handsome gold and blue banner for display at dinner meetings. Our photo shows John DiBlasi, W2FX (left), president of the organization, and Ralph Barber, W2ZM, secretary, with the banner at a recent QCWA get-together.

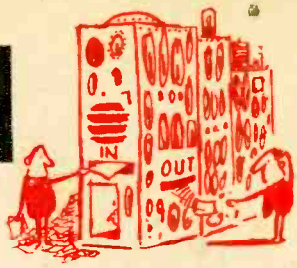
New Qth . . . Butch Griswold, who achieved international fame as KØDWC (see HIGH FLYING HAM, November '61 EI), has moved East and is now K3RBA. To be formal about it, address him as Lieutenant General Francis H. Griswold, USAF, Commandant, The National War College, Washington 25, D. C.

Doggy Dog . . . Mention of K2HAM in a recent HAM SHACK moved K9AMC to call my attention to what is probably the most exclusive ham identification of all, K9DOG. It belongs to Charlie Saulka of Chicago. I wonder if he answers with a growl or just woof-woof?

Nothing for Nothing . . . Multi-element beams for the 2-meter band are so small, light and inexpensive and provide so much gain that some hams are going overboard on them. Stacking beam above beam is about the only way of making a small transmitter work like a big one but there is a hidden price to pay: the more elaborate the antenna, the sharper the signal in the aimed direction and the weaker it becomes in all other directions. This often means that while you can work station A 25 miles away when your beam is pointed that way, you can't raise station B a fraction of a mile in the opposite direction. For local rag-chewing and net operation, it is helpful to add a ground plane.

[*Continued on page* 104]

ELECTRONIC BRAIN



Have a question on electronics? Send it to Electronic Brain, Electronics Illustrated, 67 West 44th St., New York 36, N. Y. Enclose a stamped, self-addressed envelope for prompt reply.

Coil Inductance

Can a 2.5 millihenry RF choke be reduced to 1 millihenry by cutting it half? (National R-50, 4 sections.) If not, how could I reduce its inductance to 1 mh?

D. C. Fleming
Columbia, Mississippi

The inductance of a coil varies directly as the square of the number of turns. For example, if a coil of N turns has an inductance of, say, 3 millihenrys, then a coil of 2N turns (twice as many) would have an inductance of 9 millihenrys. Thus, you cannot reduce a 2.5 mh coil to 1.0 mh by cutting it in half.

If you remove one of the four banks of turns, the inductance would decrease from 2.5 mh to 1.44 mh. To bring it down to 1.0 mh, you would then have to remove about ⅛ of the next bank. Of course, the best way to carry the operation through would be to take periodic readings of inductance as you remove turns, using a bridge or a Q-meter.

6-12 Volt Auto Radio Conversion

Is there a practical method by which a 6 volt car radio can be used with a 12 volt car battery without tapping to the center of the battery?

James M. Houck
Greencastle, Indiana

Electronic and auto parts supply stores stock a power resistor that is intended for this application.

The average 6 v. automobile radio of the vibrator type draws from 6 to 8 amperes depending upon the number of vacuum tubes it has. Say your radio draws 6 amperes; then, to obtain a voltage drop of 6.3 volts (from a nominal 12.6 volts to 6.3 volts), the resistance necessary would be given by:

$R = E/I = 6.3/6 = 1.05$ ohms (approximately)

or for an 8 ampere radio

$R = 6.3/8 = 0.8$ ohms (approx.)

Since power may be found from $P = E^2/R$, then in the first case:

$P = (6.3)^2/1.05 = 39.7/1.05 =$ *40 watts*

And in the second case

$P = (6.3)^2/0.8 = 49.6$ watts

If you cared to experiment, you could easily cut a low resistance like either of these from an old conical heating coil, possibly two or three inches of length measured to the correct resistance, and wrap it in a layer of sheet asbestos. We feel that we should emphasize, however, that any resistive method of cutting down voltage is a power-waster. In the case of the 6 volt auto radio, the resistor uses as much power as the radio itself.

Beatnik Oscillator

While listening on about 47 mc on a home-made regenerative receiver, I tuned my grid-dip meter to about the same frequency. I then heard regular broadcast stations. How come?

John Crawford
Chicago, Ill.

Your grid-dip meter turned your regenerative receiver into a temporary superheterodyne. Since a grid-dip meter is an oscillator and can radiate a signal over a few feet, suppose that it were producing a frequency of 48 mc while your receiver was tuned to 47 mc. If your receiver input stage has some nonlinearity—as no doubt it has—it can act as a mixer. Thus, 48 mc from the grid-dip meter heterodyning a broadcast station of 1,000 kc (1 mc) would give rise to a difference frequency of 47 mc containing the original modulation of the broadcast station. Your receiver would then reproduce this in the same manner as any other signal it is tuned to.

The conversion efficiency in this kind of transfer is bound to be very low. This is the reason why this effect is not often noticed.

HI-FI RECORD GUIDE

by Warren DeMotte

I DON'T KNOW what they fed the orchestra of the Royal Opera House, Covent Garden, and conductor Georg Solti, but they tear through their recording of Gaite Parisienne (see cut below) like a pride of lions. The gay melodies of this popular ballet never had it so brilliant, in playing or in electronic reproduction. It's somewhat bigger than life but breathlessly exhilarating. To fill up the disc, the Ballet Music from Faust is trotted out. Wrong word! Solti whips it into a gallop, and who would have thought there was so much life left in the familiar old tunes?

A few months ago, Angel released a splendid recording of Francis Poulenc's Concerto for Organ, Strings and Timpani. Now RCA Victor presents the piece done by the Boston Symphony Orchestra and organist Berj Zamkochian under the baton of Charles Munch. This is a performance of intense, tightly-knit music and a hi-fi man's delight. The deep, deep growls of the organ's low notes are guaranteed to vibrate your floorboards—if your speaker system can reproduce them.

Less sensational sound, but even more impressive for its natural spaciousness, is offered in the new Ansermet recording of Manuel de Falla's ballet, The Three-Cornered Hat. Listening to it is like sitting in a good seat in an acoustically fine concert hall. When the timpani are struck at the opening of the piece, and the brass and castanets follow, the instrumental individuality is startling in its clarity, yet as the music progresses it is obvious that each instrument is in perfect perspective with relation to the orchestral mass. This is superior engineering and it is mighty effective when heard on a good stereo system.

The electronic engineers have their fun with something called the Electro-Sonic Orchestra under the direction of Dick Jacobs. The ensemble consists of violins, violas, cello, guitar, piano, organ, drum and two or three other instruments, but they don't sound like you'd expect them to because no open microphones were used in making the recording. Each instrument had its own contact mike (here called a transducer) with its own volume control and all of them were fed into a mixing unit before taping.

By means of the many controls, the sound of an individual instrument could be intensified, diminished, blended with its fellow instruments, made to wander from speaker to speaker or even to turn somersaults. It's weird but fascinating to hear the melodious strains of Itsy Bitsy Teenie Weenie Yellow Polkadot Bikini, Volare and Mack the Knife knifing through the sonic concoctions dreamed up by these imaginative sound chefs.

Easier on the ears but essentially no less a test for timbre discrimination is the recording of The Chordettes singing 12 hit songs from recent movies, headed by Never on Sunday. The four girls are joined by an orchestra conducted by Archie Bleyer and their presentations are delightful. It is a shame that the name of the skillful arranger is nowhere mentioned. [*Continued on page* 112]

Continued from page 29

feature articles and construction projects.

Citizens Band radio, now approaching its fourth birthday, has made notable advances in the last year or so. The band in a good many areas of the country, at least, has been cleaned up and now is used more and more for the purposes for which it was intended.

This is due partly to the aging process. A good many of those chatterboxes who once inhabited CB have grown up with the service and have gained respect for the rules, or perhaps they have tired of their new toy and are now enjoying other playthings.

In the early days, when the FCC seemed to be looking the other way, many CBers found immense pleasure in just chatting about their equipment. But that subject now is about talked out. Standard transceivers and antennas can be discussed only so long, and then the subject is exhausted. If someone tells you he has an HE-15, a CB-3, a GW-10 or a G-15 you're likely to know all about the rig and any discussion is pointless.

Many violations used to be due to pure ignorance. New licensees often did not understand the rules of Part 19, or made no effort to learn them. Then there was the business of experimenting to see just how far you could go. The FCC's answer, though long in coming, left no one in doubt. A flock of new rules, citations and other missives mailed directly to CBers had the effect of making everyone wary, and of quieting the band.

CB today could be said to be in the good graces of the FCC. Though anyone in Washington is quick to tell you that there are still too many problems and too many violations, federal officials generally are pleased at the progress that has been made and they have great hopes for the future.

The FCC certainly recognizes that it did sire this infant called CB and, though the child may be a bit of a brat, it cannot be disowned and no one particularly wants to bar the door. They just wish the kid would take on some manners.

Not long ago we had an interesting talk at the FCC offices in Washington with the two men most responsible for regulation of the Citizens Band: Curtis B. Plummer, young chief of the Safety and Special Radio Services Bureau, and Ivan H. Loucks, chief of the Land Transportation Division. Mr. Loucks is the man who comes directly to grips with CB. You could call him chief administrator of the service.

What does Mr. Loucks think of the Citizens Band and the way things are going on the band?

"CB has proved to be a useful service," says the chief. "We have problems in enforcing the rules, sure. But this is only part of the FCC's overall job of enforcement. We have a good many other services to worry about, too. By and large, we do catch the worst cases on the Citizens Band, and we do write citations."

And then Mr. Loucks, talking of the future of CB, volunteered a surprising opinion.

"The FCC *wants* to see the organization of Citizens Band clubs," he said. "I'm talking about business-type clubs, not the purely social ones, which we oppose. But good CB clubs can organize in such a manner that they can help us enforce the rules through self-policing programs.

"That's why we support clubs. It's a matter of self-policing, and members can make available information to each other. Pass the word, so to speak. There can be mutual assistance for solving QRM problems. Clubs could do a great job."

Mr. Loucks went on to say that reports of violations from individuals necessarily get little attention. However, when a club with a self-policing program makes such a report, things happen.

"For instance," he said, "if a club reported a man getting drunk on Saturday night and carrying on illegally on the air, we'd take positive action."

As a general rule, CB licenses are issued to individuals and businesses. But if any club acquires a clubhouse

and has need for a station at that location, it will have no trouble getting a license, Mr. Loucks made clear.

So that is the FCC's official stand on CB clubs. EI gives its support to the formation of clubs, and elsewhere in this issue we tell you how to form your own club and how to make it worthwhile.

—*R.G.B.*

Four CB Antennas

Continued from page 54

tom end of the radiator rod (Fig. 2-B). Thread this wire through the plug, slide the vertical radiator into the top end of the plug and use epoxy cement to hold it in place. Then cut the wire short and solder it to the center terminal (Fig. 2-C) of coax socket J1. Use small brass wood screws to mount J1 to the bottom of the plug, fitting it into the ⅝" well. Connect a 5½" length of bare stranded wire to one of J1's mounting screws (Fig. 2-D). Install the bottom skirt plug as shown in Fig. 2. Before installing the top (nose) plug and male coax connector, run the coax cable through the rotator mounting pipe, the just-installed bottom plug and the skirt. Then solder the connector on the cable and plug this connector into J1 and tighten it securely. Next, fit the top plug into the top of the skirt dressing the bare wire between the side of the plug and the wall of the tubing as in Fig. 2-D. Fasten the plug with three ⅝" wood screws through ⅛" holes drilled in the skirt as in Fig. 2. Use vinyl tape liberally around the top of the nose plug for waterproofing.

The *director* and *reflector* are made from 10′ lengths of ½" EMT thinwall aluminum tubing. For the *director,* use extension fittings and add a 3′ 5" piece of ½" tubing to each end of a 10′ length. For the *reflector,* add a 4′ 3" piece to each end of a 10′ section.

The boom is a 10′ length of 1¼" EMT tubing. Drill ¼" holes through ends of the boom to accept the U-bolt clamps for the *reflector, director* and the wood clamp plate for the driven element as shown.

Make the wood clamp plate of ¾" exterior grade plywood and drill the holes as in Fig. 2. Give the wood plate two coats of spar varnish for waterproofing. Mount the reflector and director on the same side of the boom as the driven element for best balance.

After the antenna is assembled, drill $\frac{3}{16}$" holes in the director and reflector and ¼" holes in the boom to accept the plastic clothesline struts. (Avoid changing antenna element spacing with these struts since it is critical.) Also drill ⅛" holes near the top of the *vertical* rod, the *reflector* and *director,* and thread 20-pound test monofilament nylon fishline through these holes (making a knot at each element) to reduce element vibration and changes in spacing. Use spaghetti tubing through the holes to keep the nylon line from chafing.

Standard TV antenna hardware with 2" U-bolts may be used for mounting. When buying the rotator, make sure to get one which can accommodate the 1¼" pipe. I used the standard Channel Master automatic TV rotator with built-in 2" U-bolts.

Attach the rotator to the mast first. Then mount a stub mast on your chimney, a tripod, etc. Use a good length (3 feet or so) of sturdy cast iron pipe for the mast and no guying will be needed. Remember that the highest point on the antenna must be not more than 20 feet above an existing structure. The antenna is 18 feet. Therefore, the mast can only go 2 feet above the chimney or whatever it is mounted on.

And there you have it—a high-gain vertical beam antenna guaranteed to give your signals the long reach you want.

PARTS LIST: CB BEAM

10 feet—2" EMT Thinwall aluminum tubing
40 feet—½" EMT Thinwall aluminum tubing
10 feet—1¼" EMT Thinwall aluminum tubing
4—extension fittings for ½" EMT thinwall tubing. Available at any large electrical supply house
8 feet—⅜" solid aluminum rod (Reynolds "Do-it-yourself" aluminum Item 3A)
4 feet—⅜" solid aluminum rod (Reynolds "Do-it-yourself" aluminum Item 3)
1—coaxial cable socket receptacle (Amphenol 83-1R)
1—coaxial cable plug (Amphenol 83-1SP)
1—coaxial cable plug adapter for RG 58U (Amphenol 83-168)
Length of RG 58U cable from antenna to CB rig
1—set of heavy duty TV antenna chimney mounts (or other suitable mounting hardware)
2—1" U-bolt assemblies
2—2½" U-bolt assemblies (2" U-bolts may be used)
20 feet—plastic clothesline
20 feet—20 lb. test (or higher) monofilm nylon fishline
18 inches—iron pipe, 1¼" OD (for bottom plug of skirt)
Total cost of parts: about $20

Tune Your Transmitter Output

Continued from page 83

RF indicator in hand, the other adjusting the transmitter. When shouting won't serve, some other means of communication is necessary. If an intercom or equivalent isn't available, a serviceable signalling system is easily devised with a piece of cord strung out between the two points. The fellow on the roof yanks on the cord once or twice, depending on the ups and downs of the FS meter.

In a mobile installation, try placing the indicator on the rear window shelf of the car. This will locate it within a foot or so from the whip antenna—and can make tuning a one-man job since the meter will be visible from the front seat. Meters such as the EI unit mentioned earlier are sensitive enough to provide readings while sitting atop the dashboard. Equipped with a magnetic base, they will provide constant monitoring of transmitter power.

In any transmitter tuning job, keep the FS meter the maximum distance away from the antenna. This keeps interaction between the antenna and the indicator to a minimum. It's a good idea also to hold the FS meter at arm's length to prevent body capacity from upsetting the readings.

Note that maximum energy occurs at the base of the mobile whip or ground plane antenna. On half-wave (17-odd feet long) antennas, the power will be concentrated at the mid-point, where the feedline enters. Take care that you don't burn out your FS meter by getting too close to the antenna when tuning.

Peaking the Pi. As mentioned earlier, the transceiver with the pi-network (Fig. 2) requires two adjustments and there is a definite order in which they should be made. Start by setting capacitor C6 for a peak indication on the RF indicator. Then adjust antenna capacitor C7 for a *slight* increase in output. Go back to C6 and repeat the peaking adjustment.

You will come to a point at which the antenna capacitor produces no further increase in output (the antenna elements are fully loaded). When this happens, the last step *always* should be to peak reading with the plate capacitor.

Finally, adjust the 54-megacycle trap provided by most manufacturers to reduce harmonic interference to TV. The second harmonic energy of a CB transmitter (on 54 mc) is not very strong, but might disrupt reception on Channel 2. Using a TV receiver as an indicator, the trap is adjusted for minimum disturbance to the picture while someone talks into the CB microphone.

CB Corner

Continued from page 51

But this should be only an occasional, incidental activity.

Use CB radio in *any* manner if life or property are in danger.

On the subject of clubs, Gilligan says these organizations should take on the responsibility of enlightening their members on rules and regulations and institute programs of self-policing.

Still on the subject of policing, Gilligan turned to those indignant CBers who spot violations on the air and tape-record them as evidence to present to the FCC (or somebody). Monitoring and self-policing are dandy, says Gilligan, but when you record CB, ham and other such transmissions and divulge the contents to *any* third party, the FCC included, you are violating the secrecy provisions of the Communications Act. This can easily send you up the river, while the errant CBer you're copping on normally would just get a license suspension. So forget the idea of recording violations!

In the next issue we'll take a look at one of Paul Gilligan's most interesting official activities—the mobile monitoring of the Citizens Band.

A Safe Mobile Mike

Continued from page 69

microphone cable through the tubing and cap. The microphone element is set in the cap with plastic cement. Connect microphone connector PL2 to the free

end of the cable and the boom is completed. For greater comfort, the headband can be lined with a strip of felt.

The Switchbox. Push-to-talk switch SW1 mounts in a Minibox which has a large rubber suction cup (available from auto supply stores) attached to its cover. For the usual three-wire control circuits, wire SW1 as shown. For four-wire or special control circuits, section B (shown in parallel with section A) can be used separately.

Operation. Put on the boom and adjust the headband to a comfortable position. Adjust the swivel so the microphone is about one inch under your lips and tighten the swivel nut. With the microphone in this position you talk across it, avoiding sharp pops and hisses. It is also out of the line of vision.

Connect the switchbox to the microphone and transmitter.

Tiny Talkie

Continued from page 50

percentage and quality is maintained.

High sensitivity and stable regeneration are achieved by using the choke-loaded emitter of Q2 as both the antenna input and the oscillator of the super-regen circuit. The rate of oscillation is controlled by R3 which can be set for maximum sensitivity.

The demodulated RF signal appears across collector-load resistor R5 and is amplified by Q3. Best listening quality is obtained with a set of double earphones of about 2,000 ohms impedance.

CERTIFICATE OF COMPLIANCE WITH FEDERAL COMMUNICATIONS COMMISSION REGULATIONS, PART 15, PARAGRAPH 205

ELECTRONICS ILLUSTRATED certifies that this low-power transmitting device can be expected to comply with the requirements of Paragraph 15.205 of the FCC Regulations under the following conditions:

(a) When this device is assembled according to the diagrams and instructions published by this magazine.

(b) When used for the purpose and in the manner indicated in the instructions.

(c) When operated on a frequency between 26.97 and 27.27 megacycles and using an antenna limited to a single element not more than 5 feet long.

Fred H. Maynard Applications Engineer

ELECTRONICS ILLUSTRATED, New York, N. Y.

dated: November 1, 1961

I hereby certify that I have assembled and adjusted this device in strict accordance with the above.

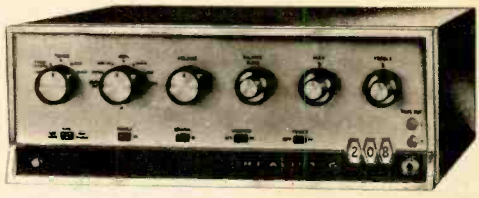
Owner's signature.....

Date.....

Marketplace

Continued from page 24

And In This Corner . . . Eighteen transistors that pack a 50-watt audio output punch put the Realistic TA-208 integrated stereo amplifier in the heavy-



weight class. The unit has a full array of controls for inputs and outputs. The kit runs about $140, the assembled unit, $190. Radio Shack Corp., 730 Commonwealth Ave., Boston 17, Mass.

Wireless Intercom . . . The AC power line in the home or office is the transmission medium for this new Heathkit intercom. Just plug in two or more units and you're in business. The outfit is

great for baby-sitting and temporary hookups, as well as for permanent installations in offices or the home. The kit has an all-transistor circuit, a self-contained power supply, squelch circuit for full quieting and pilot lights indicating standby or talk. The model GD-51 sells for $23. Heath, Benton Harbor, Mich.

Marketplace

Wall-to-Wall Short Wave . . . The National NC-105 is a ham-SWL receiver with a tuner output jack that enables you to pipe the audio through any external amplifier and speaker system to achieve plaster-cracking sound. The set

also has a 5-inch built-in speaker. It offers continuous coverage from 550 kc through 30 mc in four bands, has bandspread tuning, S-meter, noise limiter and selectivity control. The NC-105 sells for about $120 in a steel cabinet. A walnut enclosure costs extra. National Radio Co., Melrose 76, Mass.

Who's Got The Button? . . . Yardney Electric has introduced a unique hermetically-sealed, rechargeable silver-cadmium storage battery not much bigger than a button on your overcoat. It has a flat voltage discharge characteristic, low internal resistance and the

ability to hold up for thousands of charge/discharge cycles. The battery should excite the imagination of designers of all kinds of miniature and cordless electronic gear from pocket transceivers to portable TV sets. Yardney Electric Corp., New York 13.

Ham Shack

Continued from page 99

Grandfather Ticket . . . Occasionally you hear mention of an *Amateur Extra Class* license. The word extra implies that the ticket carries operating privileges beyond those of the General Class, but that is not true. This class was set up some years ago primarily to honor pre-World War I hams and is issued to them without examination if they can prove they held amateur licenses during or prior to April 1917.

Younger hams who have been Generals for at least two years can obtain the Extra Class document by taking a special FCC examination. This includes a code test at 20 words a minute and a written test on advanced radio theory.

Portable vs Mobile . . . Many hams seem not to make a distinction between these two types of operation. If you merely transport your equipment from your home to a summer camp, bungalow, ranch, etc., without hooking it up in the car, the temporary new installation is portable. In identifying yourself on the air you say, "This is W2DUX portable 3," on phone or, "W2DUX/3," on CW, the last number to show the call area of the temporary location. If you hook up the rig in the car and use it along the way it becomes mobile and you add that word to your call.

Incidentally, mobile means not only an automobile, but takes in anything that moves, including human beings and animals. There are many mobiles in boats and private planes, some on motorcycles and bicycles, and even a few on horseback.

Add An S-Meter

Continued from page 75

where in this issue, the S-M will give you the equipment necessary for keeping your CB receiver tuned to peak performance. Consult your manual for the manufacturer's recommended alignment procedure.

- Dial Calibration. To adjust your

tuning dial, set it to the frequency of the CB Signal Generator. Now adjust receiver oscillator trimmer and/or coil slug for maximum S reading. The dial will now be in exact calibration. By inserting your transmit crystals in the Generator you can check the calibration across the dial.

● IF Alignment. When the dial is accurately calibrated you can then use the received signal for IF alignment. Set the S-M sensitivity control to maximum and move the generator away from the transceiver until the S-M reads between S-3 and S-7. If you do not have a CBSG use a received signal of known accuracy. Starting with the last IF transformer, the one feeding the detector, peak the IF's for maximum S reading. Next, tune in a signal in the center of the band (channels 9-12) and peak the RF coils for maximum S reading.

● Antenna Tuning. Another good use for the S-M is in assisting the tuning of another station's antenna, particularly beams.

Theory. Meter movement M1 is connected as the indicator of a four-arm (Wheatstone) bridge. One arm of the bridge is V1. To balance the bridge for a no-signal condition, V1's bias is set with R5 so that V1's DC resistance is in the same ratio to R1 as R4 is to R2. When a received signal develops negative AVC voltage, V1's DC resistance increases, thus unbalancing the bridge and causing current to flow through the meter. The very high input impedance of V1 eliminates any possibility of loading down the AVC Line.

Servicing Made Easy

Continued from page 73

check good, turn on the transceiver and feed the audio signal to the input grid (Y) of V1. If the output stage is operating properly, a clean signal will be heard in the speaker. If the tone is distorted, disconnect the Y end of C1 and check for leakage. The best way to do this is to connect the leads of your VOM between the free end of C1 and ground. With the set on, the presence of positive voltage at C1 indicates leakage and that replacement is in order. A positive voltage at Y (with C1 still disconnected) may indicate a gassy V1. Check this by replacing V1 with a good tube.

Next, move the AF signal lead to the plate of V2 (W). If the tone is not heard, coupling capacitor C1 probably is open. Trace the signal back to the grid of V2 and other audio amplifiers which may precede V2. Failure of the tone to be heard from any grid indicates the defective stage. The audio section can be checked right back to the volume control and detector. Resistance and voltage measurements will pin-point the defective component.

No Reception; Modulation Okay. Since the modulation check indicated the audio section is working, the trouble must be *before* the audio amplifier.

Set your RF generator to provide a modulated RF signal at the IF frequency indicated in the transceiver manual. Connect the generator's RF ground lead to the transceiver chassis and the RF hot lead in series with a .001 mf, high-voltage (500 or above) disc capacitor to the grid (X) of the last IF amplifier tube (Fig. 4). With the generator's RF output control and the transceiver's volume control both set to maximum, a loud tone in the speaker indicates proper operation of the IF stage. If your transceiver has two IF stages perform the same test on the first IF amplifier, but reduce the RF input signal to prevent overloading the stage. The IF section can be checked as far back as the grid (Y) of the mixer tube by the same technique.

To test the mixer, connect the generator's RF lead to Y through a 5 mmf capacitor.

If the tone is heard, even though reduced in volume, it means that the IF strip is okay.

Next month we'll continue with this series, tackling the receiver oscillator section.

The Listener

Continued from page 92

flaws. Besides being indefinite about the date, Mr. Pee describes the satellite's

signal as a bleep-bleep, and Russia has not used that type of transmission since the first Sputniks. The signals from the Vostoks and the experimental spaceships immediately preceding them resembled a click with periods of a superimposed tone (A2) lasting much longer than a single bleep. The Soviets also use separate channels for voice (or code) transmissions and when not in use, there is no signal at all.

Language Problem . . . The great barrier for DXers who sample foreign utility stations is language. Many foreign broadcasters have English programs but marine stations, police, etc., invariably communicate in their own tongue. These stations can be reported and verified but their actual operations remain a mystery for many because of the language problem.

One channel which overcomes this difficulty is the 2752 kc ship-to-ship frequency for the Gulf of Mexico, the Caribbean and Western South America. Vessels are of Central American or West Indian registry and all use English. This is the place to listen for inside news on hurricanes and other disasters, pro- and anti-Castro doings and other off-trail stories. Such ships as the Malinda, Nespas and KirkDeal were the first news sources for the Belize hurricane disaster late last year (the British Honduras Broadcasting System, 830 and 3300 kc, was destroyed).

Power here averages 75 watts or less but on what is normally a clear channel reception is fair throughout North America. Then 2752 kc has its share of DX, too. Stake Bay Radio on Cayman Brac, 175 miles west of Jamaica, is a real catch because the Caymans are without a broadcast station and the aeradio at Grand Cayman is seldom heard at a distance. Best time to try for Stake Bay (or any other transmitter on this channel) is shortly after sunset.

Stake Bay is operated by R. B. Kirkconnell & Bro., with C. G. Kirkconnell as officer-in-charge. Unlike many operators on this frequency, he verifies readily. This same firm also operates small motor vessels bearing names beginning with Kirk.

Easy Time Conversion

THE fact that most international broadcasting stations and certain other communications media use Greenwich Mean Time (GMT) gives them a common time reference and helps keep things running smoothly on the airwaves. But it's not particularly helpful to some Short-Wave Listener out in the boondocks (or on Park Avenue) who merely wants to know the time *by his clock* when a certain program from Berlin or Melbourne or Peking comes on the air. Too often the SWLer depends on finger-counting or tries to figure out in his head what time it is in Greenwich, England, when his own clock reads—say, 7 o'clock in the evening. The handy chart we present here will make such calculations easy for DXers anywhere in the United States and the more populous parts of Canada. And it works either way—GMT-to-local time or vise versa. Just add an hour during Daylight Saving Time.—*Ken Boord*

EI TIME CONVERSION CHART

GMT	EST	CST	MST	PST
0000	1900	1800	1700	1600
0100	2000	1900	1800	1700
0200	2100	2000	1900	1800
0300	2200	2100	2000	1900
0400	2300	2200	2100	2000
0500	0000	2300	2200	2100
0600	0100	0000	2300	2200
0700	0200	0100	0000	2300
0800	0300	0200	0100	0000
0900	0400	0300	0200	0100
1000	0500	0400	0300	0200
1100	0600	0500	0400	0300
1200	0700	0600	0500	0400
1300	0800	0700	0600	0500
1400	0900	0800	0700	0600
1500	1000	0900	0800	0700
1600	1100	1000	0900	0800
1700	1200	1100	1000	0900
1800	1300	1200	1100	1000
1900	1400	1300	1200	1100
2000	1500	1400	1300	1200
2100	1600	1500	1400	1300
2200	1700	1600	1500	1400
2300	1800	1700	1600	1500

are you standing still in electronics while this man advances?

Find out why—and do something about it—if you have the ambition to want a career instead of just a job.

LET'S LOOK AT THE FACTS. There's something wonderful about knowing how a circuit works or what a filter capacitor does. If you've ever fixed a TV set, built a radio or used a voltmeter, you've tasted the thrills of electronics.

This excitement may have led you to a job in electronics. But the glamour fades if you are stuck in the same job year after year. You'll be bored with routine and unhappy about prospects for future earnings. You'll discover, as have many men, that simply working in electronics does not assure a good future.

If electronics is the "field of opportunity," how is this possible? No question about it, electronics offers many opportunities, *but only to qualified men.* In any career field, it is how much you know that counts. This is particularly true in the fast moving field of electronics. The man without thorough technical education doesn't advance. Even men with intensive military technical training find their careers can be limited in civilian electronics.

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FEEDBACK

Continued from page 6

served more attention was excellent. I'm an ARM and I'd like to see more about this hobby.

David G. Lee
San Francisco, Calif.

As far as ARM's are concerned, I found Mr. Duignan's letter very interesting. I think it is a special challenge to pick up radio amateurs in foreign countries.

Bruce P. Tio
Southport, Conn.

Yes, I'm for the ARM's. I've had good luck as an ARM recently, picking up KC4, KR6, KG6 and KH6 transmissions.

Roger W. Byrd
San Francisco, Calif.

EI was overwhelmed by the response to Reader Duignan's letter. We're convinced we should do an article on the subject. It will appear in a future EI.

● *Tape Tricks*

Why not publish an article on building a small, portable tape recorder?

Mark Davis
Levittown, N. Y.

Unfortunately, Mark, the first piece of equipment you need to build a tape recorder is a precision lathe. The second requirement is considerable knowledge of and interest in metal machining. The large amount of mechanical (vs electronic) work required puts such a project outside the interests of most of our readers.

● *Not So Tony*

I read in your November '61 issue about building a Tone Call/Squelch unit for CB. It happens that I have here some commercially-made tone call-squelches I paid almost $50 for and they DO NOT work. Perhaps I have the wrong serviceman or something.

Clyde Stevens, 17W5764
Grand Island, Neb.

Not the wrong serviceman, Clyde. Just the wrong tone call-squelch. You should try EI's unit. It WORKS.

Tech Editor's Test Bench

Continued from page 85

easy, particularly if you have Greenlee punches. However, there are some jobs even punches won't handle. When the cutout must be large (as for a subchassis assembly) or must have squared-off corners, it's still difficult to do a neat job. Difficult, that is, unless you happen to own an Adel nibbler.

This nibbler is one of those rare tools that does exactly what you hope it will. It takes a nice square bite out of any aluminum chassis up to 16 gauge and steel up to 18 gauge. Transformer mounting holes, for example, can be made by drilling a $\frac{7}{16}$" pilot hole. Then, with a squeeze per bite, you nibble away. As a bonus, the nibbler turns out to be ideal for shaping perforated boards, too.

Solder, Sweat and Tears . . . At one time almost all electronic parts were coaxial—that is, their two leads came out of the center of their opposite ends. The exceptions were components that normally mounted above-chassis, such as can filter capacitors, tubes, etc. Now, in the days of printed circuits, almost all components find themselves in an above-chassis position.

What has this to do with soldering? If you have occasion to remove a defective printed circuit board tube socket, you'll find yourself with an interesting problem. In order to get the socket off the board you'll have to unsolder all nine pins (and perhaps the center shield) *simultaneously.* An insoluble problem? Not if you have an Ungar pencil iron and a set of their screw-in desoldering tips. These special tips are a dream for printed board work and can solve once unsolderable problems.

Another interesting solder tool (I don't want to call it an iron) is made by the Oryx Company of England. They call them soldering tweezers. Although these tweezers are specialized, if miniature work is your meat you might take a look at them. The pair I have operates from the 6-volt winding of a filament transformer and develops considerable heat at the joint.

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America's Super Secret Satellite

Continued from page 88

whether a satellite is carrying a nuclear bomb and whether the bomb is armed.

The detection system for an A- or H-bomb would involve the inter-relation of mass and weight and their resistance to change in motion. The heavier a body is, the more it resists change. The Saint, moving beside another satellite, would simply fire jets of gas against its neighbor. From the reaction of the second body, it could determine whether a weapon was aboard.

In the basic orbital tests the Saint components were mounted in the Agena satellite vehicle. The early shots were in the Discoverer series from Point Arguello, Calif., using Thor boosters. (The Agena vehicle, carrying different equipment, also was used as a test bed for the Midas satellite shots.)

The outside physical shape of the final Saint (pictured in our lead illustration) probably will be roughly the same as the Agena B vehicle, a new and larger version of the first Agena. Advanced test shots are likely to use a combination of the Agena B and the Atlas D booster. The Atlas D may give way to the powerful Titan II rocket for final rendezvous tests.

Hi-Fi Record Guide

Continued from page 99

He deserves credit for much of the good taste and musicianship displayed.

Another view of the movies appears in 50 Years of Movie Music from Flickers to Wide Screen, produced by Robert Franklin and directed by Jack Shaindlin. The cumbersome title is no misnomer. From the tinny piano accompaniments of the flickers of yore, with their characteristic music for the chase, slapstick and newsreels, through theme songs like Charmaine to the integrated score for The Man with the Golden Arm —this is the history of movie music, imaginatively set forth in the stereo sound of today.

When Lester Young died three years

ago, a giant passed from the jazz scene. Fortunately, he was recorded extensively and from his many discs eight of his big numbers have now been put on one record and released as The Essential Lester Young. Undoubtedly, this is the most effective introduction to the work of the great tenor saxophonist. The 12-minute version of Lester Leaps In is alone a textbook of his individual style.

If the Twist is still with us when these lines are published, then Doin' the Twist, with Louis Prima, Sam Butera and the Witnesses, will surely be pounding along. A lot of energy has been expended in these sacroiliac-menacing performances of Marie, Route 66, Tag That Twistin' Dolly, some other numbers and, of all things, Glow Worm.

For those moments when the sap runs high, 28 songs have been taken from the four notorious Dalliance discs (in which Ed McCurdy sings pungent songs of Elizabethan England) and issued in a two-record album yclept The Best of Dalliance. The warning is on the album cover: For Mature Libidos Only!

Another economic enticement is the complete Nutcracker Ballet on two discs offered as Demonstration Records. Maurice Abravanel leads the Utah Symphony Orchestra in a flowing rendition of Tchaikovsky's charming music and the recording permits every triangle tinkle and cymbal crash to be heard distinctly.

Not at all sure that every listener knows what every instrument in the orchestra sounds like, or should sound like, Capitol has issued a two-record album titled Instruments of the Orchestra. Spoken commentary is by Yehudi Menuhin, and he and other top-notch musicians, solo and in ensemble, demonstrate the capabilities of the various instruments.

The narration is well written and expressively spoken and the musical examples are well chosen and beautifully played. Despite the educational nature of these recordings, there isn't a dull moment in them. They are a must for the serious listener, and particularly for children. Audiophiles should find them especially useful as a reference in determining the fidelity of other recordings—or of their own hi-fi systems. A 56-page book, written by John Hosier and published by the Music Department of the Oxford University Press, accompanies the records.

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

Offenbach: Gaite Parisienne *Solti, Royal Opera House Orch.*	London CM-9285	$4.98
	CS-6216	5.98
Poulenc: Concerto for Organ, Strings and Timpani *Munch, Boston Sym. Orch.*	RCA Victor LM-2567	4.98
	LSC-2567	5.98
Falla: The Three-Cornered Hat *Ansermet, Suisse Romande Orch.*	London CM-9292	4.98
	CS-6224	5.98
The Electro-Sonic Orchestra	Coral CRL-57381	3.98
	CRL-757381	4.98
Never on Sunday *The Chordettes*	Cadence CLP-3056	3.98
	CLP-25056	4.98
50 Years of Movie Music	Decca DL-9079	4.98
	DL-79079	5.98
The Essential Lester Young	Verve V-8398 (monaural)	4.98
Doin' the Twist *Louis Prima*	Dot DLP-3410	3.98
	DLP-25410	4.98
The Best of Dalliance *Ed McCurdy*	Elektra EKL-213 (monaural—2 discs)	4.98
Tchaikovsky: The Nutcracker *Abravanel, Utah Sym. Orch.*	Vanguard SRV-123/4	3.96
	SRV-123/4-SD (2 discs)	5.96
Instruments of the Orchestra	Capitol HBZ-21002 (monaural—2 discs)	9.96

Good Reading

Continued from page 84

meant to be taken together as a complete course in basic radio. The separate volumes present the fundamentals of DC electricity, AC electricity, electron tube circuits, AM and FM receivers, transistors and transmitters. The entire presentation has been well thought out and virtually everything worth understanding—for the beginner—is thoroughly covered. But this reviewer, for one, has some doubts about the pictured-text presentation. The illustrative technique is a little too reminiscent of the Army classroom. Those who have sat through Army training courses need no further explanation.

INDUSTRIAL ELECTRONICS MADE EASY. By Tom Jaski. Gernsback Library, New York. 288 pages. $3.95

This book seems to be aimed primarily at the student who is thinking of making a career in industrial electronics. And it is a good, readable guide to a complicated field. While it's just not feasible in a book of this kind to cover computers, data recorders and the like in any real detail, there is enough information on them—and on the overall subjects of control systems and servo techniques—to give a student an initial feel of the subjects. In addition, the author points out ways in which technicians and servicemen may be able to apply their current knowledge and skills to free-lance servicing of industrial equipment. For anyone considering a career in electronics or thinking of changing his current focus, this is a potentially useful volume.

And make note of . . .

ELECTRONIC GAMES AND TOYS YOU CAN BUILD. By Len Buckwalter. Howard W. Sams, New York & Indianapolis. 128 pages. $2.50

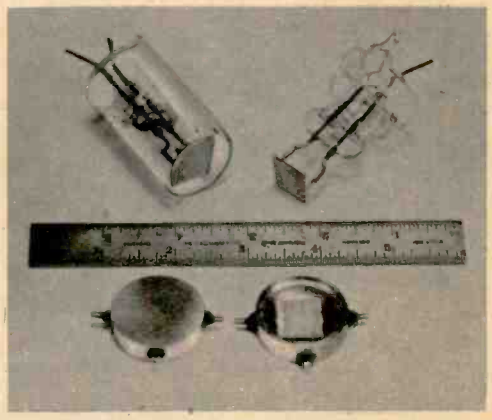
DETECTOR AND RECTIFIER CIRCUITS. By Thomas M. Adams. Howard W. Sams, New York & Indianapolis. 128 pages. $2.95

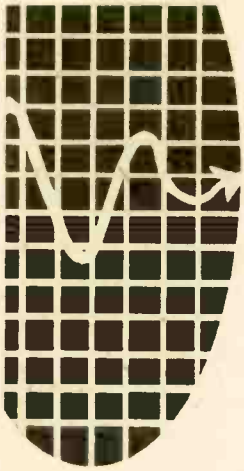
New Fallout Checker

THE USUAL radiation exposure meter is a film badge that can be used only once and requires photographic developing. But now scientists at the Naval Research Laboratory have invented a new type of dosimeter. It keeps a constant record of the radiation exposure of its wearer—whether from a luminous watch dial or A-bomb fallout. It can be used more than once and is easier to read than film.

At the heart of the dosimeter is a glass or glass-and-metal tube containing a white powder (a type of calcium fluoride) coated on a metal holder. The powder traps electrons emitted by atomic radiation. Later, current is applied to the holder and the resulting heat boils out the electrons which, when returning to the trapping material, give off light. A photomultiplier tube measures the light and produces a radiation reading. The term given to the process is *thermoluminescence*. Pictured above is a miniature version of the tube.

Heart of Navy's exposure meter is a small tube (we show four models) containing white powder.





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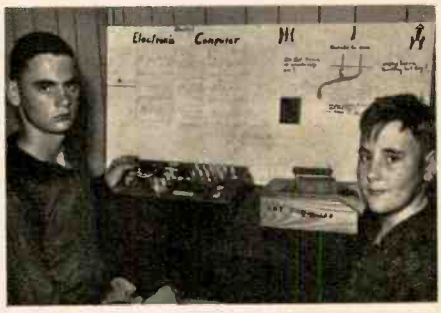
youth wants to DO

IN WHAT we call the good old days our youngsters were supposed to be seen but not heard. Fortunately, things have changed until today our youth actually is encouraged to be inquiring and to experiment with home-made gadgets. Partly as a result, we now have tots of less than 10 who get ham licenses and scientists in their thirties who win Nobel Prizes. In these two photographs we show four young people who wanted to do something and did it. At left are researchers Lloyd Cross and Jerald Cook, both in their mid-twenties, who used an 85-foot radio telescope at the University of Michigan to obtain the world's first definite temperature reading of Saturn's surface. The scope is in the background. The reading was 283 degrees below zero. At right are Bob Swaine, 14, and his 12-year-old brother Stan of Milton, Fla. Bob successfully built EI's rather complicated Electronic Computer (January '60 issue) as his entry in the West Florida Regional Science Fair. Brother Stan designed an electric hot dog cooker.



THE KIT BUILDERS

by Rodrigues

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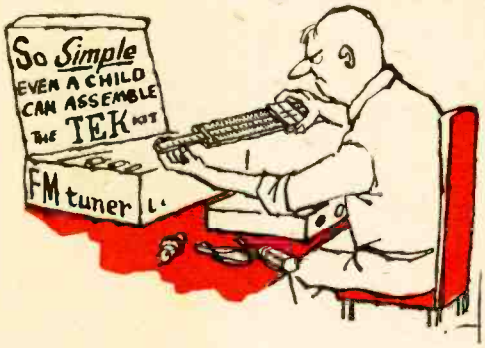
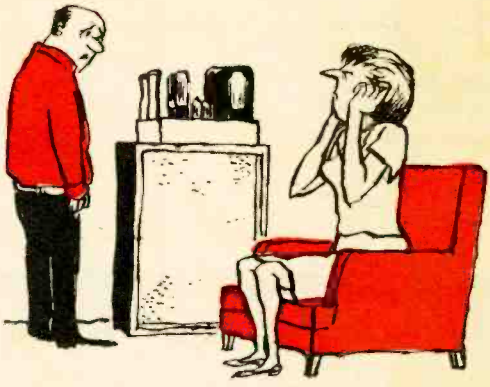
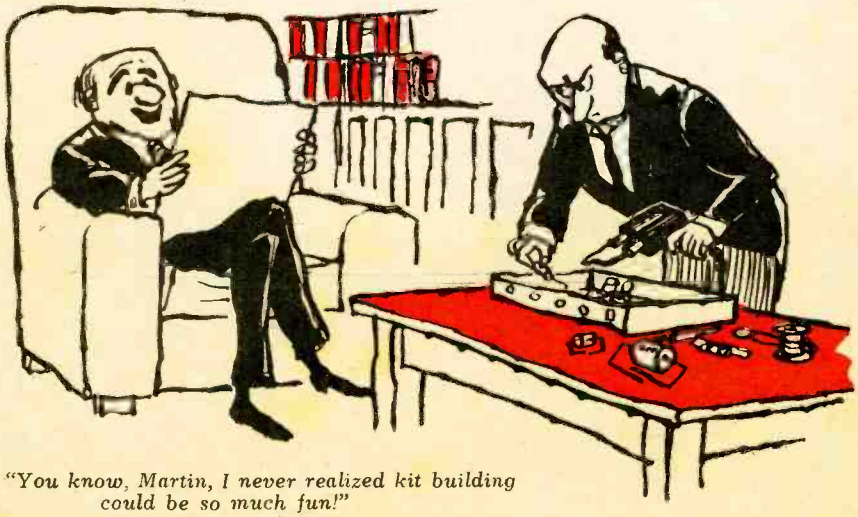


"Now wind the transformer. Primary is 2,100 turns. Secondary is 8,455 turns . . ."



"Volume control? Well, you just sort of move away from it."



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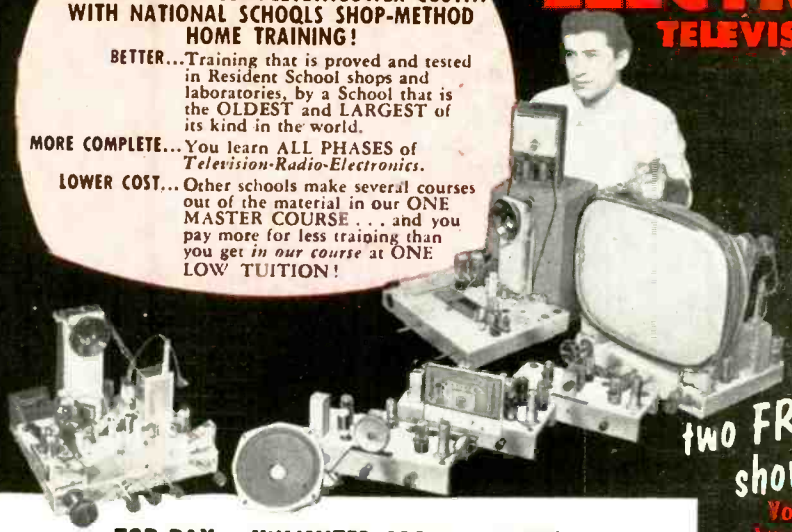

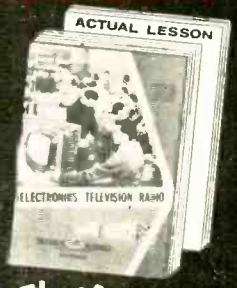

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