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ELECTRONICS ILLUSTRATED®

By the Publishers of MECHANIX ILLUSTRATED

Special Issue: CITIZENS BAND RADIO

Complete CB Coverage! 60 Pages of CB Features! 12 CB Projects!

Projects: **How to Get Rid of CB TVI • A Novel Modulation Meter**
16db Speech Compressor • Perk Up Your Mobile Rig
A "Voice Power" Amplifier • Mapping Your Signal Pattern
CB Signal Booster • Transmission Line Tune-Up Meter
Add a Handset to Your Transceiver • Switch to a Better Mike

- **Read the Hilarious "Confidential History of CB"**
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- **Basic CB Circuit Theory • All About Modulation**
- **The Truth About CB Skip • The Top Ten CB Clubs**

BUILD THIS SPECIAL CITIZENS BAND OSCILLOSCOPE
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here is an immediate and grow-g need for trained technicians Industrial-Military Electron-s, Radio-TV Servicing and ommunications. Better than erage jobs with high pay, in-resting work, bright futures vait you in the fast growing dustry of the 1960's. Join thou-nds of NRI graduates now nefiting from career oppor-nities in this Electronic Age.

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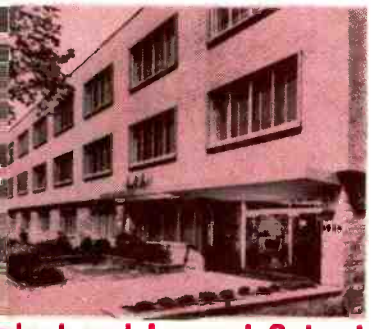
NRI "learn-by-practice" training is the time-proved way to higher earnings and advancement. Except for FCC License rse, all NRI courses include—*at extra cost*—special training equipnt to give shop and laboratory perience in your own home. Makes RI training come to life in an easy-grasp, interesting manner. Take advice of job counselors, investie Electronics if you are dissatisfied h your present job or pay, or you nt to prepare for military service.



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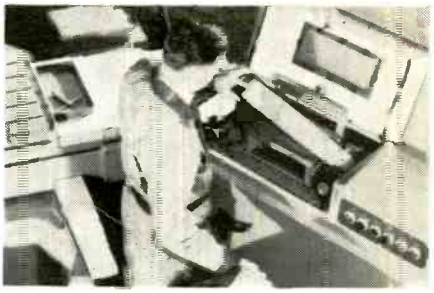
The NRI course in Electronics-Principles, Practices, Maintenance prepares you for a career as an Electronic Technician in industry, business, government, the military. Computers, telemetry, automation, missiles, rockets all employ the same basic Electronic principles . . . and that is what this NRI course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



Commercial FCC LICENSE

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

TV-Radio COMMUNICATIONS

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

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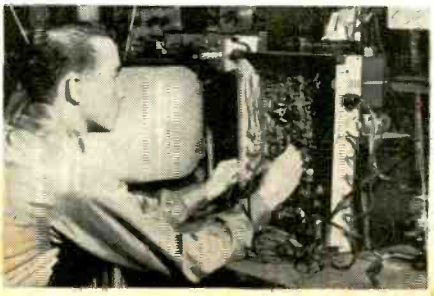

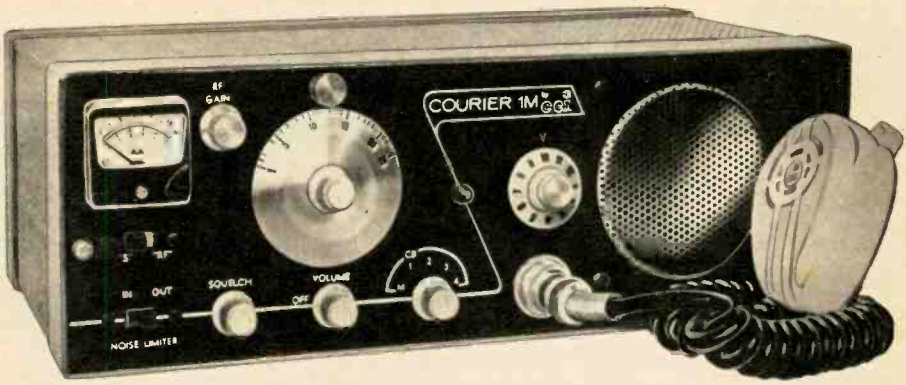

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ELECTRONICS ILLUSTRATED

March 1963 — A Fawcett Publication — Vol. 6, No. 2

Special CB Features

Special CB Projects

Radio: CB • Amateur • SWL

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COVER—Photograph by Herb Friedman. Executive Model 100 Citizens Band transceiver by International Crystal Manufacturing Co., Inc.

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

"I HAD PRACTICALLY no knowledge of any kind of repair work. One day I saw the ad of NRI in a magazine and thought it would be a good way to make money in my spare time. 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 the basement of my home."

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

IF YOU'VE BEEN WANTING TO START "A LITTLE BUSINESS OF YOUR OWN" IN YOUR BASEMENT OR GARAGE

CHECK the advantages of NRI training in Servicing Electrical Appliances

- ☐ **STEADY DEMAND** for your services. Over 400 million appliances in U.S. – 6 million sold last year alone – mean shortage of trained appliance service men.
- ☐ **NO ELABORATE EQUIPMENT NEEDED** – just simple hand tools, and Appliance Tester which we provide at no extra charge.
- ☐ **START SMALL – GROW BIG.** You can start out in your own basement or garage, in spare time. Gradually expand until you open your own shop.
- ☐ **NO NEED TO RISK YOUR SAVINGS.** Many businesses require a sizable investment. But here you can build up a following of customers *first*, then open a full-time shop if you wish to.
- ☐ **EARN $3 TO $5 PER HOUR.** Fixing appliances is a high-paying skill because the demand for trained men is so great.
- ☐ **ENJOY SEMI-RETIREMENT ON A GOOD INCOME.** When you're ready to retire, you can devote a few hours a day to this work. Live and work anywhere you please.
- ☐ **NO PREVIOUS EXPERIENCE OR TRAINING NEEDED.** We tell you and show you everything you need to know, in plain English and clear pictures.

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

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

Your Skill Always in Demand —"Set Up Shop" Anywhere

People need their appliances fixed in good times or bad. Once word gets around that you are trained to service them, you'll have plenty of work.

Your training costs less than 20¢ a day. And you need only the few basic tools you may already have – and an Appliance Tester which we provide at no extra charge. You can work anywhere—in a corner of your basement or garage, even on the kitchen table. If you like, you can open up your own shop, have others work for you. And you can save money by fixing your own appliances.

FREE BOOK *and Sample Lesson*

Our 24-page Free Book tells how you can "cash in" on America's "Electrical Appliance Boom"—the money our students are making, what they say about us.

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

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

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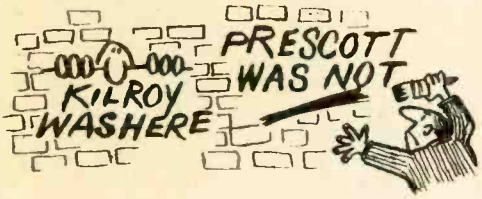
FEEDBACK from our readers

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

● ***Last Word?***



I mailed a letter to Sid Prescott at the Ultra Electronics & Paper Clip Co. in Houston and it was sent back. He was the man who was manufacturing the 2N½ transistor, a sub-miniature resistor and paper clips. You published two of his letters in FEEDBACK. Could you give me a better address?

G.B.
Phoenix, Ariz.

We're not quite sure who is pulling whose leg, G.B. We assumed Sid Prescott was the pen name of somebody who was kidding us and our readers. We suspect you're calling his bluff. If you're serious, forget about old Sid. His paper clips don't work worth a darn.

● ***Flash!***

I am interested in building your MINIATURE SLAVE FLASH (Nov. '62 EI) but I find the CK914 transistor you specify is no longer stocked here. Can you give me a substitute?

Robert J. Binnie
Pittsburgh, Pa.

Any small-signal PNP audio transistor, such as the 2N34, 2N107, CK722, etc., may be substituted for the CK914.

● ***Mike Mix-Up***

Thanks for the thorough-going article on microphones (MICROPHONES!, Jan. '63 EI). It should help clear the air at the buying level, where there is much confusion. I have frequently been critical of attempts in this vein, the usual results being a watered-down catalog of what is available. I am glad to see a real attempt to provide useful explanations of what to use and when.

A minor note: page 118 says the [Dynaco B&O stereo] mikes are set 3 feet apart. I hope not! It is closer to 8½ inches.

Robert H. Tucker
Dynaco, Inc.
Philadelphia, Pa.

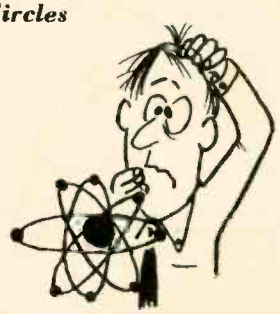
● ***BFO, SSB, Etc.***

I enjoyed your article on TUNING SSB WITH BFO (Sept. '62 EI), but what about us poor guys who don't have BFO? How can we get SSB?

David Cox
Carrollton, Ala.

A Q-multiplier, if you have one, will supply the missing carrier, Dave. Or you could add external BFO or Q-multiplier. As a last resort, just decide you don't care for SSB, anyway.

● ***In Circles***



Dr. Millman's expert definition of electricity in the September '62 EI was circular. It is the electron that needs an exact definition. What is it? Your article on transistors in the same issue was wonderfully helpful. You Americans do scientific exposition superbly.

Greg Smelters
Manly, N.S.W.,
Australia

[*Continued on page* 6]

Let I. C. S. equip you for success in radio-TV-electronics—with professional equipment!

Brand-new "Electronic Laboratory," now being offered for the first time, can help you land in this big money-making field—FAST!

Here's an opportunity for you to turn spare time into cold cash, or begin a whole new career—in a field where the rewards have never been greater. And you *don't* need previous experience to do it!

International Correspondence Schools has just developed a new I. C. S. Electronic Laboratory you can construct in your own home. Includes series of training kits, plus the new I. C. S. VTVM—the professional quality vacuum tube voltmeter shown here. With it comes complete course instruction combining all the fundamentals with practical knowledge you can apply at once. And best of all, you build your own professional test instrument!

I. C. S. instruction gets you going with equipment you can really use!

A famous manufacturer of nationally known electronic testing equipment worked closely with I. C. S. to develop the Electronic Laboratory and the VTVM itself. Everything you get is geared to increase your skill and knowledge step by step. Until finally, you've completed a precision testing unit you can use for practically any kind of experimentation, design or servicing work.

Here's how I. C. S. instruction works. You begin with basic study lessons. Texts are clearly worded and easy to follow. At the same time, you "act out" what you learn with simple experiments. Then, in 3 easy stages, you assemble your own precision testing unit. Throughout, your instructor gives you expert, professional help. You learn at home, in spare time, as fast as ability permits.

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Make up your mind right now to find out how I. C. S. training in Radio-TV-Electronics can pay off for *you*. See how it can help you cash in on the tremendous demand for men skilled in installation, maintenance and servicing of radios, TV sets, hi-fis, computers, automation systems and a host of other space-age devices. Clip and mail the coupon below. You'll receive 3 valuable *free* booklets—including sample lesson. They'll show how you can land in this big money-making field *fast!*

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FEEDBACK

Continued from page 4

● ***Dismayed***

I was dismayed to read the attack on Russian stations in your November HAM SHACK . . . If you had investigated your facts a little more you'd have found exactly 260 short-wave stations operating on the 40-meter ham band. These represent 60 countries. Included are 16 Voice of America transmitters.

I'm neither pro-American nor pro-Russian . . . just a DXer who believes that *both* sides are bad at cluttering.

Fred Woodley, Chairman
Canadian DX Club
London, Ont.

We agree with your facts, Fred, but not with your sentiments.

● ***Crazy Records***

I got a kick out of your article, DIG THAT CRAZY MUSIC!, in the November EI. That music that isn't music is something (I think). Inspired by it, I invented a still newer form of non-music—a record with *nothing* on it. Since then I have improved my invention by eliminating the record. How's that?

J. B. Whittier
San Francisco, Calif.

How's that?

● ***Clubman***

I am interested in forming an electronic experimenters club in my area.

Wayne Bolser
20 Amherst St.
Roslindale 31, Mass.

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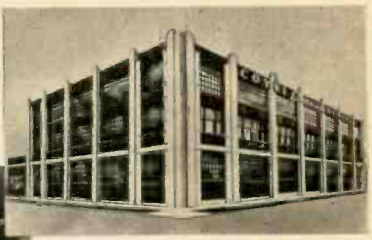

No matter what branch of electronics you prefer, you'll have no trouble landing just the job you want—*provided you get the right kind of training.*

Without this training you'll not get far. *With* it most of our graduates start right out with a beginner's salary of $100 a week or more. Once you've started, you can move ahead fast to more important jobs that pay as much as $14,000 a year.

AIRLINES NEED MEN

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

THE MISSILE INDUSTRY

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

COMPUTERS—Data Processing

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

TV and RADIO Manufacturers

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

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

OR, YOUR OWN BUSINESS

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

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

CHICAGO—THE NATION'S ELECTRONICS CENTER

Don't get the idea that coming to Chicago to learn with Coyne is a costly or complicated undertaking. *Nothing could be further from the truth.* With modern transportation, *Chicago is "close by" no matter where you live.* High living costs? Not at all. We find a place for you to live—a place where, in many cases, your room and board cost no more than you would pay at home. And don't forget that you have every opportunity to earn money while you learn. Our employment department helps you get a part time job if you need extra money.

And think of the training you will get! Coyne is the oldest, largest and most completely equipped Resident School of its kind. And it is right in the heart of America's electronics center! Best of all, you can start your training with only a small down payment. Then take care of the balance *after you graduate!*

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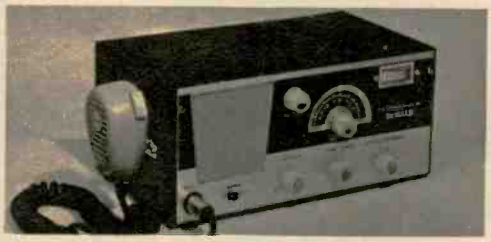
CB MARKETPLACE

New Browning transceiver, M-523, has 23-channel operation, measures 8x3x9 inches, comes with DC power supply and TVI filter (harmonic). Accessories: S-meter, rear deck speaker, AC power supply. Browning Labs, Laconia, N. H.

Cadre 510 has 18 transistors, 8 diodes, 5 crystal T-R channels, AC and DC power supplies, squelch, noise limiter and push-to-talk. Meets Canadian DOT specs. $199.95. Cadre also has on tap the new 515, a stripped-down business model. Cadre Industries, Endicott, N. Y.



DeWald R-1050 has 6 crystal-controlled T-R channels plus manual tuning, S/plate-current meter, PTT with electronic switching. Nuvistor front-end, pi network, squelch, noise limiter. $119.95. United Scientific Labs. LIC, N. Y.

Kaar TR327B features 2 crystal T-R channels plus three other crystal transmit channels with tunable receiving; squelch and noise limiting. Another model, TR327A, has 4 crystal channels plus BC band. Kaar Engineering, Palo Alto, Calif.

CB MARKETPLACE

Globe Master has 11 crystal T-R channels, dual conversion, speech clipping adjustable to 22db, noise limiter, squelch, pi network, S-meter. The set contains 14 tubes, has slide-rule dial. $229.95. GC Electronics, Rockford, Ill.

Hammarlund CB-23 offers crystal-controlled transmitting and receiving on all 23 channels, has dual conversion with 262-kc IF, squelch, noise limiter, meter. Price of $229.50 includes all crystals. Hammarlund Mfg., New York 10, N. Y.

Heath GW-42 is a kit which includes 3 circuit boards. It has a 3-way power supply, 5 crystal T-R channels, four-tone selective call, slide-rule dial, meter, noise limiter, squelch. Price is $119.95. Heath Co., Benton Harbor, Mich.

[Continued on page 14]

Learn Electronics

PREPARE FOR YOUR F. C. C. LICENSE—YOUR TICKET TO A BETTER JOB AND HIGHER PAY!

F.C.C. LICENSE—THE KEY TO BETTER JOBS

An F.C.C. *commercial* (not amateur) license is your ticket to higher pay and more interesting employment. This license is Federal Government evidence of your qualifications in electronics. Employers are eager to hire *licensed* technicians.

WHICH LICENSE FOR WHICH JOB?

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) including all radio and television stations in the United States, its territories and possessions. This is the highest class of radiotelephone license available.

GRANTHAM TRAINING PREPARES YOU

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

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Grantham training is available by correspondence or in resident classes. Either way (residence or correspondence), we train you quickly and well—no previous training required. Even a beginner may qualify for his first class license in a relatively short time.

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To better serve those students who wish to attend resident classes, Grantham School of Electronics offers DAY and EVENING classes in four different cities—Los Angeles, Seattle, Kansas City, and Washington, D.C. The same rapid course in F.C.C. license preparation is conducted in all four locations. If you are interested in attending a DAY or EVENING class, indicate the city of your choice in the coupon below, and mail the coupon to Hollywood for *free information*. There is no obligation of any kind.

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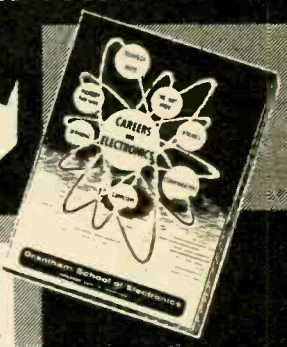

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Upgrade Your Income with a First Class

F. C. C. LICENSE

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
Gary DeLeo, 9219 N.E. 76th St., Vancouver, Wash.	1st	12
Dennis P. Miller, 416 W. Oak St., Alexandria, Va.	1st	12
Cecil C. Hironimus, 113 Berwick Rd., Johnstown, Pa.	1st	12
Max D. Reece, 4222 Fremont Ave. N., Seattle 3, Wash.	1st	20
Robert Benns, 3802 Military Rd. N.W., Washington, D.C.	1st	12
Jon M. Martin, 7913 Sausalito Ave., Canoga Park, Calif.	1st	24
Kline H. Mengle, 401 Granville Dr., Silver Spring, Md.	1st	24
Gary D. Burnard, Johnson Rd., Kirkwood, RD #1, N. Y.	1st	12

YOUR F. C. C. LICENSE

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...electronics in the news

PASTA, ANYONE? . . . That edible-looking material held by the cute young thing at right fools you into thinking it might be bound for Mother Leone's cooking pot. One nibble and you'd be dribbling teeth on the floor. What the girl holds is an interesting new coaxial cable which has extremely low loss characteristics because the insulation around it is mostly air. A ballooning white plastic sleeve is first slipped over the center conductor. Then it is crimped and sealed at short intervals to form a moisture-proof and gas-tight bond with the metal. The air trapped inside each small cell represents insulation. The coax, called Ballon, is a French invention now licensed to Superior and Simplex, U. S. cable firms. Marketing plans haven't yet been announced.

Micro Mike . . . Dwarfed by the O-for-Operator on the telephone dial shown at lower left is the newest thing in microphones. Needless to say, it's also the smallest. Raytheon's Dr. Wilhelm Rindner was studying effects of surface defects on transistors when he accidentally bumped into some phenomena that led to the baby mike. Dr. Rindner noticed that when he probed, scratched and tapped the semiconductor material in a transistor, the current flowing through the device varied in accordance with his puttering. Out of that observation came a mike which consists of a PNP transistor and what looks like a thumbtack, a small one. The point of the tack bears down on the top layer of semiconductor material, while the head represents a tiny diaphragm. The diaphragm, like any normal-size one, responds to vibrations. The resulting pressure is passed on to the semiconductor material and produces variations in the transistor's current flow. Frequency response is a fantastic .01 to 120,000 cps. Raytheon predicts uses in seismology, for weight and pressure tests in labs, as a strain gauge, in space vehicles, in military weapons, in medicine and in hearing aids.

Brain Cell . . . At the heart of the rig at right is a cubic inch of quartz fibers. The action: the chap from Sperry Gyroscope speaks the word *five* into the mike and that numbers appears on the panel above the apparatus. Sperry calls it a brain cell in that it can listen to, recognize and react to a voice, a single word or any sound. It bears the same Sceptron. By responding selectively to voices or sounds, the cell may make possible dial-less phones, key-less cash registers and secretary-less typewriters. You'd just speak directly to the machine. In the Sceptron thousands of light-carrying fibers react to a sound by vibrating. This pattern is recorded on a light-sensitive plate placed between the fibers and a photo cell. The fibers then react only to the particular stimulus that drew the recorded pattern.

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CB MARKETPLACE

Executive Model 10 is stripped rig with 3 crystal transmit channels, manual T-R control, noise limiter. Accessories are power supplies, squelch, PTT, 12-position crystal selector. $59.50 less power supply. Intl. Crystal, Oklahoma City.

Knight KN-2500 features 6 crystal T-R channels, noise limiter, squelch, pi network, PTT and combination S-meter and RF field-strength meter. Spot switch permits you to locate your own signal. $99.95. Allied Radio, Chicago 80, Ill.

Lafayette HE-90 gives you 6 crystal T-R channels, a Nuvistor RF amplifier, PTT, noise limiter, squelch, S-and-power meter, spotting switch for locating your signal on tunable receiver. $94.50. Lafayette Radio, Syosset, N. Y.

EICO 772, for 117-VAC or 12-VDC operation, comes as a kit ($89.95) or wired ($119.95). Offers crystal control on 4 transmit, 1 receive channel; PTT, pi network, squelch and noise limiter. EICO, Long Island City, N. Y.

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CB MARKETPLACE

Pearce-Simpson Companion features 5 crystal T-R channels, noise limiter, squelch, 3 watts actual RF output. Modulation limited to 95%. Cabinet is 8¾x12¼x5 inches. Price is $189.50. Pearce-Simpson, Miami 35, Fla.

Poly-Comm Senior 23 includes 23-channel, 11-crystal synthesizer, message light, tone call/squelch, S-power meter, PTT, noise limiter, audio output for PA use and tilting bracket. Price: $349.50. Polytronics Lab, Clifton, N. J.

Falcon Mark V features an RF gain control, 3-way supply, squelch, special noise limiter, double conversion, pi network. S-meter doubles as power meter. $169.95; twin noise suppressor $20 extra. Tecraft Sales, S. Hackensack, N. J.

Band Spanner 440 has 10 crystal T-R channels (using one crystal per channel), dual conversion with 250-kc IF, output modulation meter, noise limiter, squelch, simulated woodgrain cabinet. $209.50. Webster Mfg., S. San Francisco, Cal.

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

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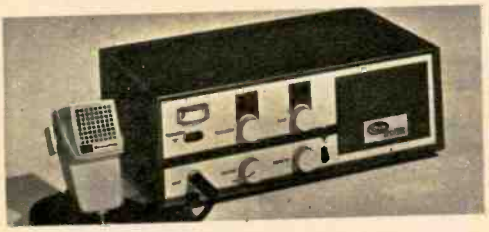
CB MARKETPLACE



Olson Spotter features 12 crystal transmit channels, dual-conversion receiver, S/modulation meter, squelch, noise limiter, spotting switch. Operates on 117 VAC and either 6 or 12 volts DC. $119.95. Olson Radio, Akron 8, Ohio.

Ray-Tel 2 is a business rig offering 5 channels without variable tuning. It has adjustable squelch, noise limiting, 10 tubes, 117-VAC or 6/12-VDC operation. Comes with a yoke mount. $189.95. Raytheon Co., Lexington 73, Mass.

Apelco AR-10 is a 10-channel job with noise limiter, squelch, and combination modulation-output meter. It has 3 IF stages, operates on 117 VAC or 12 VDC. Meets DOT specs for use in Canada, maker claims. Apelco, S. San Francisco, Calif.

Heath GW-30 walkie-talkie is a 90-milliwatt unit which can be operated without a license but requires a ticket when talking to CB stations. Superregen receiver, 1 crystal transmitting channel. Uses 9-volt battery, has 40-inch whip antenna. The kit is $32.95, wired unit runs $50.95. Heath Co., Benton Harbor, Mich.

CB MARKETPLACE

Kaar Hand-D-Phone contains 9 transistors and 3 diodes, has a superhet receiver. Input to final is under 100 mw, making it usable on License-Free Band. Weight is just under 2 lbs. 1 crystal transmit channel. Kaar Engineering, Palo Alto, Calif.

Lafayette HE-66 walkie-talkie has 4 transistors. It features a superhet receiver and 1 crystal T-R channel. Actual RF output claimed is 85 mw. Runs on 6 penlight batteries. $19.95 each, 2 for $38.95. Lafayette Radio, Syosset, N. Y.

WRL Spacemate gives you 9 transistors, weighs 2½ lbs. and offers 2 crystal channels (11 or 16). The whip antenna telescopes to 46 inches. World Radio Labs, Council Bluffs, Iowa.

Globe Signal Optimizer is a multi-purpose instrument which gives you actual RF output in watts, percentage of modulation, harmonic readings, SWR, field-strength figures, etc. $47.50. GC Electronics, Rockford, Ill.

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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."

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CB MARKETPLACE

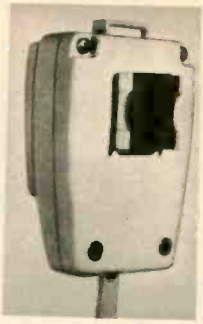
Seco 510 Transmitter Tester is a portable instrument which gives you a direct reading of percentage of amplitude modulation and actual RF output. High impedance input for handi-talkie checks. $46.95. Seco, Minneapolis 19, Minn.

Lafayette TM-58 is an SWR bridge and RF power meter which can be inserted permanently in the coax line. It indicates up to 15 watts power, has a built-in dummy load, measures SWR from 1:1 to 4:1. $7.95. Lafayette Radio, Syosset, N. Y..

Executive Frequency Synthesizer uses 23 crystals to give you frequency control on all CB channels. 24th position is spare. Self-contained power supply. Matches Executive 100 and 50 transceivers. $159.50. Intl. Crystal. Oklahoma City.

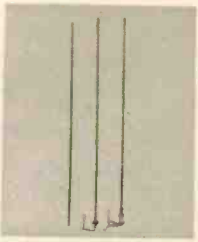
Turner 355C CB microphone has a push-to-talk bar on the side which is gripped by all fingers rather than just one. It has an output level of —50db, response of 80-7,000 cps. $12.50. Turner Microphone Co., Cedar Rapids, Iowa.

CB MARKETPLACE



Sonotone CM-30M Ceramike has a magnet on the back (shown) which holds it to the dash of your car or any other metal. Sensitivity rating is —49db, response is 60-7,000 cps. PTT button on top. Case is Implex plastic. $9.70. Sonotone Corp., Elmsford, N. Y.

Big Mike Mark I is a CB microphone with a built-in transistor amplifier. Screwdriver adjustment on the side varies output level and frequency response (tone). The amplifier is operated by a mercury cell. Push-to-talk bar on side; —39db output. $33.50. Instruments & Communications, Inc., Wilton, Conn.



Black Beauty Fiberglas mobile antennas (3 shown) have a solid black Fiberglas sleeving for weather protection. They are center-loaded, 48 inches high, can be mounted on cowl, fender or trunk. Antenna Specialists, Cleveland, Ohio.

WRL NA-27 Pre-Amplifier uses two Nuvistors (6CW4's) to give you up to 20db gain in signal strength, can be mounted inside most CB transceivers. Requires 90-125 VDC, 6 or 12 volts for filaments. $11.95. World Radio Labs, Council Bluffs, Iowa.

Scott Stereo Tuner Kit Wins Rave Reviews from every Leading Hi-Fi Expert!

Just one year ago Scott introduced the LT-110 FM Stereo Tuner Kit. High Fidelity Dealers built this superb kit themselves, examined its many features, and recommended it without reservation. Enthusiastic kit builders deluged us with mail. Now the verdict is in from all the leading technical experts. Never before in the history of the industry has a single kit received such unanimous praise. We reprint a few excerpts below.

from Popular Electronics

A test model of the LT-110 was wired at POPULAR ELECTRONICS in just under five hours. Another 40 minutes was used for careful alignment and the tuner was "on the air." . . . The LT-110 met or exceeded all the manufacturer's detailed specifications on sensitivity, distortion, output level, a.c. hum, and capture ratio. . . . the audio response is excellent, being within ± 1 db, from approximately 20 to 16,000 cycles. . . . Channel-to-channel crosstalk is particularly excellent both in terms of uniformity and the fact that it holds up well above 10,000 cycles. . . . Frequency drift of the LT-110 from a cold start is extraordinarily low — less than 5 kc. The a.c. hum level (referred to 100% modulation) is low and exceeds the manufacturer's rating by 5 db. . . . It's difficult to imagine a kit much simpler to assemble than the LT-110. The full-color instruction book eliminates just about the last possible chance of wiring errors. . . . From a plain and simple operational standpoint, the LT-110 *works well and sounds good.*"

Popular Electronics, Oct. 1962

from ELECTRONICS WORLD

"Construction time for the unit we tested was 6½ hours, without alignment. . . . in listening tests, the tuner showed its high useable sensitivity to good advantage. Using an indoor antenna which produced marginal signal to noise ratios on most other tuners we were able to get noise-free, undistorted stereo reception."

Electronics World, Nov. 1962

from AUDIO

"The LT-110 (is) so simple to build that we unhesitatingly recommend it for even the novice. . . . We found that the useable sensitivity (IHFM) was 2.1 uv. . . . a fine stereo tuner and an unusually easy kit to build." Audio, April 1962

from RECORD GUIDE

"It seems to me that every time I turn around I am building another of H. H. Scott's kits. And each time I end up praising the unit to the skies.

The Scott instruction books should be a model for the industry. They feature full-color, step-by-step, illustrated directions. Each resistor or other component is shown in the progressive phases in its color code and in its proper position. . . .

This tuner kit has to be ranked on the same plane as H. H. Scott's factory-wired units. It is an excellent product. . . . very likely to give long, trouble-free service."

American Record Guide, Sept. 1962

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Scott's unique Sonic Monitor has now been added to the LT-110. This foolproof stereo signaling device tells you audibly when you are tuned to a stereo station.

LT-110 FM Stereo Tuner Kit . . . $159.95

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LC-21 Stereo Control Center Kit . . . $99.95

LK-150 130-Watt Stereo Power Amplifier Kit . . . $169.95

*Patent Pending. (All prices slightly higher West of Rockies.)

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Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto

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GORDON FAWCETT,
Business Manager

Sworn to and subscribed before me this 26th day of September, 1962.

[SEAL] LILLIAN M. KLEIN
(My commission expires April 1, 1963)

ELECTRONICS ILLUSTRATED
MARCH 1963

what the FCC thinks of CB

IN a little less than five years the Citizens Radio Service has changed from an almost unknown band to one of the liveliest and most talked-about media in the world of communications. A few thousand licensees of 1958 have grown now to almost 400,000. Tens of thousands of small businesses and private citizens derive incalculable benefits from Citizens Band radio, which at once offers a fast, modern means of communication with modestly priced equipment and a simplified licensing procedure. It is truly radio for the average man and the independent merchant. The Federal Communications Commission can congratulate itself for originating a service so useful to so many, but by the same stroke of genius it also created problems in rules-enforcement of a magnitude never before seen. It was not long after the birth of CB that Commissioners and the FCC staff began asking themselves what they could do to regulate the new service without destroying its usefulness. The question did not lend itself to easy solution. It still has not been answered with finality, and probably never will be. But the FCC has definite opinions on the Citizens Radio Service as it now stands and some clear-cut intentions about the near future. Among them:

- *Most* licensees are using their stations for the purposes intended by the rules.
- The Citizens Band *is* considered a special "problem band" insofar as Class D stations are concerned.
- Another revision of the rules is under way, though no drastic changes are imminent for CB (see below).
- CB is declining in popularity amongst radio *hobbyists*.
- No new frequency allocations are contemplated and CBers *will be fortunate to hold those they now have.*

The last item may come as a surprise to many CBers—that those who assign and police the radio frequencies would contemplate a squeeze on the band when the number of licensees is expanding so rapidly. Yet it does at this writing appear to be a definite, though vague, threat. The underlying consideration at this point is whether those frequencies now allotted to the Citizens Band are being used properly and are providing the service needed.

(*Continued on next page*)

what the FCC

The actual make-up of the Federal Communications Commission—who it is and what it does—is the source of no little confusion, even on the part of those who hold radio licenses granted by the agency. The Commission itself is made up of seven men who are given political appointments by the President. One Commissioner serves as chairman, the current one being Newton N. ("Wasteland") Minow. The Commissioners have the job of formulating policy and doing other such high-level work. Working for the Commission is the FCC staff—such men as Ben F. Waple, Acting Secretary, and Ivan H. Loucks, who now heads up amateur and Citizens Band radio operations. The staff carries out the Commission's policies, doing the paperwork, making lower-level decisions, running a monitoring program . . . and writing citations.

The Commissioners, as a group, never have made any pronouncement regarding Citizens Band radio—or the Citizens Radio Service, as it is known in official circles. However, last summer one Commissioner, Frederick W. Ford, speaking in Parkersburg, W. Va., at the Annual Tri-State Citizens Band Roundup, aired some of his own views on the band that coincide with those held by members of the FCC staff (they have said). Presumably, other Commissioners also agree, since there has been no postscript from them.

"It seems obvious," said Mr. Ford, "that if the (CB) service gets so out of hand that the Commission is unable to cope with it; if because of extreme numbers of users and general lack of care for restrictions the service virtually destroys itself, it might become necessary to withdraw the 11-meter frequencies from the service."

Mr. Ford hastened to tell his listeners, who must have been a little shook up by this time, that such an eventuality seemed drastic and unlikely. But, on the other hand, he continued, "it would be most difficult to justify the extensive and expensive field force which might be required to police the band."

The speech, which ran to seven close-typed pages, was a transparent attempt to make friends with the CBers at the roundup, to enlist their help and cooperation in steering CB in the right direction. It was a friendly talk and no doubt had the desired effect, but the carefully gloved hand had to make a momentary appearance.

"Your service has come in for a good deal of attention lately," Mr. Ford concluded, "and my parting (wish), which I hope will be taken with all the good will with which it is given, is that the future attention which (CB) receives will be all in the nature of commendation and not condemnation."

Mr. Ford's journey to Parkersburg was not the first made by the FCC people to Citizens Band gatherings. For more than two years the FCC has been steering on a friendship-and-education tack. Administrators (such as Mr. Loucks) and engineers alike have talked to CBers in groups large and small, telling them where the service had gone wrong and where they hope to see it arrive in the future. The public relations work has not been in vain. Most Citizens Band licensees now view the FCC with friendly feelings, replacing the all-they-do-is-write-citations hostility of the past. The net result has been a vast improvement in operating practices and conditions on the band.

In the words of Messrs. Waple and Loucks, "The Commission believes that by and large most Citizens Radio station licensees are using the stations for the purpose intended by the rules, i.e., short-distance communications necessary to the conduct of business or personal activities." But then they add: "Unfortunately, however, some licensees operate their Class D stations for purposes other than these, in violation of the rules, and they threaten the utility of the service for the intended purposes."

The primary violation, they say, and nearly any CBer could guess, is the use

thinks of CB

of the band for hobby-type communications. This is what they call "amateur-radio-type of operation with contacts for the sake of contacts, including discussions regarding carrier frequency, modulation, antennas, signal strength and checking into local nets."

"In some parts of the country," say the two FCC staff members, "stations are used for social conversations that can and should be handled over regular wire-line telephones."

The FCC, pointing to the large number of licensees, resulting from simple eligibility requirements and low-cost equipment, has noted that a small minority of CBers are causing most of the trouble. Less than 10 per cent of the licensees are responsible for 85 per cent of all violations, according to their figures.

As for the hobbyists, Messrs. Loucks and Waple have this to say: "It is expected that after the novelty wears off many of these licensees will settle down, as they already have in some areas, to conservative operation more in line with the rules."

Rules changes or new rules are put together in the form of proposals by the FCC staff and then presented to the Commissioners for adoption or not. The latest proposed rules changes have now been announced. The FCC says there's nothing *radical* about them, but that's *their* term. For a full discussion see CB CORNER in this issue.

At the end of 1962 approximately 380,000 CB licenses had been issued, of which 315,000 were for Class D stations. For the first nine months of the year, an average of 10,564 licenses was granted each month. Figures for the later months are not yet available.

"With no let-up in Class D applications and with some months running one or two thousand over previous months, the popularity of CB appears to be gaining somewhat," Mr. Loucks and Mr. Waple state. "In the last 12 months the lowest number of applications received for Class D stations was about 10,000 (December 1961) and the highest number was 17,543 (August 1962). The application receipts during each month of 1962 were some 4,000 more than during the same month of 1961."

The mushrooming licensing rate has been accompanied, inevitably, by a jump in citations (also due, to some extent, to stricter enforcement). In one three-month period (April-June) of 1962 the FCC wrote an average of 450 citations every month, compared to about 250 a month a year earlier.

"Apparently applications for licenses solely for hobby-type activity are falling off," the FCC says. "The number of applications appears to be increasing for the combination personal-and-small-business type of activity where the wife takes an active part in her husband's business. Small corporations, associations, volunteer fire departments, auxiliary police, Civil Defense organizations, parcel delivery and taxicab operations now account for many applications."

Ham-type chatter and skip contacts, though major headaches, are not the most serious problems in CB, according to the Commission's view. The worst-offense title goes to totally unlicensed operation of CB equipment and the "lending" of call signs to friends. The FCC's stepped-up monitoring program has hooked more than a few violators on these rules infractions. The new rules changes, the FCC says, will make these and other violations more apparent when they occur (in addition to facilitating the understanding of the rules by licensees).

To help it enforce the rules, the Commission encourages the organization of CB groups interested in self-regulation. "Clubs," says the Commission, "when properly organized and conducted are of help because they discuss the Commission's rules and thus give members a better understanding of how they should operate their stations. They also call each other's attention to faults in their equipment and operating practices."

CB SIGNAL BOOSTER

Transistorized unit achieves up to 24 db boost in reception.

By Kevin Redmond, K2HTZ (Head, Semiconductor Applications Laboratory, Amperex Electronics)

YOU can add greater sensitivity, lower cross-modulation, and quieter operation to your rig with the twenty-four db of gain provided by this versatile CB Signal Booster. Low sensitivity receivers use its high gain to improve sensitivity while high sensitivity receivers can use the gain to permit higher squelch settings and therefore quieter reception. Output impedance taps on the booster allow matching to a variety of antennas and receiver input stages. Satisfactory performance is delivered with a DC supply range of six to twelve volts assuring adaptability to various supply systems.

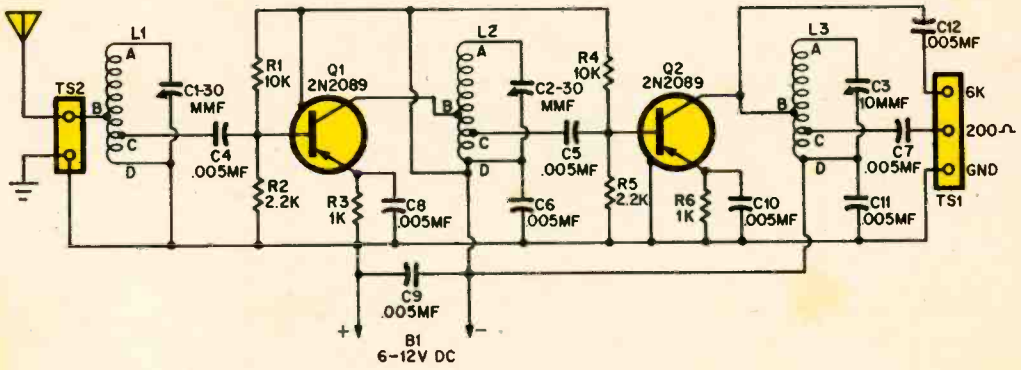
Construction has been simplified by mounting all parts on a perforated board. When completed, the board can be used as a subchassis mounted inside a CB rig or in a Minibox using standoffs as mounting supports. The three coils are closewound on paper coil forms with the taps at the end of the coil nearest the mounting. Be careful not to bend the lugs too much when mounting the coil as the form may separate from its mounting base. The layout shown in the pictorial should be followed closely, except that the socket of transistor Q1 should actually be installed between L1 and L2 for the shortest possible leads. It's important that the "ground side" of trimmer capacitors C1, C2 and C3 be connected to the bottom end (D) of coils L1, L2 and L3. See photo. If this is not done hand capacitance effects will make tuning difficult.

Coupling capacitors C4 and C5 carry RF and must be kept away from ground leads and RF circuitry or coupling from the capacitor body will reduce gain or cause oscillation.

DC Check. Once the unit has been completed, check the DC operating point first. This can be done by measuring the DC

Photo of author's prototype of Booster differs slightly from pictorial below. Most wires are run on reverse side of perforated board and transistor Q1 is located between L1 and L2. The photo should be followed, particularly in the placement of trimmers C1, C2 and C3.

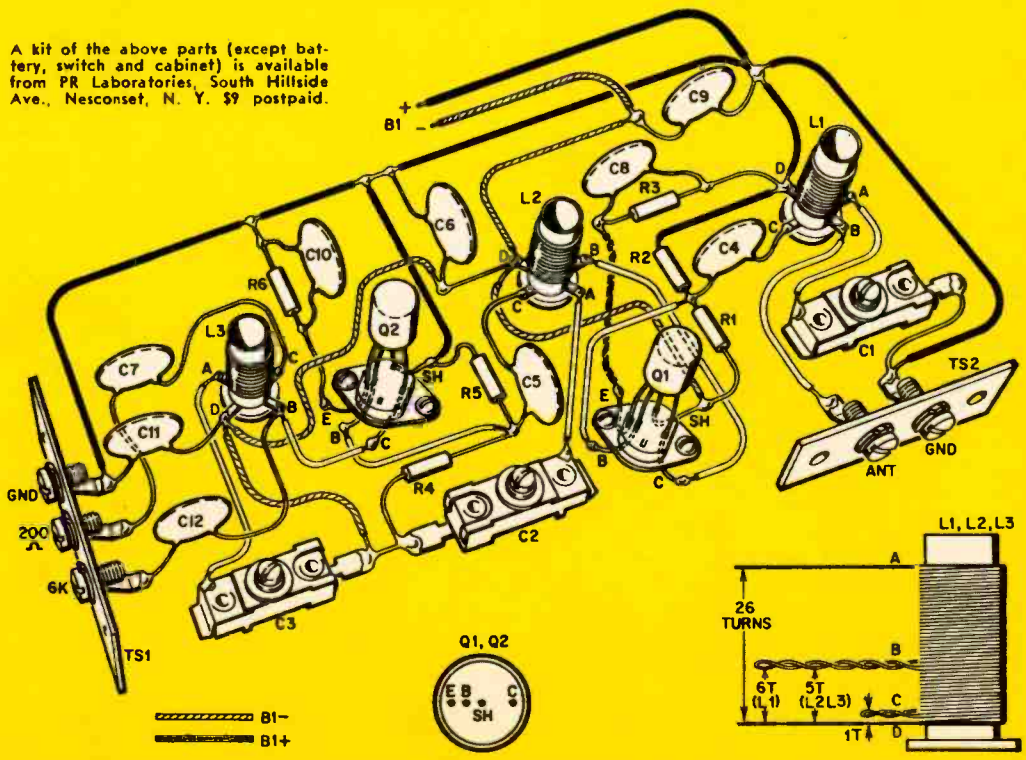
In the pictorial below, for the sake of clarity the component and other interconnecting leads are shown longer than required. In this unit, as in all RF devices, leads should be short and run direct as possible. The taps on the coils should be connected to the lettered lugs.

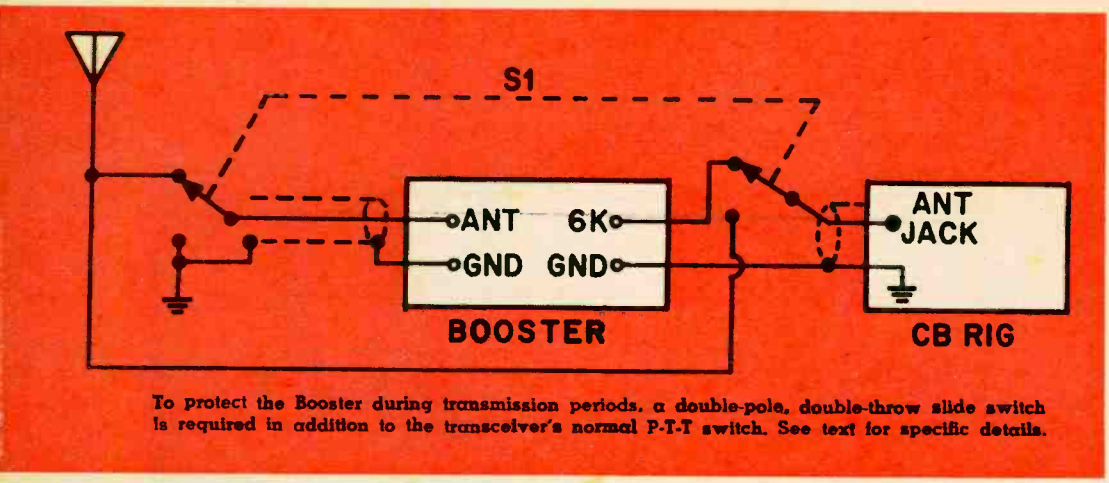


PARTS LIST

R1,R4—10,000 ohms resistor, ½ watt, 10%
R2,R5—2,200 ohms resistor, ½ watt, 10%
R3,R6—1,000 ohms resistor, ½ watt, 10%
C1,C2,C3—2-30 mmf trimmer capacitor
C4 to C12—.005 mf low-voltage ceramic discs or .0047 mf tubular types
Q1,Q2—2N2089 transistor (Amperex)
L1—.285" dia. Cambion coil form, SPC-2J4L, slug removed; 26 turns closewound #28 enam. wire tapped at 1 and 6 turns
L2,L3—Same form as L1; 26 turns tapped at 1 and 5 turns
TS1—3-screw terminal strip
TS2—2-screw terminal strip
Misc. — Perforated board (approx. 8½"x2½"); flea clips; plastic cabinet two 4-lead transistor sockets, hardware, etc.

A kit of the above parts (except battery, switch and cabinet) is available from PR Laboratories, South Hillside Ave., Nesconset, N. Y. $9 postpaid.





To protect the Booster during transmission periods, a double-pole, double-throw slide switch is required in addition to the transceiver's normal P-T-T switch. See text for specific details.

voltage across R3 and R6. At a supply voltage of 6 volts, the voltage across each of these resistors should be approximately 1 volt. Or, with a supply voltage of 12 volts, the reading will be about 2 volts. The voltages across R2 and R5 should be .25 volts higher than those across R3 and R6.

Tuning the Booster. To adjust the tuning capacitors (C1, C2, C3) connect the Booster's 6K output and *Gnd* terminals to a short length of coax cable fitted with a plug to match the antenna input jack of the CB receiver. The receiver should be tuned to a center band channel. A transmitter on the same channel can be used as the signal source if it is kept at least 10 feet away from the Booster. No antenna should be used for the booster at this step. Capacitors C1, C2 and C3 should be now adjusted for maximum signal as determined audibly or read by the receiver's S-meter.

If a signal generator is used as the signal source, an 18,000 ohm resistor should be used between the generator's hot lead and antenna terminal of the Booster. In addition, a 12 mmf capacitor should be installed across the antenna and ground terminal of TS2.

Using the Booster. With transceivers, special precautions must be taken not to damage the booster's transistors when transmitting. The simplest solution is to connect a DPDT switch as shown in the diagram. This switching arrangement will work with practically all receiving systems. The booster input is shorted during transmission when the DPDT switch is thrown to the *xmit* position. Use a DPDT slide switch or other low capacitance type as both the RF input and output of the booster go through it. S1 is shown set for *receive*.

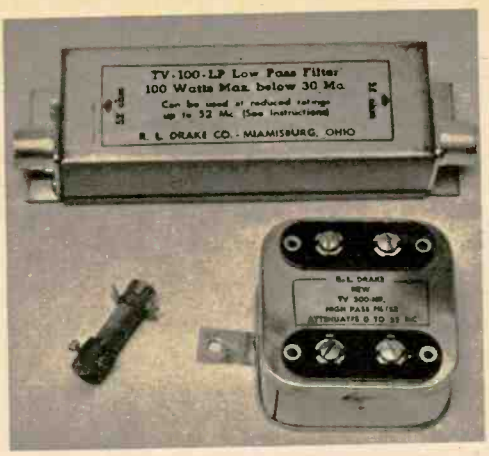
Standard antennas, including whips, are connected to TS2. An antenna with a loading coil or one which reflects a low impedance because of mismatch or overlong transmission line is connected directly to tap C on L1. Either connection is made via the slide switch mentioned above.

If your rig is transistorized, the 200-ohm output terminal on the Booster can connect directly to the base of the RF input transistor. As an alternative on a handi-talkie type rig, the 6K output of the Booster can be connected directly to the whip antenna. *Gnd* on the Booster connects to the ground of the CB unit. Super-regen receivers will probably only be able to operate with the direct antenna connection.

There are several inexpensive handi-talkies which use the super-regen receiver stage as their transmitter. Don't expect the Booster to be of much help.

When receiving strong stations, the Booster may provide excessive amplification and cause blocking in the CB rig's input stage. This problem is easily solved by reducing antenna length or by dropping the voltage feeding the Booster.

HOW TO GET RID OF CB TVI



Ten bucks plus a few minutes of work will rid you of that nagging interference problem.

By Bert Mann

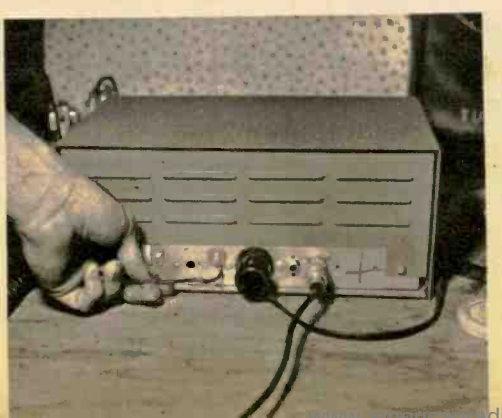
WHAT do *you* do when you get complaints about television interference (TVI)? Many Citizens Banders tremble when they hear the term. Actually, a CB rig's 5-watt input creates only marginal TVI and its elimination is neither difficult nor costly.

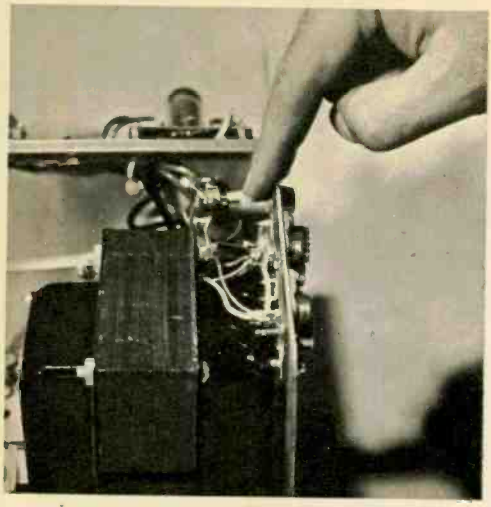
CB TVI has two primary causes: second harmonic radiation from the transmitting antenna and TV receiver overload. In addition to a 27-mc signal, your transmitter produces harmonics—multiples of 27 mc. The second harmonic is 54 mc, which falls on TV channel 2. It can cause a herringbone pattern. TV receiver blocking, which produces a herringbone or a negative (reversed) picture, is caused when your 27-mc signal gets into and overloads the TV's tuner.

To eliminate harmonic output of your transmitter, start with a good ground. Without it, all efforts will be in vain. Use a ground rod or a cold-water pipe and a grounding clamp. Scrape the pipe clean or attach your ground wire (a grounding braid or No. 8 electrical wire) to the bright-metal part of a valve for good contact.

A 54-mc trap installed between the transmitter's final output tank circuit and the coax antenna connector, *as close as possible to the connector,* will prevent most harmonic power from being fed to the antenna. The best trap is a specific tunable coil (Lafayette Radio HP-59; 49¢) shunted by a 25-mmf, 600-volt (or

Regardless of the transceiver type, the first requirement for elimination of TVI is a heavy ground wire from the set (see photo below) to a cold-water pipe (photo right) or ground rod.





A 54-mc trap (small cylinder just under finger) is installed in the transmitter's output lead as close as possible to the coaxial jack of the rig.

A low-pass filter will give you maximum harmonic attenuation if it is installed properly on your transceiver. You must have a firm bond between the cabinet and filter. It may be necessary to scrape paint off the cabinet at mounting spot.

The final ingredient of our anti-TVI formula is a high-pass filter (at right) for installation in television sets. It must be mounted as close as possible to the input of the TV tuner; its case is grounded to tuner via a special grounding tab.

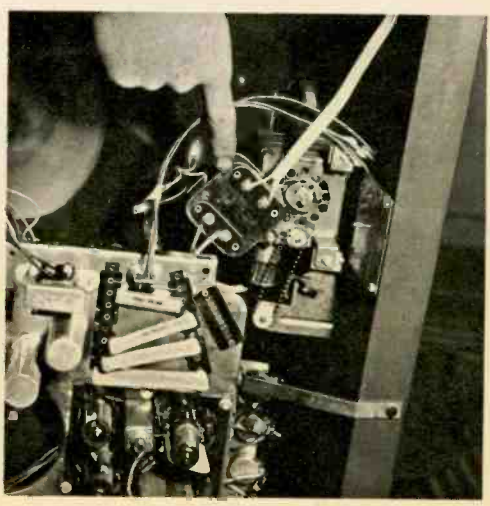
higher) disc capacitor. With the rig grounded, the antenna connected and the transceiver cabinet in place, adjust the trap's slug for minimum TVI on your own TV receiver.

A low-pass filter—a device which passes the CB signal but attenuates its harmonics—will eliminate any remaining harmonic interference. Good low-pass filters are made by several manufacturers (we show R. L. Drake's TV-100-LP; $5.95) but all must be attached to the transmitter cabinet, permitting a good ground bond between the two. The coax between filter and transmitter should be as short as possible, with the coax shield soldered to the connectors.

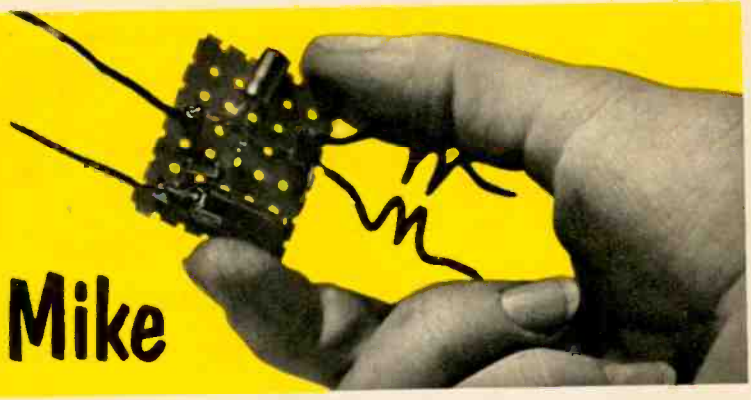
Any TVI that remains is caused by TV receiver blocking due to your fundamental 27-mc signal. The answer is a high-pass filter to prevent the signal from entering the TV tuner. This installation is the TV set owner's responsibility, of course, but you can assist his serviceman by seeing that he gets the right filter correctly installed. Our recommendation is R. L. Drake TV-300-HP, which sells for $3.97 (it is shown in our photos).

An HP filter must be installed *inside* the TV *on* the tuner (*not* at the antenna terminals) and grounded to the tuner. In an AC/DC receiver, the filter's case is grounded through a .005-mf capacitor.

With just an evening's work and a little care you can banish TVI forever!



Switch to a Better Mike

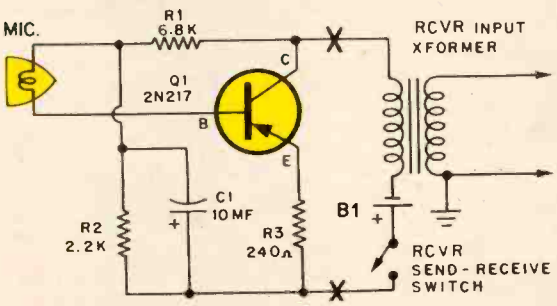


MANY an early CB rig is gathering dust because of the poor audio quality delivered by its carbon microphone. Converting the rig to use a ceramic mike is one answer, but the job may be more trouble than it's worth. However, by replacing the carbon mike element with a controlled-magnetic microphone cartridge and adding a simple one-transistor amplifier you can enjoy the advantage of a rig with lots of clean "talk power." Both the new magnetic element and the amplifier probably can fit inside the old carbon mike case.

No additional battery is needed to power the amplifier since the transceiver's original carbon microphone voltage supply is used. The amplifier is built on a small section of perforated board, with flea clips as tie points. Layout and wiring is not critical, but protect Q1 from heat damage by placing an alligator clip or similar heat sink on Q1's leads when soldering.

The amplifier has no common ground lead and hence may be connected to the input transformer regardless of the polarity of the DC supply. It is important however, that Q1's collector be connected to a *negative* voltage.

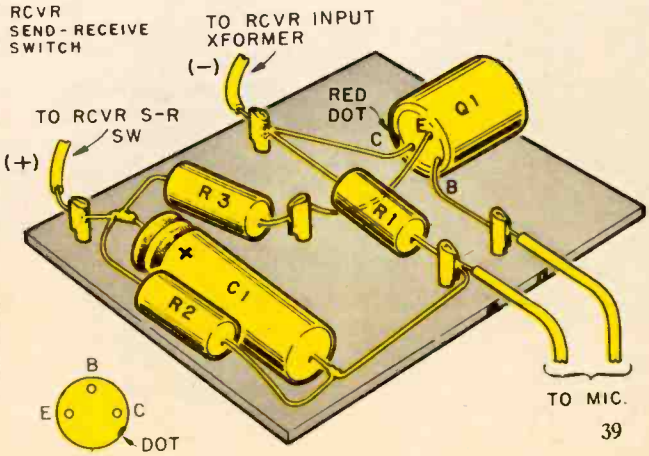
—*Chet Stephens*



The preamp joins the original input circuit at the points marked X in the schematic. A jack for the original carbon mike, if present, may be used or direct connection to the circuit may be made at these points.

PARTS LIST

Resistors: ½ watt or lower, 10%
R1—6,800 ohms
R2—2,200 ohms
R3—270 ohms
C1—10 mf, 6 VDC capacitor
Q1—Transistor—2N217, 2N109 or equiv.
Mic.—Magnetic type replacement cartridge (Shure R5 or low-impedance type)
Misc.—Perforated board; flea clips



BASIC CB CIRCUIT THEORY

Theory can be downright practical! Here's the inside story of the electronics found in the basic Citizens Band transceiver.... Part 1

By Len Buckwalter, 1W5733

WHY BOTHER with theory when all you have to do is push the mike button and start talking? There are good reasons for theory—for knowing how your station operates is the first step in dealing with the troubles that are bound to arise. Theory gives you the basic know-how when you are buying, modifying, troubleshooting or installing equipment.

Three CB Voltages

In any rig, from a tiny handi-talkie to a $300-plus unit, you'll find three forms of electrical energy. These may appear singly or in combination.

Audio Frequencies (AF). Any time you speak into a microphone, electrical currents are produced which vary in accordance with the pressure (volume) and frequency of your voice. Microphone signals begin at a level of a few thousandths of a watt and ultimately are boosted to two or three watts at the plate of the modulator tube.

Radio Frequencies (RF). In CB an RF signal of about 27 megacycles provides the carrier which transports the AF signal through space. If an AF voltage were introduced into an antenna it simply would radiate a weak field for a few feet. RF, however, gets out—and goes! There are other RF frequencies in a CB rig, notably in the receiver, which we will investigate later.

Power: AC & DC. No circuit will operate without some source of power. In a CB rig the power may be derived from the AC line or a car battery but, in every case, it must be processed in a form suitable for operating a tube or transistor.

The Transmitter

Illustrated in Fig. 1 is a typical transmitter section. Feeble AF currents developed at the mike are fed to the mike preamp, which gives them a considerable boost and applies them to the modulator. The amplifier-modulator stages are conventional audio amplifiers with an audio output of approximately 2.5 watts. This power is used to impress the AF energy on the RF carrier.

Now let's trace the source of the radio-frequency energy. As any CBer knows, without a crystal you can't transmit. So let's look at the crystal first. A small piece of quartz can be cut to act as an electro-mechanical resonator. When an RF current is passed through such a crystal, it vibrates at a precise frequency determined by its physical characteristics.

This may come as a surprise, but CB crystals are *not* cut for 27 mc. The quartz sliver needed to produce this frequency would be so minute that it could not pass sufficient current without fracturing. Instead, the crystal is cut for one-third the operating frequency, or approximately 9 mc. As the crystal vibrates at the fundamental 9 mc, it also produces several *overtones* or multiple harmonics. The third

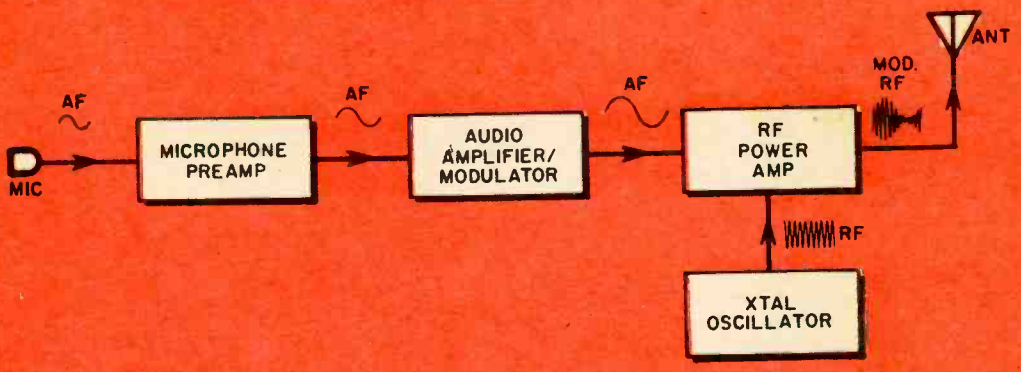


Fig. 1. Block diagram of the transmitter section of a typical transceiver. Switching is not shown.

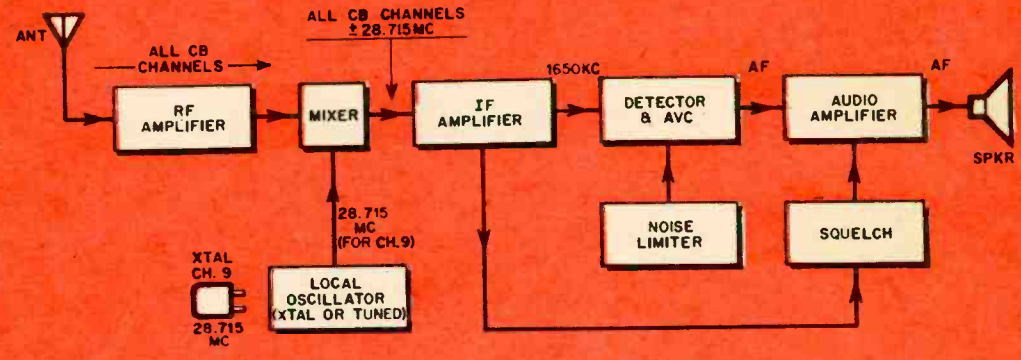


Fig. 2. Typical receiver section. Note the relative complexity in comparison to the transmitter.

such harmonic is at 27 mc (3×9mc=27mc). This 27-mc signal is introduced to the RF power output amplifier, where its strength is raised as close as possible to the full 5-watt carrier level permitted in CB. During the final processing, audio is impressed on this RF carrier. The audio signal from the modulator tube aids or opposes the ability of the RF tube to amplify by varying its plate voltage. The result is a shaping of the RF signal's amplitude to make it mirror the audio—called modulation. Note that the RF *frequency* doesn't change—just its amplitude. Hence the term—amplitude modulation. The audio signal must have a power level about half that of the 5-watt carrier to achieve 100 percent modulation. Fed to the antenna, the modulated carrier is then radiated.

Receiver

The block diagram of Fig. 2 is representative of the superheterodyne circuit found in most modern transceivers.

The signals at the antenna vary from a few microvolts to more than 100 microvolts—enough to pin the S-meter. As shown in Fig. 2, every signal on the band—channel 1 on 26.965 mc to 23 on 27.255 mc—is applied to the RF amplifier. At the output of the RF amplifier tube they are presented in amplified form to the mixer.

Tuning Tricks. Now the problem is how to get rid of 22 undesired channels and leave the desired one. Some inexpensive super-regenerative type receivers use a tuned RF amplifier, but such rigs are prone to co-channel interference due to

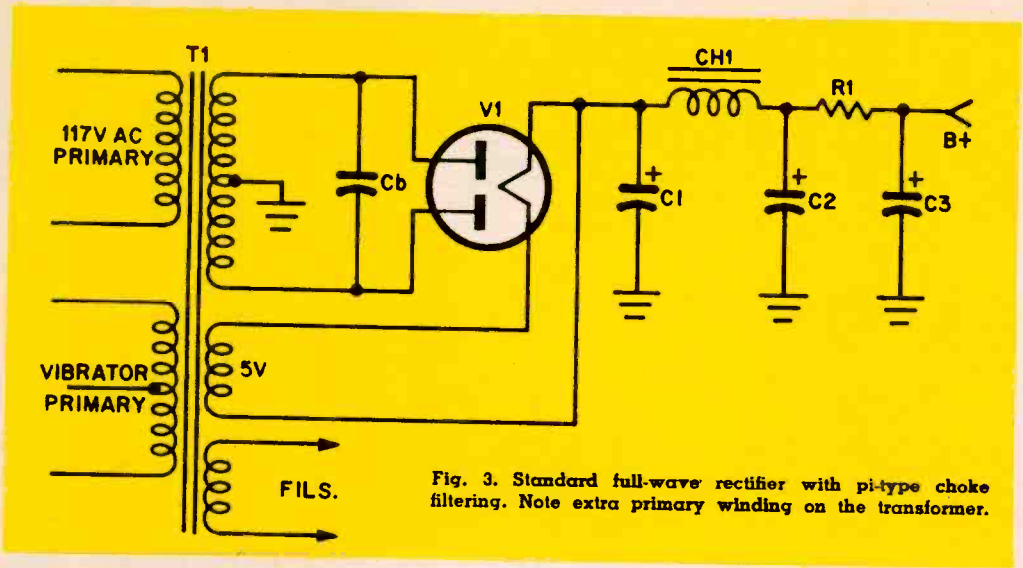


Fig. 3. Standard full-wave rectifier with pi-type choke filtering. Note extra primary winding on the transformer.

inadequate selectivity in the stage.

The problem is this: as the frequency of a tuning circuit increases, its *selectivity,* or ability to separate close-spaced signals decreases. CB's frequency of 27 mc is relatively high. More than 40 years ago Major Edwin H. Armstrong solved this problem by developing a circuit that converted the received signals to a lower frequency, where tuned circuits could be razor sharp. This is the theory behind the superheterodyne receiver.

Assume that 9 is the desired channel. At the output of the RF amplifier (see Fig. 2) all CB frequencies are present. At the output of the mixer, they're all still present, but they've been mixed with an oscillator signal. Among the many signals resulting from the beating of the CB frequencies with the oscillator signal, only one is at 1650 kc—and that is the channel 9 signal. A receiver crystal (cut precisely 1650 kc *higher* than channel 9) switched into the local oscillator did the trick. As we'll see in a moment, only the 1650 kc signal can penetrate further into the receiver.

Other channels are selected by switching other crystals into the local oscillator circuit to generate the appropriate IF (which always is the difference between the original CB signal and the oscillator frequency). For example, channel 2 on 26.975 mc requires a receive crystal of 28.625 mc—again a 1650 kc difference. In CB rigs with a continuous tuning dial in addition to the crystals, the local oscillator is the tunable element and when tuned across the band produces a signal always 1650 kc higher than that indicated by the channel numbers on the dial. The same theory applies, of course, to CB rigs using 455 kc or other IF frequencies.

Next in the receiver lineup is the IF amplifier. This section is tuned to the IF frequency and rejects everything else. Considerable amplification occurs in the one or more stages of the IF "strip."

Two for the Money. The quality of a CB receiver usually is reflected in the number of IF stages. The more IF's, the greater the selectivity. In the more elaborate systems, double conversion is used. Here the received channel is converted twice, producing two IF frequencies. This insures good image rejection —a problem peculiar to superhet circuits with sensitive IF strips. An image is a station *outside* the CB band which mixes with the local oscillator signal and produces a result at the receiver's IF frequency. For an example, let's say a commercial teletype station is transmitting on 30.365 mc. If some of this energy reaches the mixer it combines with 28.625 mc (receive crystal for channel 9) generating (among others) a 1650-kc

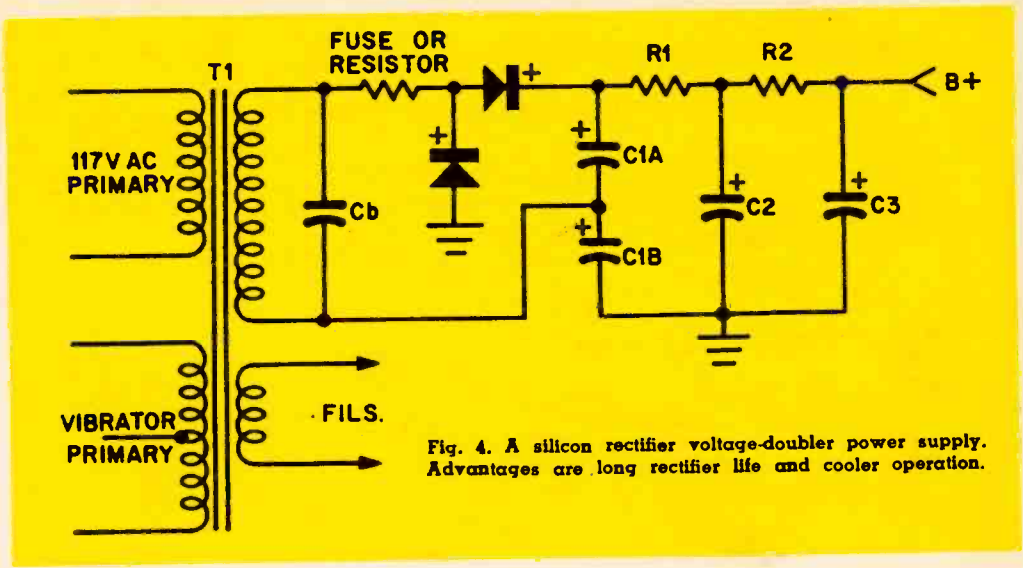


Fig. 4. A silicon rectifier voltage-doubler power supply. Advantages are long rectifier life and cooler operation.

difference signal, which the IF strip accepts and amplifies. In the transceiver's speaker the teletype signal is heard as if it were transmitted on channel 9.

The double-conversion technique meets the problem with *two* IF frequencies. The first is high, to cut out images, and the second low to preserve selectivity. Typical double-conversion IF frequencies are 4 mc followed by 455 kc.

The signal next encounters the detector. It is the detector's job to strip away the RF envelope from the audio. The separation of RF and AF is achieved by the rectifying-filtering action of the detector. The audio signal fed to the audio amplifiers starts out at about .5 volts more or less and is boosted to two or three watts of power at the speaker terminals.

Limiting and Squelching. Two refinements in the block diagram of Fig. 2 deal with problems of noise. The noise limiter, which is tied into the detector, relies on the fact that noise (mostly from auto ignition and other electrical machinery) has peaks higher than the signal itself. The limiter, which effectively clips off anything above a given level, kills these peaks. Although noise still comes through, its audible effect is greatly reduced when both signals are equal.

Atmospheric hiss in the absence of signal is muted by action of the squelch. Tied into an audio stage, the squelch switches the tube on and off, depending on the absence or presence of a signal. An IF stage supplies the control signal, as explained in Part 2.

The Power Supply

The circuits of the transmitter and receiver sections of the CB rig depend on a power source—a battery or AC power line. In either case, the raw power must be converted into a form the tubes can use. The simplest design (see Figs. 3 and 4) is for operation from the power line.

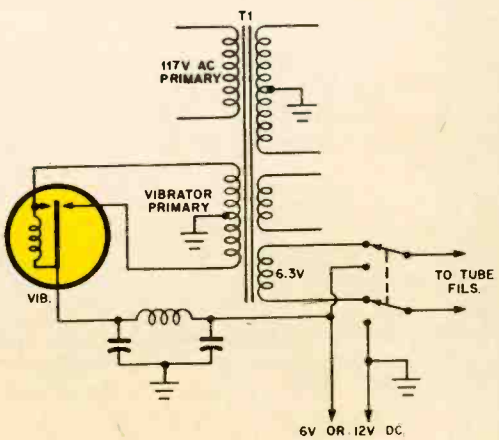


Fig. 5. Vibrator hookup showing filament switch.

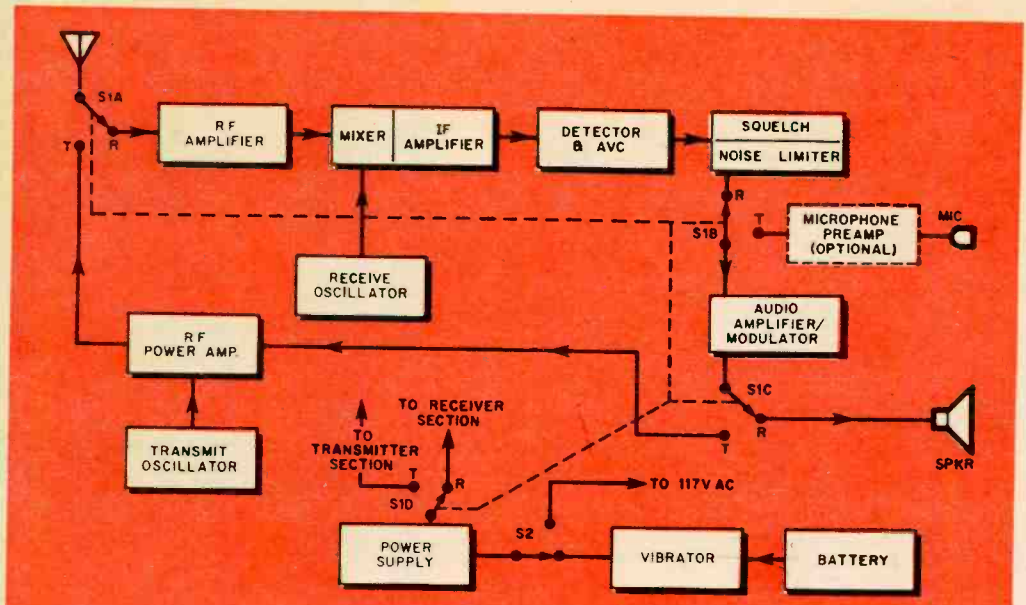


Fig. 6. Complete block diagram of a typical transceiver. S1 switches from transmit to receive.

Starting with the 117-volt AC line, power is applied to a transformer primary. A standard full-wave rectifier (Fig. 3) produces 250 volts DC or higher for the tube plates and screens. One or more filament windings supplies the low-voltage AC required by the tubes. Figure 4 is a voltage-doubler type of supply using silicon rectifiers.

Figure 5 is the same supply now set up to operate on a 6- or 12-volt DC car battery. Since power transformers cannot operate on pure DC, a vibrator's moving contacts chop the battery current into pulsed DC—a form acceptable by a transformer. In some cases, the vibrator is replaced by a transistor oscillator to achieve the same effect. Note that Fig. 5 is quite simplified and that most noise filtering elements have been omitted. The vibrator supply may be separate or built into the transceiver.

Simply plugging in the AC line cord or battery connector (via a cigarette lighter adaptor plug) makes the conversion from AC to DC operation. At the ends of both line cords you'll find an octal socket. When plugged into its male counterpart mounted on the transceiver's rear apron, the jumpers wired into the socket automatically make the correct filament and transformer primary connections.

Switching

How the switching system unifies the transceiver and allows certain sections to be shared is shown in Fig. 6. Switch S1 corresponds to the send-receive relay—or manually operated push-to-talk switch. Each section is shown in the *receive* position.

Beginning at the antenna we note that S1A switches the antenna. On transmit, the antenna picks up the signal from the transmitter's RF power amplifier. (The audio amplifier/modulator is similarly switched by S1, sections B and C.) In the receive position, signals from the receiver detector are fed to the audio amplifier and subsequently passed to the speaker. However, when S1B and C are set to transmit, the audio amplifier is placed at the disposal [*Continued on page* 118]

16db SPEECH COMPRESSOR

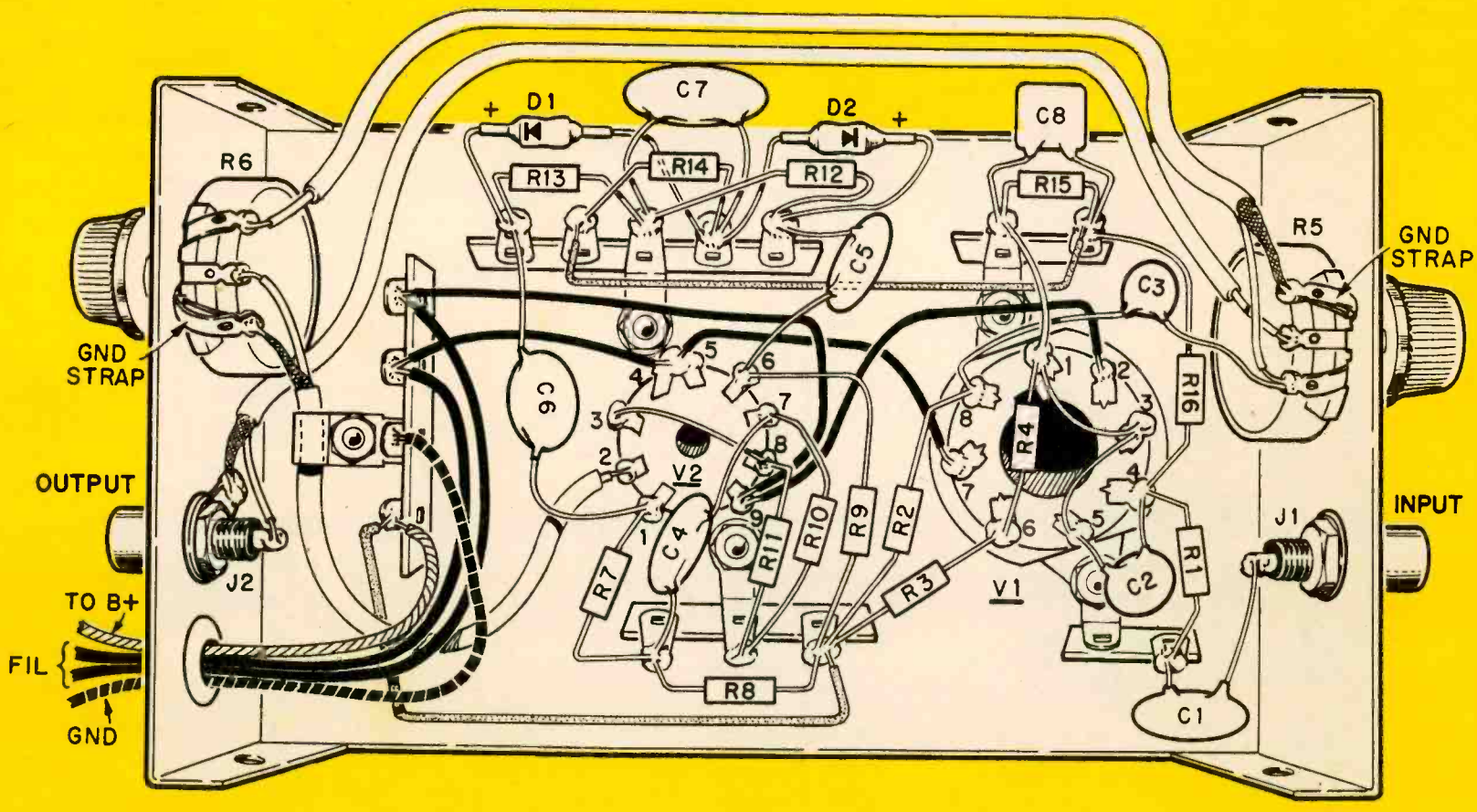
Novel circuit gives you the biggest 5-watt signal on the air.

By Herb Friedman, 2W6045

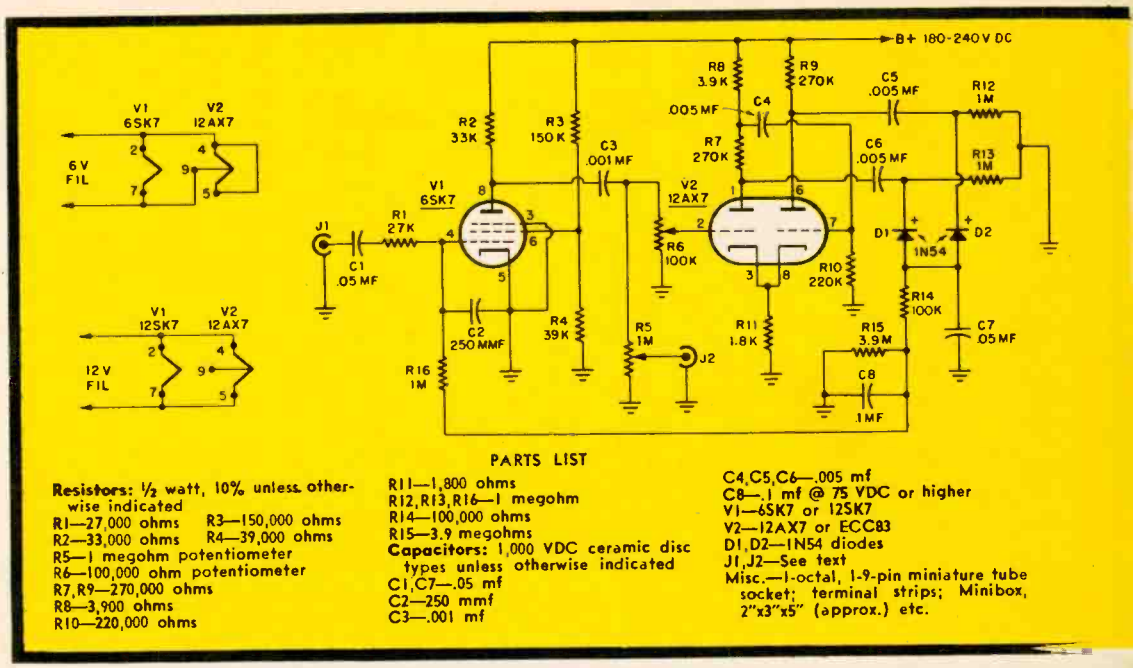
WITH MORE AND MORE stations getting on the air, the normal CB problems of short range and interference are compounded. In fact, in metropolitan areas it's frequently difficult to get solid copy even on the shortest-range contact. But now, by adding EI's Speech Compressor you can cut through the interference and considerably extend your solid copy communications range. Speech compression modifies your rig's modulation in such a manner that the *effect* is equivalent to a large increase in power output.

When you say a CB transmitter's signal is modulated 100%, you refer to the situation when audio power is at its *peak*. The *average* power is another factor—usually about 10db less than peak, producing 30% modulation. Our speech compressor lowers (not clips) the peaks, permitting average modulation to be moved up toward 100%. The effect is a signal that is all audio and one that stands out from others. With the usual CB microphone and EI's compressor, up to 16db compression can be obtained. If you suddenly raise your voice, additional compres-

Compressor is shown in use with an Olson Electronics transceiver.



Filament leads (shown wired for 6 volts) should be twisted tightly to prevent hum. Note grounding lugs on pots and single grounds on the shields.



PARTS LIST

Resistors: ½ watt, 10% unless otherwise indicated
R1—27,000 ohms
R2—33,000 ohms
R3—150,000 ohms
R4—39,000 ohms
R5—1 megohm potentiometer
R6—100,000 ohm potentiometer
R7,R9—270,000 ohms
R8—3,900 ohms
R10—220,000 ohms
R11—1,800 ohms
R12,R13,R16—1 megohm
R14—100,000 ohms
R15—3.9 megohms

Capacitors: 1,000 VDC ceramic disc types unless otherwise indicated
C1,C7—.05 mf
C2—250 mmf
C3—.001 mf
C4,C5,C6—.005 mf
C8—.1 mf @ 75 VDC or higher

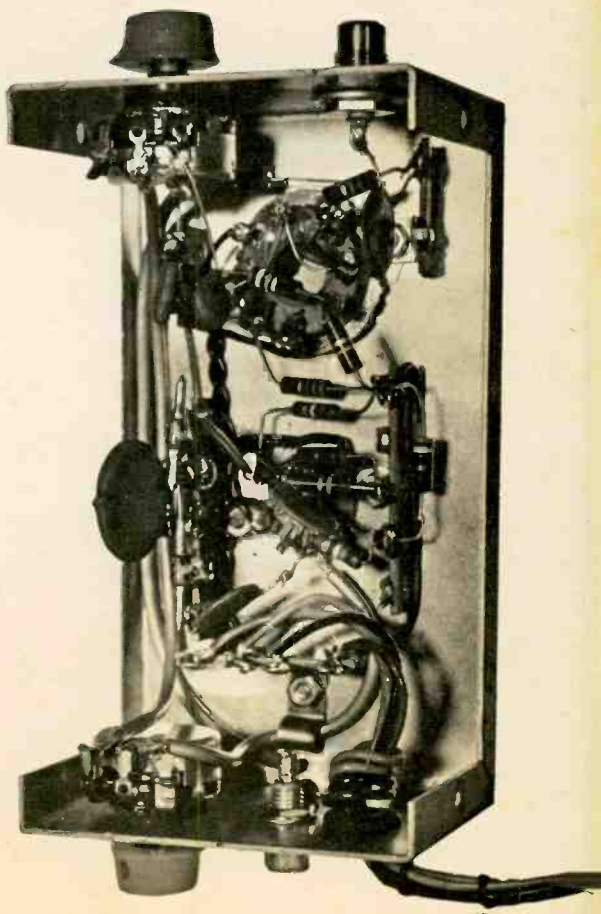
V1—6SK7 or 12SK7
V2—12AX7 or ECC83
D1,D2—1N54 diodes
J1,J2—See text
Misc.—1-octal, 1-9-pin miniature tube socket; terminal strips; Minibox, 2"x3"x5" (approx.) etc.

sion is brought into the act. Not only is there a higher average modulation percentage, but distortion-producing overmodulation is forestalled.

Construction. The speech compressor is built in a Minibox with the tube sockets spaced and oriented so the terminal strips do not interfere with each other. For wiring ease, cut off the center ground post (if present) of V2's socket. Microphone input jack J1 and volume control R5 are mounted side by side, as are compressor output jack J2 and compression control R6. If you intend to use the compressor with a push-to-talk rig, J1 should mate with the microphone plug and J2 should have enough terminals to handle the push-to-talk leads.

Since V1 *is* an amplifier, care must be taken to avoid hum pickup. Run the filament leads as shown, but twist them together tightly, keeping them away from V1's components and J2. Even if one side of the filament circuit is grounded at the transceiver, do *not* ground the compressor's filament to the Minibox.

Notice that the three shielded leads shown in the pictorial have an insulating outer covering and that the shields are grounded at only *one* end. To make wiring easy, use thin insulated phono



cable for the shielded leads. When soldering D1 and D2 use a heat sink, such as an alligator clip, on each diode lead.

Tube V2 usually will not require a shield; however, a poorly grounded transceiver or a poor antenna system can cause RF hum. If this occurs shield V2.

Installation and Checkout. Connect the filament leads across the transceiver's filament supply and the ground lead to the transceiver chassis. The compressor's B+ lead is connected to the transceiver's power supply at the point of maximum filtering (this is where the transceiver mike preamp's plate load resistor connects to B+).

Set controls R5 and R6 to full counterclockwise (off). Connect a modulation percentage indicator to the transceiver's output. With the mike in its usual position, speak in a normal voice. Advance R5 until the modulation meter reads 100% on speech peaks. Turn R6 full clockwise and the per cent of modulation will fall considerably. If you are speaking close to the microphone the peak modulation should indicate below 30% (12-16db compression). Advance R5 until the modulation peaks at 85%. At this setting you will have nearly full compression and the 85% setting leaves you a 1.5db safety margin. If you raise your voice, this margin will reduce the chance of overmodulation distortion.

If you do not have access to a monitor meter, the following adjustment procedure will give satisfactory results. Set your VTVM to the AC function on the highest range, connect the AC probe to the plate of the modulator tube (usually a 6AQ5) and the meter's common lead to the chassis. Connect the microphone directly to the transceiver and, using a dummy load, transmit in the normal manner. Note the peak reading on the VTVM as you speak. This reading will be assumed to equal 100% modulation. Next, connect the compressor and set R6 for maximum compression. Speaking as before, advance R5 until the VTVM indicates the same reading on speech peaks.

If you feel you do not need full compression on short-range contacts, an intermediate setting of R6 reduces compression. Keep in mind that as you reduce compression R5 must also be reduced or the transmitter will overmodulate. (Overmodulation sounds extra loud on short-range contacts but is just a mess of distortion when your signal is weak.)

EI's compressor is designed to operate with microphones supplied with CB transceivers or with such high-output types as the Astatic D-104, the Sonotone CM-30 and the Turner 350C. It will not perform satisfactorily with low-output microphones. Since the compressor provides gain, do not operate with R5 wide open or you will get distortion from overmodulation and overdrive.

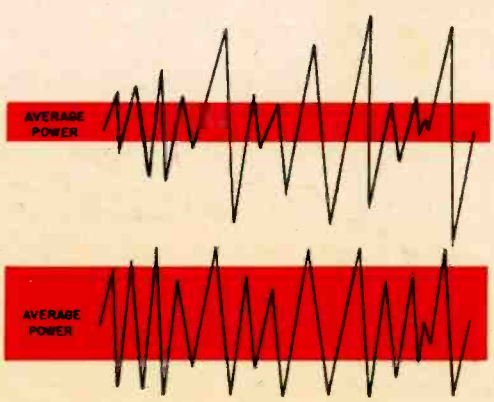
THEORY

V1 is a variable-gain preamplifier whose output is fed through volume control R5 to the transmitter via J2. V1's output signal also is fed through compression control R6 to V2, an amplifier phase inverter.

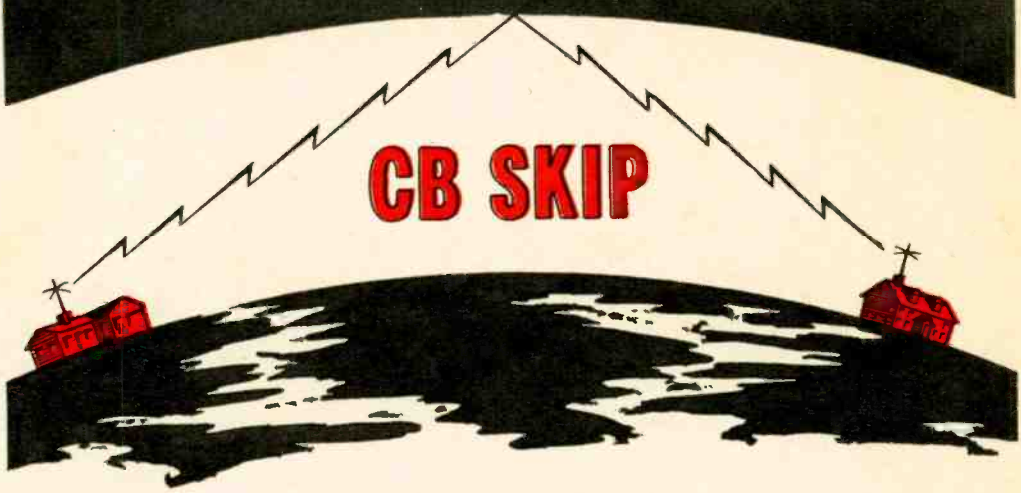
The signal at both plates of V2 is rectified by D1 and D2. The resultant DC is fed back via R14 and R16 to vary V1's grid bias, thereby controlling its gain. With R6 off, no signal is fed to V2 so there is no DC control voltage and V1 operates at full gain.

The use of the phase inverter permits both the positive and negative peaks to be compressed, rather than the negative peaks only, as is the usual case. This system eliminates distortion common to single-peak compression and provides a higher level of control voltage. Further, the frequency response is changed automatically to maintain maximum communications effectiveness. Under full compression the low frequencies are attenuated slightly to give a crisp sound. If the voice signal falls extremely low —below compression level—the low frequencies are attenuated sharply.

The waveforms at right show the difference in effective average power in a non-compressed signal (top) and a compressed signal (bottom).



THE TRUTH ABOUT CB SKIP



Some straight talk about the headache thousands want to enjoy!

By David Walker

LURKING some 80 to 200 miles above the earth is an invisible battlefield of Citizens Band radio. Scattered here in bits and pieces and layers is the ionosphere, the strange collection of atomic fragments that intercepts radio signals and bounces them back to the ground, producing a phenomenon known as skip.

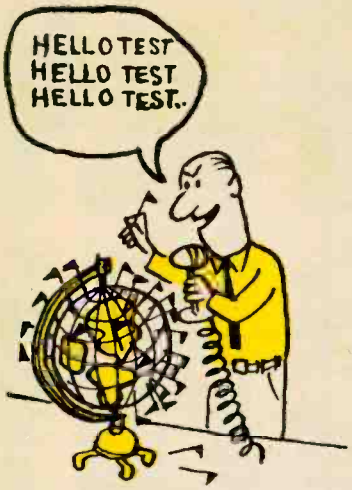
Skip is one of the biggest controversies in CB radio—always has been and probably always will be. To some licensees it's pure pie-in-the sky; to others it's a confounding source of annoyance. Most CBers simply view skip as a legal enemy and try not to fraternize—at least not so anybody will find out.

It's improbable that there is one active CBer who does not know the Federal Communications Commission's position on working skip. FCC rules say in unmistakable terms that it is illegal. And we all know if you get caught in the act you lose your license. Yet when you monitor the band you find that thousand-mile contacts persist in spite of all rules and threats.

Compiling meaningful facts and figures on those who work skip is a little like interviewing errant husbands on their follies. What they tell the boys at the bowling alley, what they tell a man with pencil and paper in hand, and the truth of the matter never seem to jibe.

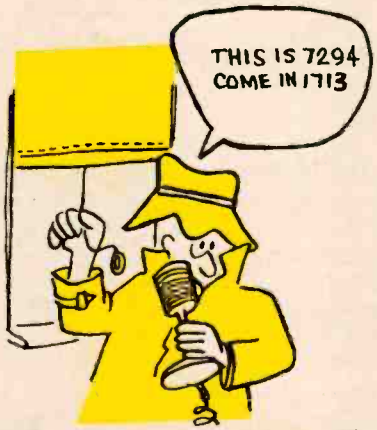
CBers do hear a lot of talk about skip, and once in a while you see something in print on the subject, which might lead you to believe that going after the long contacts is something practically everybody does. I do not share that view. As an educated guess, I would say much less than half of all active CBers have *ever* made a single skip contact. By active, I mean those who have their own equipment and get on the air frequently—a consideration which eliminates many of the 300,000-plus men and women who hold licenses. I would estimate something like one-fourth of this group has at some time made other than a local contact.

The main reason you hear so much about skip lies with an extremely small minority who get hooked on DXing like junkies take up heroin. For them, days when the band is not open are like



quick-withdrawal at Lexington. But carrying out these nefarious activities is only part of the game for the real addict. He also likes to talk about his little hobby, and talk and talk and talk—except when an FCC monitoring car or a reporter type appears. It's the well-known situation where a minority can sound like an overwhelming majority if they talk long enough and loud enough. Even so, thousands of CBers have worked and are working skip and a good many others would like to try their hand if they knew how and dared.

The irresistible siren call shrilled at the innocent CBer when long-distance signals start pouring in can break even the strongest amongst our law-abiding citizens. Confronted with a chance to stretch his measly five-watt power over 1,000 or 1,500 miles, a poor chap's senses start cartwheeling. In the old days he was likely to give a direct call to one of the stations he heard, or perhaps he'd blurt out ingenuously, "Calling CQ!" The FCC's crackdown has pretty much put an end to that procedure. Now there are new techniques designed with an eye toward working skip without losing that prized license.



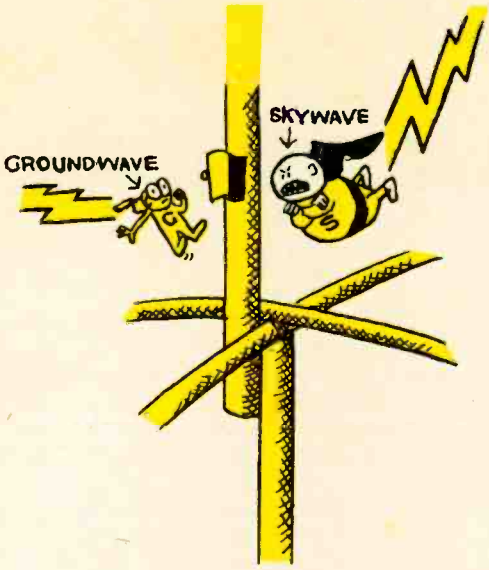
The enthusiastic tester is a prime exhibit of the new school. He *sounds* like he just wants to make sure his rig is working properly as he calls innocently, "Hello test, hello test, hello test." But if conditions are right a co-conspirator a skip away comes on with, "You're coming in fine in Texas!" Only trouble is, the tester's station may be in Maine.

Then there is the prefix dropper. As he works skip stations he uses only the last four numbers of his call. He not only remains anonymous, but racks up two violations on one contact.

An even more intriguing specimen is the sportsman, the gent who gets a bigger kick out of beating the system than making a successful contact. He begins by calling one of his *own* units in the normal fashion. The only rub is the fact that he doesn't *have* any other units. Meanwhile, across the country a fellow sportsman (they exist everywhere) is engaged in the same activity. It doesn't take long for two DX hounds to find each other. But they're too clever to be caught red-handed. With masterful aplomb they proceed to exchange comments indirectly by addressing messages to their non-existent units. It's like being at a cocktail party and talking to one person while hoping someone else will hear.

There is no doubt that working skip is a challenge from aspects other than the legal. At 27 mc, the Citizens Band is far from being an ideal frequency for skip operations, especially at the present time.

As we said earlier, skip signals are a phenomenon caused by the ionosphere, which was first identified by a couple of scientists



named Kennelly and Heaviside. The ionosphere is a region above the earth that reflects radio signals like a mirror reflects light. It is made up of tiny particles of gas which have been ionized by ultraviolet radiation from the sun. In becoming ionized, the particles acquire an electrical charge (a normal atom is balanced, exhibiting no charge) and are conductive. Radio signals of certain wavelengths bounce right off. That's what happens when a CBer hears skip signals. A transmission from a distant station takes off toward the sky, hits the ionosphere and bounces to earth again a few hundred (short hop) or several thousand miles away (long hop). The amount of power in the signal seemingly is a minor consideration. Five-watt CB signals can jump just as far as those from a kilowatt ham rig.

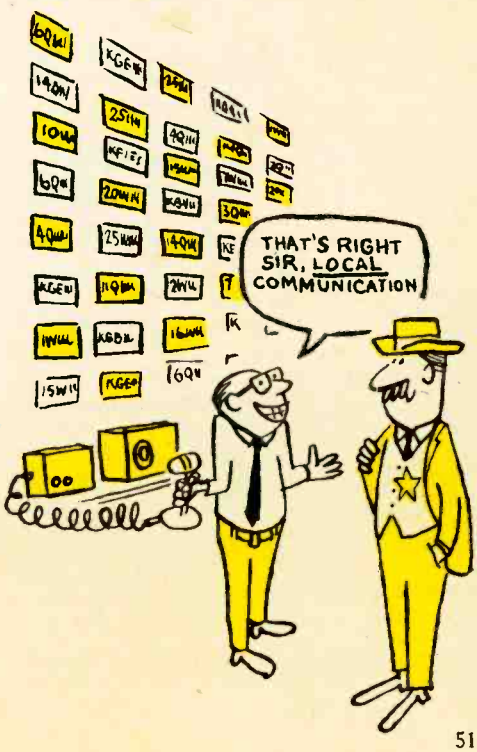
How far do CB signals reach under good skip conditions? We know they've been heard (with readable copy) in several parts of Europe, including the most distant point of Sweden. They also have been picked up in Latin America. California and Hawaiian CBers once communicated almost daily (they theoretically have stopped it now). Here on the East Coast, the Mid-West comes in strong nearly every day, and at times the Southwest and California are heard.

The big variable in skip transmissions is the ionosphere. It keeps changing, sometimes being a good reflector, at other times not reflecting at all. Skip conditions are at their best just after the sun has passed, spraying a big dose of ultraviolet into the atmosphere. This is one reason skip-working is somewhat limited. The best periods are during the day, when most CBers are at work. Nighttime is not usually good for skip.

The ionosphere is a better reflector for signals of certain frequencies than for those at others. Maximum reflection is offered signals between 5 and 17 mc. When you get up to 27 mc you're outside the good-skip spectrum, which is why we say the Citizens Band channels offer a challenge when it comes to DXing.

The ionosphere also is affected by sunspots—the more sunspots, the better are conditions for skip. Sunspots run in 11-year cycles, from maximum to minimum. We're now sliding down a slope. Between 1964 and 1965 we'll hit rock bottom—what scientists call the Year of the Quiet Sun. So CB skip will lessen from now until then, and afterward start improving as the cycle repeats itself.

[*Continued on page* 121]



CB CORNER

BY LEN BUCKWALTER KBA4480

MORE PART 19 REVISIONS

THOUGH the FCC once said there was nothing radical about the changes being contemplated for Part 19 rules for the Citizens Radio Service, the agency's Docket No. 14843 (Notice of Proposed Rule Making) indicates its idea of what radical means varies a little from the norm. If the changes go through, which seems likely, the Citizens Band is in for a shake-up.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington 25, D. C.

In the Matter of

Amendment of Part 19, Citizens Radio Service, to revise Subpart D, Station Operating Requirements, and to make other changes

Copies of Docket No. 14843 (see cut), incorporating the changes, were distributed in a release dated November 16, 1962. With them went an invitation to interested persons to file comments for or against the proposed changes. An original and 14 copies of such statements must be furnished the Commission. Ivan H. Loucks, head of the amateur-CB division, made it a point in a conversation with us to say that the FCC welcomes comments, whether for or against, and considers them seriously. But merely saying you oppose or favor Docket No. 14843 is not enough. The Commission is not trying to obtain a vote before adopting, altering or rejecting the changes. It wants well-thought-out *reasons* why the changes should or should not be made. Deadline for filing comments is January 15.

In an introduction to the proposed changes, FCC Acting Secretary Ben F. Waple says revisions are necessary because of interference on the band, partly due to misuse of operating privileges, which is "so prevalent in some areas as to threaten the continued usefulness of the service." The FCC's own investigations and complaining letters from licensees brought the condition to light, Mr. Waple says. This abuse of privileges, he goes on, in a service as large as CB is bound to destroy its utility.

Of paramount importance in the proposed changes is one which would limit communications between different stations (e.g., KBA4480 to 2W6045) to five channels (12, 13, 14, 15 and 23). Communications between units of the same station (e.g., KBA4480 to Unit 2) could be transmitted on any channel.

The idea here, of course, is to put a damper on pseudo-hamming, skip contacts and idle chatter by cramming the hobby types into a closet-size speck of the band, where they will kill each other off in one good-DX day. To make things more difficult for the long-distance boys, they'll also have to put up with interference from diathermic machines and other radiation-type industrial, scientific and medical equipment, which operates on 27.12 mc and fills the center channels (12-15) with QRM. On channel 23 they'll have trouble from the high-power (30 watts) modelers and other Class C remote-control transmitters. In addition, a new mileage limit would be imposed. Maximum range would be 150 miles for *any* contact.

Under the proposed changes, the 5-minute rule would give way to a new time system. Any communication between two or more stations would be limited to 3 minutes, and the ensuing period of silence would be 5 minutes long.

Phone patches in any form are outlawed in the changes, and so are speech scramblers and all other non-standard methods of coding (the FCC wants to be able to understand what you are saying). Tone control is still approved but the signal is limited to 5-second dura-

[*Continued on page* 119]

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TOP 10 CB CLUBS

AFTER SEVERAL YEARS of observing and being associated with Citizens Band clubs, we at EI are asked repeatedly to name the best one in the country. It's a question no one could answer fairly without spending some time with each club—a formidable undertaking.

But amongst the scores of clubs dotting the countryside from Maine to Hawaii are a few truly outstanding groups, if you consider them from the viewpoint of general activities, interest shown by members and success in achieving goals. Without doubt, these are the *better* clubs. We've chosen ten of them as the top CB organizations in the country. They're listed below, along with a paragraph describing the activities of each. The paragraphs also explain our reasons for putting the clubs on our list. The ten are *not* ranked in order. They're arranged *alphabetically* and all are of equal stature. The month or year following the address is the date of founding.

The Top Ten were selected for accomplishments in recent months—deeds which speak well for the clubs—and after careful observation on our part. Why isn't *your* club included? It may be because you do not have a good public relations program, a must for any organization. A PR program lets the rest of the world know what your club is doing. We *do* hear about the activities of what we consider the more outstanding groups. Are

1 **CITIZENS BAND ASSOC. OF CONNECTICUT**, 379 Pine Tree Dr., Orange, Conn. August 1959. Charles Collins, 1W4265, president. 150 members. Club provides frequency checks for members, assists Civil Defense, auxiliary police, marine emergency groups. The organization is expanding, having established three new chapters in recent months. It seeks other local groups wishing to affiliate. Monthly paper, CBAC Journal, runs technical tips and other useful information, some clever and pertinent humor pieces and bright news items. A woman's auxiliary unit is known as the She-BAC.

2 **CITIZENS RADIO LEAGUE**, Box 28, Northlake, Ill. February 1960. Joe Perry, 18W5527, president. 267 members. Club is affiliated with Northlake CD Communications Group, takes part annually in a Boy Scout Canoe Marathon and performs many other public service deeds. Recently club members participated in the rescue of a boat lost on Lake Michigan, devising a method of transmitter clicks to help locate the craft, which was then towed to shore with one member aboard as radio operator. Monthly paper, CB News & Views, is one of the finest in the country, featuring profiles on members, thoughtful editorials, good light pieces, general articles and news about coming events.

3 **DELAWARE VALLEY CITIZENS RADIO LEAGUE**, c/o Allen Miller, Seabrook Farms, Seabrook, N. J. November 1959. Ed Yoos, 3W1343, president. 75 members. Affiliated with RACES. Club is one of the older ones in the country. It has participated in many types of emergency operations and runs a highly interesting series of demonstrations, picnics, banquets, raffles and prize contests, proving that a good club gives its members opportunities for fun while doing public-service work. A monthly paper is published by the group.

4 **DIXIE COMMUNICATIONS CLUB**, Box 2004, Decatur, Ga. July 1960. Larry Peevy, 6W6576, president. 62 members. Club is Georgia's official Civil Defense unit. Members have participated in several emergency operations. They were on hand when a small boat carrying eight persons was rammed on Lake Burton, they found a man who was lost in Lithonia, provided lights for a search on Stone Mountain and were the first rescuers on the scene when a small plane crashed. When the radio in a police car went out, CB units provided communications. Mobile units are used in helping collect toys for underprivileged children at Christmas. Members receive frequent bulletins on rescue and lookout operations; the club keeps three pages of information on each member, including when he is available for emergency work, his home and business telephone numbers, etc. The club's monthly paper, The Dixie Communicator, carries items about club operations, activities of individual members and some humor pieces.

5 **GREATER DALLAS CB CLUB**, 1318 Michigan Ave., Dallas, Tex. November 1959. Dick Johnson, 10W4075, president. 285 members. Associated with Civil Defense, the Dallas Police Department and the Red Cross, the club in recent months has provided mobiles at 62 schools during a mass polio immunization program (sparing police cars for other duties), helped out during a July 4th fireworks display at the city park and was on hand for a Civil Air Patrol air show. Members monitor channel 11 from 10 p.m. to 1 a.m. nightly, listening for emergency calls. Club's paper, The Broadcaster, is filled with safety tips, operating hints and other useful information.

6 **LANCASTER COUNTY CB CLUB**, Box 202, New Holland, Pa. October 1960. Carl Stief, 3Q0333, presi-

you letting others know what *your* club is doing? If you think your club has been unjustly excluded, write us a letter and tell us about your organization and its activities. In a future issue we'll publish a report on clubs which nominate themselves for our Top Ten list.

A good club, to our way of thinking, need not have an extremely large membership. Nor must it be in a large city or possess fancy gear. The interest, enthusiasm and willingness of the individual members alone decide a club's status.

Our files show there are just over 300 established CB clubs in the country. New groups have a way of appearing almost weekly, but others give up the ghost at about the same rate. Our figure approximates the current average total, though it doesn't reflect the hit-or-miss, sometime clubs which never get fully organized. Average number of members amongst the clubs on our books is 52, making a total of something over 15,000 CB clubbers altogether. Local clubs range all the way from 12 to 350 members.

Annual dues run from the $12 charged by several groups to free membership offered by two clubs. The average is $5.25 and the most-popular fee is $6. Independent clubs outnumber those affiliated with regional or larger organizations by six to one, but six out of ten independents express an interest in joining the right kind of national CB association.

Most clubs meet monthly, though one holds a weekly get-together. Favorite activities include working with local Civil Defense organizations (No. 1) and police departments (No. 2). Nearly all involve themselves also in such community activities as July 4th celebrations, town festivals, parades, Christmas drives and so on. The majority have one big annual club event, such as an eyeball QSO, a banquet, a fair or a picnic, and most maintain some kind of emergency program or team.

dent. 145 members. Affiliated with Civil Defense, the State Police and the Pennsylvania CB Association. Organization was founded as a social club but has since developed a useful program of service work, taking part in searches for lost persons, helping out at fires and after water accidents and providing emergency communications wherever needed. Club's emergency channel, 17, is now monitored by the fire and police departments, constables, sheriff, county prison authorities, Red Cross, Civil Defense and Pennsylvania State Medical Department—indicating how well the group is accepted by local authorities. Unit publishes a monthly paper.

7 LYCOMING CB RADIO CLUB, Box 247, Montoursville, Pa. May 1960. Robert Shearer, 20W1480, president. 80 members. Club works with Red Cross, State Police and West Branch Fire Department, has a frequency meter and members licensed to do frequency adjustments, maintains an emergency communications squad for special assignments, using channel 4. Control station is on a mountain top. Members have taken part in the Montgomery Boat Regatta, Lions Club parades, Civil Air Patrol work (when CAP communications failed), the Montgomery Diamond Jubilee and flood alert work. Club publishes an extensive directory and a monthly paper, Lyco CB News, which carries many news items of interest to members, club programs and some operating information.

8 MOBILE CIVIL EMERGENCY UNIT (MCEU), 1203 Butternut St., Syracuse 8, N. Y. 1960. Chip Cardinali, 20W1803, president. Organization has local chapters in some 20 states and a total of 1,250 members. Chapters carry out their own activities. As examples, the Maumee Valley (Ohio) Chapter got mentioned in the local newspaper after summoning help quickly to the scene of a grade crossing accident. The Washington-Warren-Saratoga (New York) Chapter has affiliated some members with the Washington County Security Squad, a group of specialists in rescue work, first aid, SCUBA diving and police emergency duties. Many chapters issue individual papers and headquarters publishes a monthly.

9 RACINE CB CLUB, 1019 Crabtree Lane, Racine, Wis. August 1960. Roger Tischendorf, 18A8858, president. 80 members. Affiliated with Civil Defense. Club has given talks on and demonstrations of radio gear for the Racine Junior Deputy Sheriffs, provided communications during Safari Days festivals and July 4th parades, ironed out cases of TVI and during a blizzard in the winter of 1960-61 rescued a couple who had wrecked their car. Members have cleaned up an undesirable situation on channel 11 and persuaded the police to monitor channel 22 on a 24-hour basis.

10 SOUTH JERSEY CITIZENS RADIO CLUB, Box 99, Stratford, N. J. February 1959. Craig Wooster, 3W4964, president. 100 members. One of the oldest—if not the oldest—CB clubs in the country, the organization has proved its strength by having and solving some extremely difficult problems. Affiliated with Civil Defense. The club originated a set of 12 special signals for use in emergency alerts. The signals were approved by the FCC and have been adopted by other CB clubs, CAP units and various communications organizations. The club offers its services in emergencies and in the past has tried to improve CB by emphasizing the need to keep operations within the limits prescribed by the FCC.

BUILD THE
EI CITIZENSCOPE

For the first time anywhere! An oscilloscope designed specifically for displaying Citizens Band modulation.

Herb Friedman, 2W6045

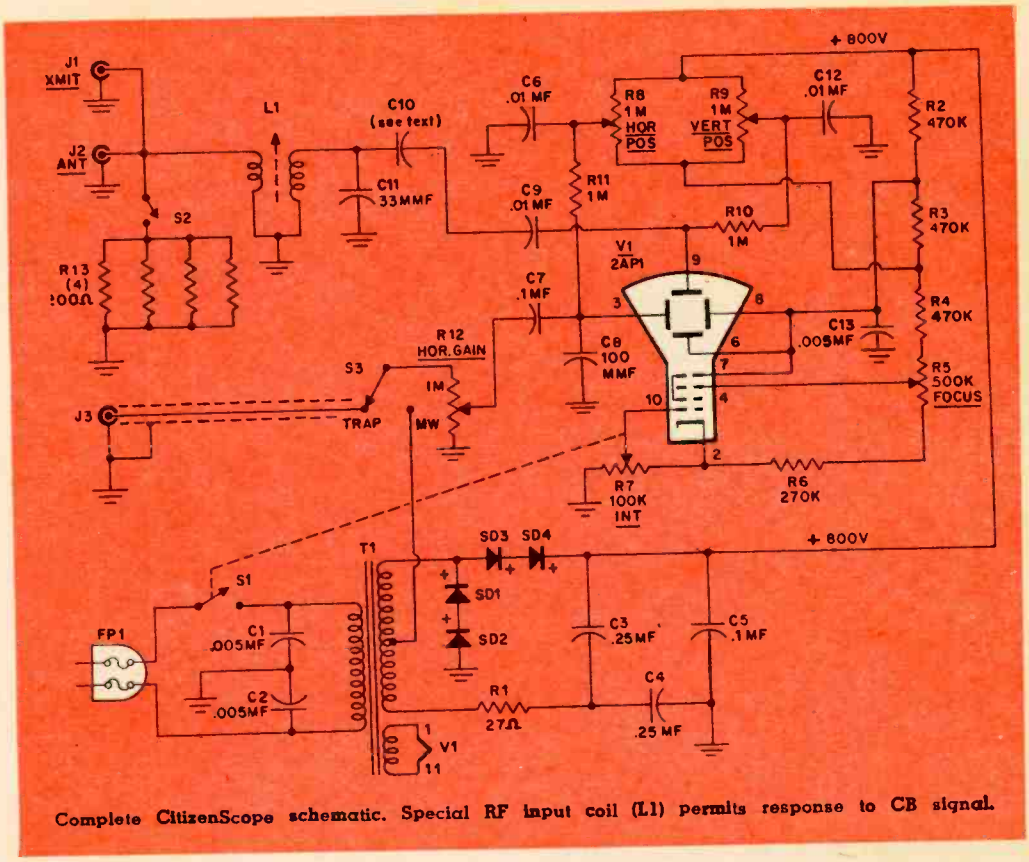
SINCE modulation quality is one of the big factors in the get-out ability of a CB transceiver, many CB'ers have rigged up some means of metering the percent modulation of their transmitters. While such metering circuits are useful, they respond to average rather than peak modulation. When an average reading meter indicates 100% modulation, the actual percent modulation may be substantially lower—or higher.

For optimum modulation adjustment, a peak indicating device is necessary. This is particularly true when speech clippers or compressors are employed since their maximum effectiveness is realized when adjusted for 100% modulation with a peak reading indicator.

EI's CitizenScope is a peak indicating unit tailor-made for the CB'er. It displays either a trapezoid (TRAP) or modulation waveform (MW) pattern, can be permanently connected into the transmission line, for monitoring (peak) percent modulation. Properly used, the CitizenScope can give you a transmission effectiveness hitherto unobtainable. EI's CitizenScope is modest in cost—about $35. The layout is specifically designed to be easy-to-build—even for the novice. Standard components are used, and except for the cathode ray tube, all are readily available.

Construction. The CitizenScope is built in the main section of a 12x7x4-inch Minibox. The first step is to mark *all* the necessary holes. When drilling the front panel follow the template and allow sufficient clearance around the controls for the cover to be slipped into place. To prevent T1's field from deforming the CRT trace locate T1, as shown, as far as possible from the CRT.

RF input components, J1, J2, L1 and S2, should be mounted close to each other toward the cabinet's rear in the



Complete CitizenScope schematic. Special RF input coil (L1) permits response to CB signal.

arrangement shown. Bus bar or doubled wire is used between J1 and J2.

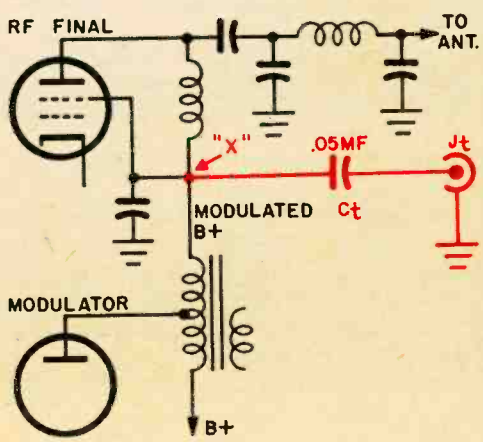
The CRT bezel, which serves as V1's front support is centered on the front panel as shown. V1's base is supported by two 2-inch standoffs, metal or insulated. You can improvise them from metal tubing or use standard standoffs. The standoffs are mounted 6⅛ inches back from the inside of the front panel.

Wrap six turns of plastic electrical tape around V1's Bakelite base. Using thin scrap metal (as from a tin can) fashion two straps. Bend the straps around the taped CRT base to give a snug (but not tight) fit when assembled.

The green filter in the Millen kit is supplied without a grid. However, grids are included in the Techni-Cal Oscilloscope Decal kit (which also includes the other control labels). It is important that V1's socket be in place before V1 is mounted. For correct trace position, install V1 with pin 1 toward the bottom of the cabinet. Terminal strip TS4 mounts on one standoff with a solder lug for grounding.

Coil L1 uses a Cambridge Thermionic

Jt and Ct must be added to transmitter output.



Co. coil form, with a secondary of eight turns of No. 24 enameled wire close-wound and centered on the form. A two-turn primary winding of No. 22 solid plastic insulated hookup wire is tightly wound over the bottom end of the first winding. Make certain both windings are as tight as possible on the form and cemented in place with coil dope.

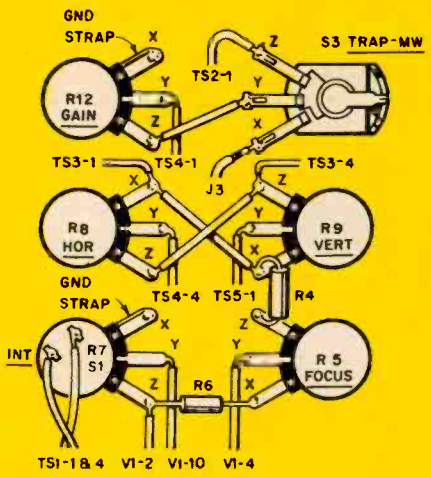
Since there's about 800 VDC in the CitizenScope, use No. 22 solid thermoplastic insulated wire throughout to prevent arc-over and breakdown.

Scope Checkout. Set the horizontal and vertical positioning controls R8 and R9 to midpoint and set S3 to TRAP. Turn on the CitizenScope with intensity control R7/S1. After about thirty seconds adjust R7 and focus control R5 until a focused spot appears on the CRT. Move the spot horizontally and vertically with R8 and R9. Set S3 to MW and adjust horizontal gain control (R12) until the spot expands into a horizontal line. If you cannot obtain the horizontal line check S3's wiring. Full clockwise rotation of R12 should expand the line past the edges of the CRT.

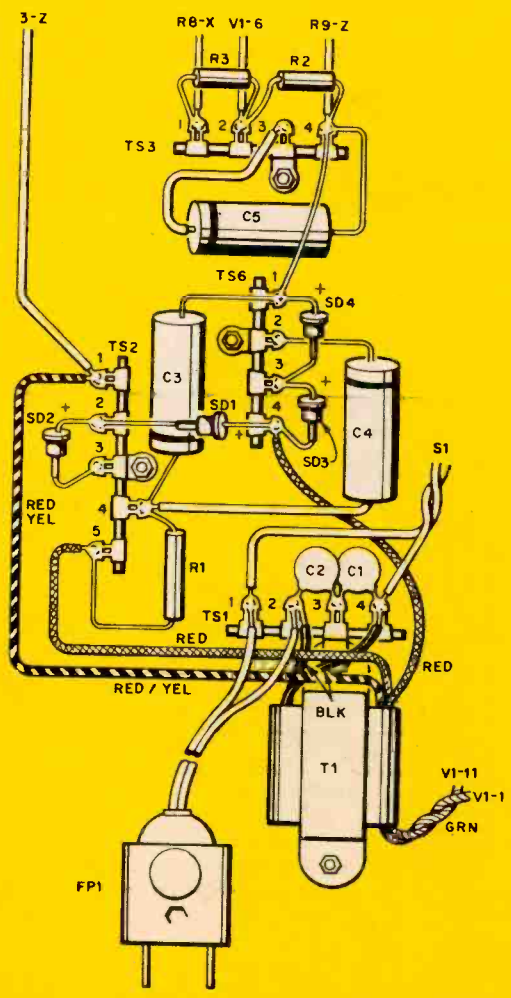
Connect the transmitter to J1 and switch S2 on—this connects in the dummy load. Adjust R12 so the line just reaches the edges of the CRT and turn on the transmitter. No modulation is required in this step. Adjust L1's slug for maximum height (about 1 inch of the observed RF pattern). For transmitters with outputs from .5 to 1.5 watts, C10 is 33 mmf; for 1.5 to 2.5 watts use 15 mmf. The pattern can be adjusted to any height by juggling the value of C10—the lower the value the smaller the pattern. Don't attempt to increase the unmodulated height beyond one inch or the pattern will go off-screen at 100% modulation.

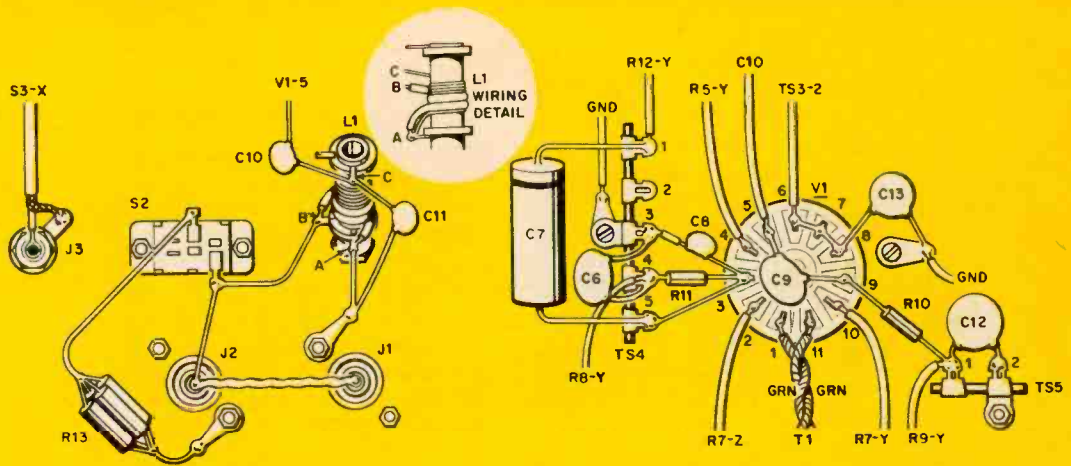
The Trapezoidal Pattern. To obtain a trapezoid pattern, a sample of the transmitter's modulator output must be fed to the CitizenScope via J3. Mount a phono jack (Jt) on the rear apron of the transceiver and connect a .05 mf, 600 VDC capacitor (Ct) between Jt and the point "X" where the modulated B+ feeds the plate and screen of the final RF amplifier.

Using shielded wire, connect Jt to J3.



Wiring of front panel controls is shown above; power supply components below. Transformer T1 should be mounted toward rear of chassis (see photo) to avoid hum pickup by CRT V1.



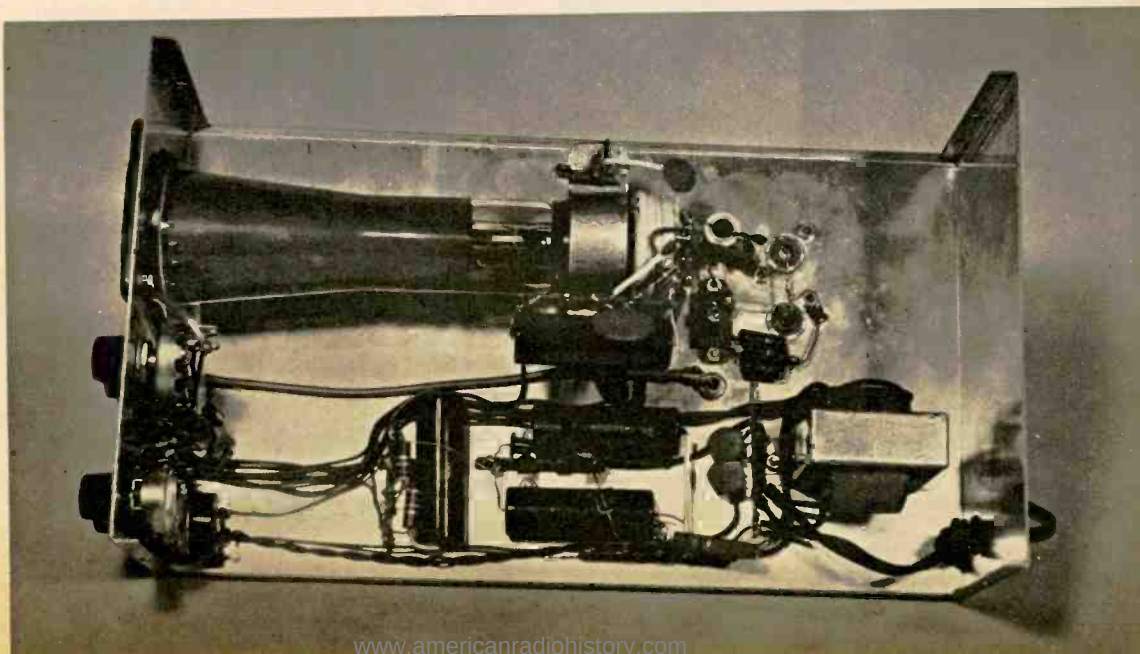


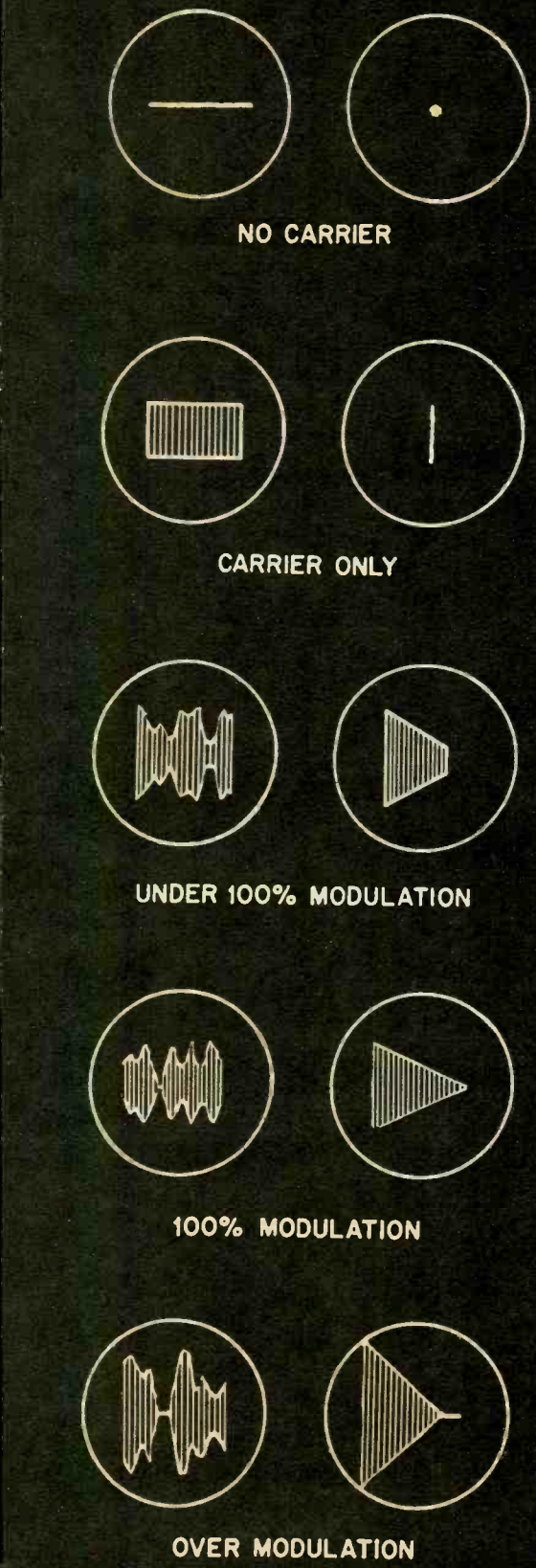
Input circuit and V1 wiring. TS4 and gnd lug mount on V1's neck clamp standoffs; TS5 on chassis.

Resistors:
R1—27 ohms, 2 watts
R2,R3,R4—470,000 ohms, 1 watt
R5—500,000-ohm linear pot
R6—270,000 ohms, ½ watt
R7/S1—100,000 linear taper pot with SPST switch
R8,R9—1 megohm linear taper pot
R10,R11—1 megohm, ½ watt
R12—1 megohm log taper pot
R13—4-200 ohms, 1 watt, 5% carbon (not metalized) connected in parallel
Capacitors:
C1,C2,C13—.005 mf, 1,000 VDC ceramic disc
C3,C4—.25 mf, 600 VDC
C5—.1 mf, 1,000 VDC or 2-.05, 1,000 VDC in parallel
C6,C9,C12—.01 mf, 1 KV or 1.6 KV ceramic disc
C10—see text, molded mica
C11—33 mmf, molded mica
S2—SPST slide switch
S3—SPDT rotary switch (Centralab 1460)
T1—Transformer: Secondary—250VCT @ 25 ma; 6.3 V @ 1 a (Allied Radio 62G008)
J1,J2—SO-239 coaxial jacks
J3,J4—phono jack
SR1,SR2,SR3,SR4—Silicon diodes, GE 1N696 (500 PRV @ 600 ma or better)
L1—Wound on CTC-PLS5-2C4L/B (Allied Radio 72H446)
V1—2AP1 or 2AP1A (Available for about $6.00 from surplus dealers such as Barry Electronics, 512 B'way, N.Y.C. and Gyro Electronic Co., 88 Leonard St., N.Y.C.)
FP1—Fuse plug with 1 A fuses
Misc.—Millen 80072, 2-inch scope bezel; socket, Amphenol Magnal type 49-SS1IL; Minibox (12"x7"x4"); terminal strips

Set S3 to TRAP, turn on the transmitter and speak into the microphone. Adjust R12 until a trapezoid pattern appears. Its shape will vary as you speak. At 100% modulation the trapezoid height (at the right of the CRT) will exactly double. On the left the trapezoid will come to a point at the baseline. (This is the reverse of the trapezoids shown in the illustration.) If you overmodulate

Completed CitizenScope with cover removed. Open, logical layout makes wiring this one a cinch.





on positive peaks the trapezoid height will be more than double, but this is not important since it is the negative modulation which requires attention. The bright tail line indicates negative overmodulation—the longer the tail, the greater the overmodulation.

Optimum modulation occurs when the modulation peaks just reach 100%. A trapezoid which fails to double its size and doesn't come to a point on the baseline indicates less than 100% modulation. Actually, many CB rigs are designed for 85-100% modulation and this will be indicated on the trapezoid as just missing 100%. We suggest that you don't attempt to improve it.

By setting S3 to MW a modulation waveform will be displayed. Actually, the MW is not as effective as the trapezoid for determining modulation percentage because the MW is a constantly changing jumble of frequencies. (The MW has value for tone tests.) However, a doubling of the carrier height again indicates 100% modulation as does a collapse to the baseline. At 100% negative modulation tiny bright spots appear on the baseline (with the scope on maximum horizontal gain). If short bright *lines* instead of *spots* appear on the baseline you are exceeding 100% negative modulation. The lines are equivalent to the trapezoid's tail. The major advantage of the MW function is that it displays noise which may be present. Unmodulated RF appears as a wide pattern with clean edges. Noise, such as caused by a defective mike pre-amp plate resistor, will appear as random spikes on the edges of the pattern. Hum will appear as ripples on the edges, etc.

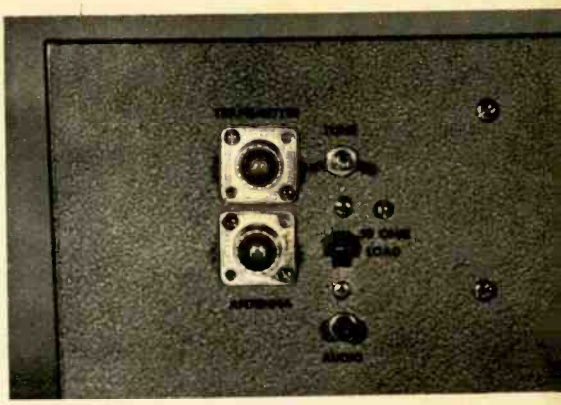
While the CitizenScope helps you obtain maximum effectiveness in terms of per cent modulation, it also helps tell you what the modulation *quality* is. Other types of modulation indicators cannot do this.

You'll notice that at 100% modulation the sides of the trapezoid are straight and that the positive peak is exactly double the unmodulated carrier height. This condition indicates a distortion-free modulating signal which has adequate power for 100% modulation.

If the negative modulation drives the pattern to 100% but the positive modulation flattens out and then slants downward before the carrier height doubles, the modulator is under-powered. Not only will your output signal then be under-modulated, but the modulating waveform will be distorted. Even though the speech amplifier and modulator may have checked out as distortion-free, the signal is being distorted through the *process* of modulation. Without a scope you might never detect this condition.

Insufficient RF drive to the final is another cause of distorted modulation. This type of distortion looks similar to the pattern caused by insufficient modulation power. However, instead of flattening out and then slanting down, the trapezoid pattern caused by insufficient RF drive only flattens out. Again you have a picture of distortion which is being added to the signal by the modulation process.

Parasitics, which are spurious signals produced by the transmitter, can also be indicated by the trapezoid. UHF parasitics which can produce TV interference may be indicated by a fuzzing of the trapezoid. This appears as a halo or fringing of the pattern. Parasitics, at or near the fundamental 27-mc frequency may appear as spikes.



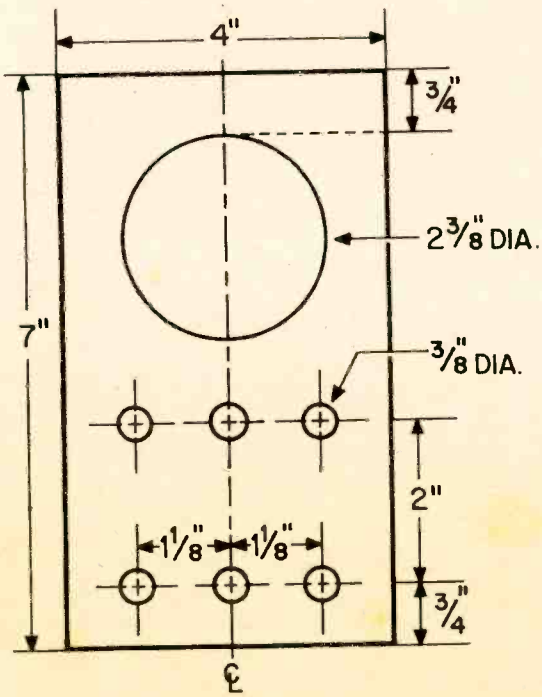
Side panel rear showing jacks J1, J2, load switch S2 and input coil L1's slug tuning adjustment.

While you might assume that parasitics being spurious frequencies have no effect on modulation, they are part of the trapezoid and that means that at the receiving end your modulation is distorted.

As you can see the modulation process is complex. One cannot connect a low-distortion modulator and then automatically assume there's good audio quality—lots of things can go wrong between the modulator and the final signal. Only a scope can give a visual picture of the complete signal.

Space prohibits detailing all the information which can be obtained from the patterns. A thorough discussion of trapezoid and modulated wave modulation patterns may be found in the Radio Amateurs Handbook.

The CitizenScope may be left permanently connected in the transmission line, permitting continuous monitoring. Connect the transmitter to J1 and the antenna to J2. Set S2 so the dummy load is *out* of the circuit. Adjust L1 for minimum SWR (standing wave ratio) or maximum field strength reading *from the antenna*. When L1 is properly adjusted the CitizenScope will have no adverse effect on SWR.



Layout of CitizenScope's front panel controls.

There's nothing like specialized flickers to heighten interest!

By Vernon Simms

IF YOUR Citizens Band club has ever shown a motion picture, you know there's some truth in the old Hollywood chestnut about there being magic in movies. There *is* magic in them when it comes to arousing enthusiasm on meeting nights.

Just any movie might help bring 'em in, but your films should be selected to cater to your club's special interest in electronics. Fortunately, scores of movies of this type are available to CB clubs, usually free of charge. A few postal cards can bring you complete information.

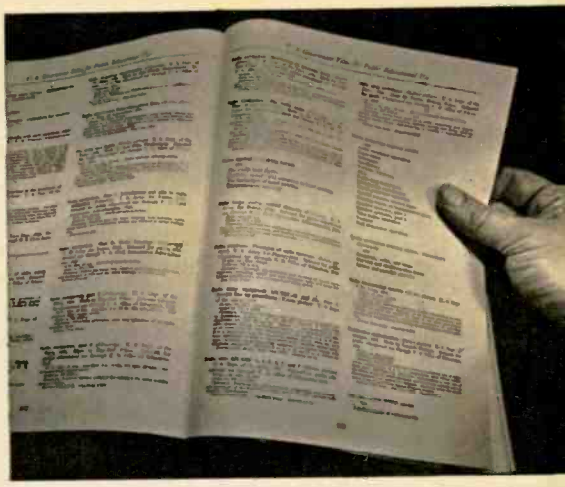
A veritable bonanza of instructive (and at the same time entertaining) motion pictures is offered by large corporations, public utilities, industrial associations, universities and other organizations. They are delighted to lend films for exhibition at club meetings.

Unlike sleep-provoking home movies, non-commercial films are slick productions created by professionals, often big-name pros. Consider, for example, a two-part epic called Basic Electricity and Basic Electronics which is offered by Minneapolis-Honeywell. It was produced by Walt Disney and uses the famous Disney animation to bring theory to life in full-color cartoon style. There's also a minor cartoon extravaganza put together by General Motors. This one shows the proper use of some dozen hand tools.

But the bulk of the movies you can get place less emphasis on entertainment and more on straightforward education. Take the films used by the Navy for training radio technicians. This is a 16-part series that presents electronic fundamentals in lucid fashion—everything from audio oscillators to how to use a volt-ohmmeter. The Navy will send you all 16 reels at no charge. Not to be outdone, the Army makes available its series called Electricity and Magnetism. Other films explain tuned circuits, telephony, FM and how radio waves travel.

Whether you secure films from government or industry, the procedure is approximately the same. First step is to send for the catalogues, which describe titles, running time, subject matter and ordering procedure (see list at end of article). Industrial organizations work in a slightly different manner. The Scientific Apparatus Makers Association, for instance, forwards a Loan Film

Easily obtained film catalogues describe movies in detail, give running time, size, other data.



The biggest listing of pictures available is a government tome with 500 pages and 5,000 films.

Directory that describes the films and gives names and addresses of member firms, which supply the actual reels.

One of the best single lists of non-commercial films is a 500-page catalogue published by the Department of Health, Education and Welfare. It details some 5,000 flickers, telling what they are and where to get them. A copy can be had for $2.75 from the Government Printing Office (ask for U.S. Government Films for Public Educational Use; No. OE-34006).

Whatever the source, movies usually are sent free of charge on condition that you return them within 48 hours after showing and pay return postage (ask the post office about special low rates for film shipments). The lender often sends along an attendance form for you to fill out. In a few cases a modest fee (usually about $5) is charged for handling.

When procuring films, remember that other organizations are doing what you're doing. You may not be able to get what you want immediately. The Walt Disney opus, as an example, normally is booked solid for months.

There's one more obvious step between you and a club movie: a projector and screen. By far the most popular non-com movie type is the 16mm color film with sound and a running time of about 30 minutes. If no one in your club has access to a suitable projector, you probably can rent one at a local photo shop for about $6 an evening.

A good place to start in your search for interesting movies is your local light & power company, the telephone company, your public library and your state university. Here are some of the organizations which provide catalogues of their films:

Information & Education Dept.
Aetna Life Affiliated Companies
151 Farmington Ave.
Hartford 15, Conn.

Motion Pictures
Advertising Dept.
E. I. DuPont de Nemours & Co.
Wilmington 98, Del.

GM Motion Pictures
General Motors Film Library
GM Building
Detroit 2, Mich.

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Institute of Visual Communications
40 East 49th St.
New York, N. Y.

Encyclopedia Britannica Films
1150 Wilmette Ave.
Wilmette, Ill.

Center for Mass Communication
Columbia University Press
1125 Amsterdam Ave.
New York, N. Y.

Scientific Apparatus Makers Assoc.
20 North Wacker Drive
Chicago 6, Ill.

Visual Aids Service
University of Illinois
Champaign, Ill.

Office of Information
Dept. of (Army, Navy, Air Force)
Washington 25, D. C.

Films Incorporated
Wilmette, Ill.

MODULATION METER for CB

By Herb Cenan

DO OTHER operators on the Citizens Band bug you about overmodulation, undermodulation or distorted modulation? You can squelch them once and for all with EI's low-cost modulation meter.

In addition to standard monitoring applications, a modulation meter is almost a necessity for adjusting speech clippers and compressors. Unless monitored, clipper/compressors frequently cause overmodulation because of their built-in microphone preamplification. While a meter is not as accurate as a peak-voltage indicating device (such as an oscilloscope), its rock-bottom cost ($5 to $6) and simple construction make it attractive for general CB use.

Construction. The modulation meter is built on the main section of a 5¼x3x2⅛-inch Minibox. Meter movement M1 is centered on the front panel in a hole cut with a 1½-inch chassis punch. Wiring is not critical but be sure that S1 is hooked up correctly or M1 will blow when the unit is turned on.

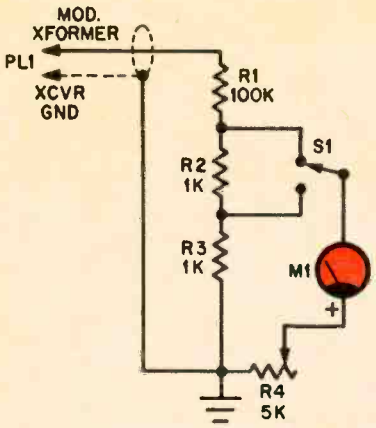
The modulation meter is connected to the transceiver's chassis ground and through capacitor C1 to point X, where the modulated B+ feeds the plate and screen of the final RF amplifier (see schematic). Mount a phono jack (J1) on the rear of your transceiver and capacitor C1 between the jack and point X as shown.

Operation. Plug the modulation meter into J1 on the transceiver and set S1 to *calibrate*, which connects M1 across R3. With the transmitter on, use a VOM or VTVM to measure the DC voltage between point X and ground. Next, set the voltmeter to the AC range leaving it connected to point X. If you're employing a VOM it will be necessary either to use the *output* jack of the instrument or to connect a .05 mf, 600 V capacitor between the positive test lead and point X.

Now, feed a 400 or 1,000 cycle tone into the microphone jack. (The tone can be obtained from an audio generator or the AF output of an RF signal generator.) Adjust the tone level so the AC voltage at point X is .707 of the DC voltage. For example, if the B+ voltage is 200 volts, adjust the tone level for an AC voltage of 141 volts (.707x200= 141). Next, adjust R4 so M1 reads 100% (same point as 0db on the meter face). The modulation meter is now calibrated.

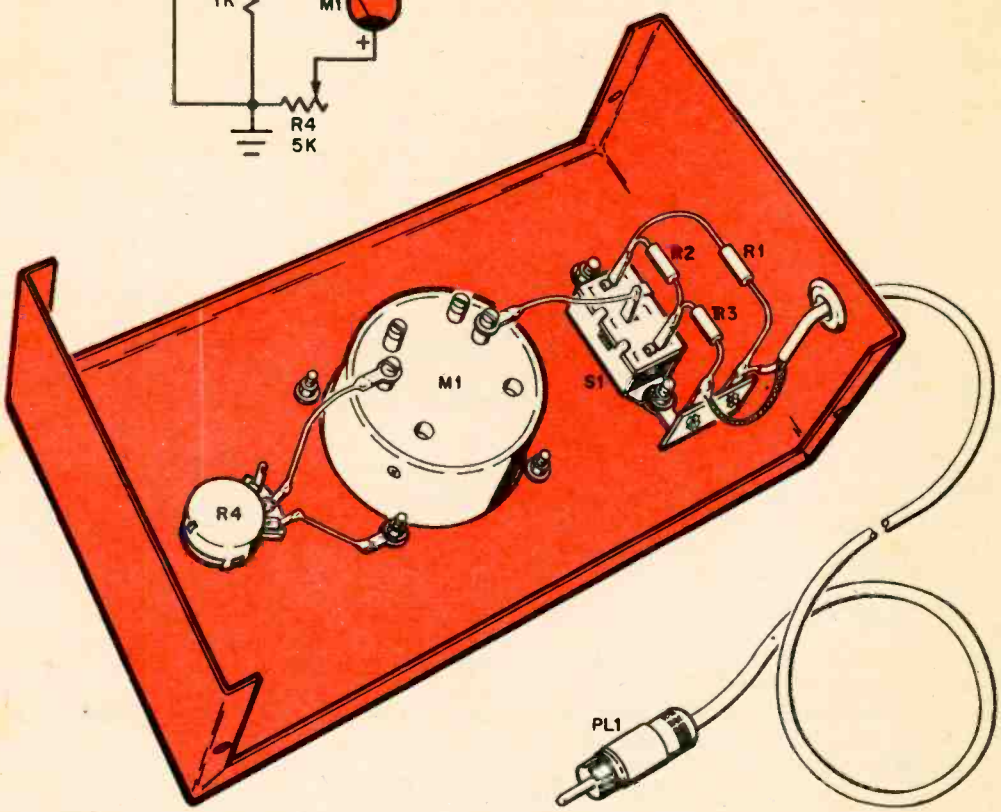
Set S1 to *modulation* (M1 connected across R2 and R3) and the meter will read voice modulation percentage directly.

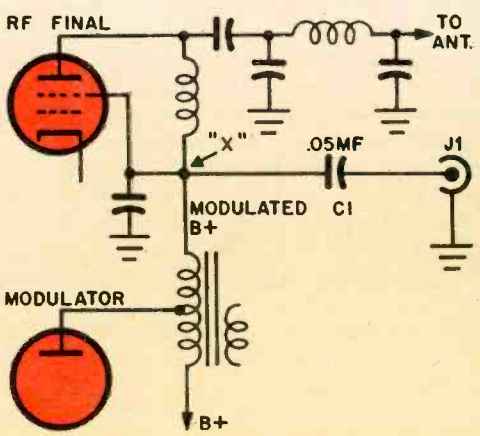
Calibration control R4 can adjust for transceivers with B+ voltages between 175 and 250. If your rig uses a B+ lower than 175 volts, drop R1 to about 75,000 ohms. If the B+ is above 250 volts, raise R1 to 125,000 ohms.

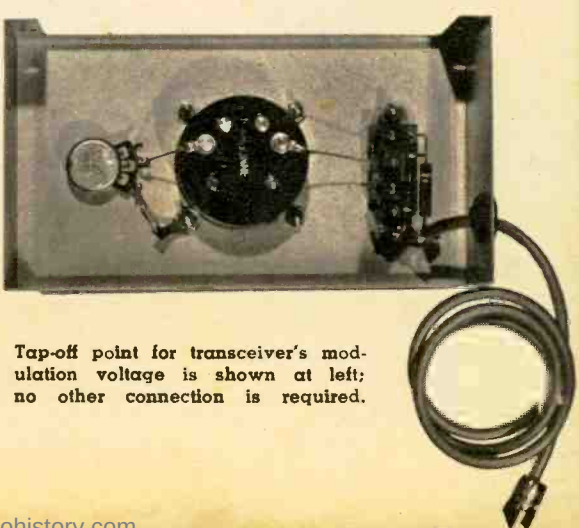


PARTS LIST

R1—100,000 ohm resistor (see text)
R2,R3—1,000 ohm resistor, ½ watt, 5%
R4—5,000 ohm pot
C1—.05 mf, 600 VDC capacitor (installed in transceiver, see text)
M1—VU meter, Lafayette Radio TM-10 (Calibration may not be accurate for any other meter)
J1—Phono jack installed on transceiver (RCA type)
PL1—Plug to match J1
Misc.—Minibox, terminal strips, etc.







Tap-off point for transceiver's modulation voltage is shown at left; no other connection is required.

March, 1963

How to MAP YOUR SIGNAL PATTERN

By Charles O'Neil

For efficient mobile-base operations, take a leaf from the book used by the broadcast boys.

YOU can take the guesswork out of your Citizens Band operations with a signal contour map. Pinned on the wall of your shack, the map will tell you at a glance about the effective coverage you can expect in mobile-to-base operations, where your signals are readable and where your fizzling-out points are. It can answer such a specific question as where to locate mobiles for reliable coverage at a parade, Civil Defense drill or other special event.

A signal contour map (see photo above) is by far the best way to display a certain kind of data. It's the type which informs you immediately that a mobile at point A in your groundwave coverage area should give you an S-9 signal-strength reading at your base station, or an S-5 reading if it's at point C.

You *can* keep this kind of dope in a notebook but finding exactly what you want at the moment it's required is not easy in most communications rooms.

The map is fine for technical purposes, too. You can run comparisons between old and new antennas, transceivers and changes in antenna height. The map shows you differences in clear-cut, before-and-after figures. It also gives warning of impending trouble. When a tube starts to fail in a mobile rig, for instance, indicated signal strength won't agree with what your map tells you. You know something's wrong.

Preparing a signal contour map is nothing new. Broadcast stations do it regularly to prove to the Federal Communications Commission that their coverage stays within licensed limits. No such requirement is tacked onto CB, of course, and few CBers have ever tried the technique. But it can be extremely useful.

The basic approach is painless. You procure a map of your area and mount it on cardboard (see photo). On a plastic overlay you put a dot at your base station's location, then crisscross it with eight radial lines as shown in our lead photograph. The radials show up like spokes on a wheel whose hub sits on your base station. After signal-strength readings from all areas are gathered, contours are drawn to link up readings of equal strength. The result is a series of irregular circles which picture the signal as it falls off with distance or obstruction.

Basic information needed for preparation of a signal contour map is gathered by jotting down signal-strength readings from various geographical points in your coverage area. S-meter numbers, shown in the left column, are transferred later to signal-pattern map. Get readings from as many locations as possible, and in all directions from base.

The broadcast boys hop in a car and drive for days to compile their readings with field-strength meters. It's much easier in CB. You simply record readings over several days or weeks while engaged in normal operations with your mobile units.

After experimenting with charts printed by the U.S. Coast & Geodetic Survey, we found the best map for the job is the everyday road map. It affords the most convenient means for pinpointing the location of a mobile because streets and roads are shown. As a car travels along the driver can report his location in unmistakable terms. For instance, if he says, "I'm at the junction of Route 7 and Mountain Road," you can put your finger on his position instantly.

It's interesting, however, to have on hand the USC&G chart for your area. It contains topographical information, such as terrain height, which helps explain why the signal is blocked in certain locales.

First step in preparing the map is to accumulate dozens of signal-strength readings from your mobiles. If the base rig has an S-meter, you're in business immediately. All readings can be taken in S units.

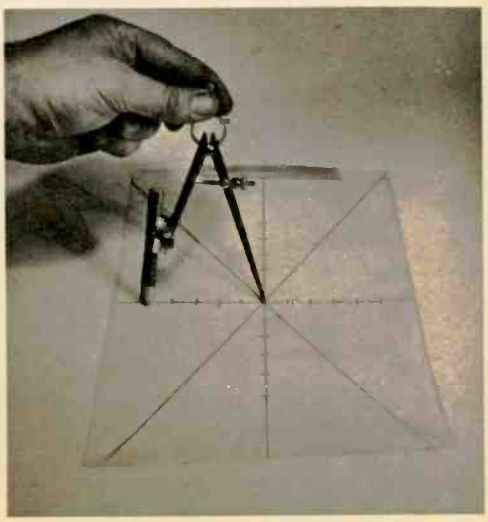
If you have no S-meter, it is possible to add one with a modest investment of time and money (see ADD AN S-METER, May '62 EI).

As another alternative, you can use a VTVM to take signal-strength readings. To make the instrument work as an S-meter, hook it to the automatic-volume-control (AVC) circuit in the receiver (see schematic on the third page of this article). Switch the VTVM to the *DC minus* function and use the lowest range that will provide maximum deflection (this may be the 15-volt range for strong signals and lower ranges for weaker ones).

The VTVM's *common* probe goes to chassis ground. The other probe is connected to point A or point B. The latter may be easier to find. First, locate the last IF transformer. It usually will be found between the last IF amplifier tube and the detector tube. Point A is the lug on the IF transformer to which are connected a 1-megohm or higher AVC filter resistor (Rf) and several other components.

Point B is located after the AVC filter resistor. Filter capacitor Cf usually is .05 mf.

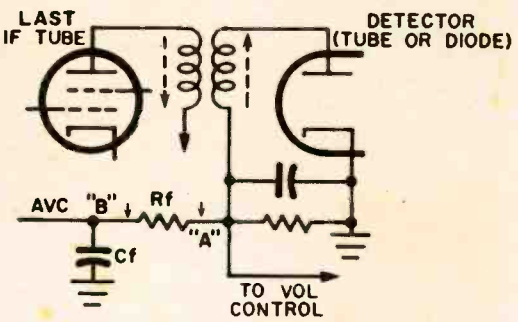
It is possible to use a 20,000 ohms/volt



On plastic overlay, shown detached from map for clarity, 8 radials are drawn from location of base; 2-mile range marks are being added here.

A regular road map is best for showing signal pattern; mount it on cardboard and hang on wall.

Finding AVC for voltmeter connection (see text).



or higher VOM for this job but the instrument creates some loading problems. The level of all readings will be reduced and weak signals may be lost.

With provision for taking readings completed, set aside a sheet of paper in your shack for tabulating readings from mobiles over a period of time. A typical sheet (see photo) lists numerous geographical points in all parts of your coverage area, e.g., NE corner Swope Park, Broadway-Main, Highway 40-Leeds Rd., etc. Beside each you write the meter reading you get when one of your mobiles is in that location. Try to get readings from as many directions as possible. The accuracy of the final map depends on the number of points, so the more the better.

This information can best be transferred to the map by using a transparent plastic overlay, which is mounted right on top of the map with tape. The overlay serves several purposes. If you switch antennas or mounting height, or change some other factor which might alter your reception pattern, it's easy to remove one overlay and put down another.

Our photo shows you how to prepare the overlay, and the lead picture shows the overlay in place on the map. Using a grease pencil or some other instrument capable of writing on plastic, put a dot over your base station's location and crisscross it with eight radial lines. Range points then are marked on each radial at two-mile intervals.

Mark in the meter readings you have collected, writing the S numbers over the proper locations. When this is completed, a characteristic pattern will be noted. Readings of the same value tend to be located at the same distance from the base station. Now draw lines to link up readings of equal value. The result looks like barometric pressure lines on a weather map—a series of distorted circles around your base station.

Interpreting the map is simply a process of noting signal strength within any area. Each circle represents a contour of RF energy, which drops steadily as distance rises. The warping of the pattern indicates intervening hills, buildings or other high structures. The map we show is for a specific area. Yours will be different. You might, for example, find a completely dead signal pocket quite close to your base station. It should be circled independently of the contour lines. Dead areas will be well defined if enough readings are taken during preparation of the map. A final refinement is the addition of Q signals in each contour.

Q signals represent signal performance in practical terms of readability. The Q code is as follows:

Q1—Unreadable.
Q2—Barely readable.
Q3—Readable with difficulty.
Q4—Readable with little difficulty.
Q5—Perfectly readable.

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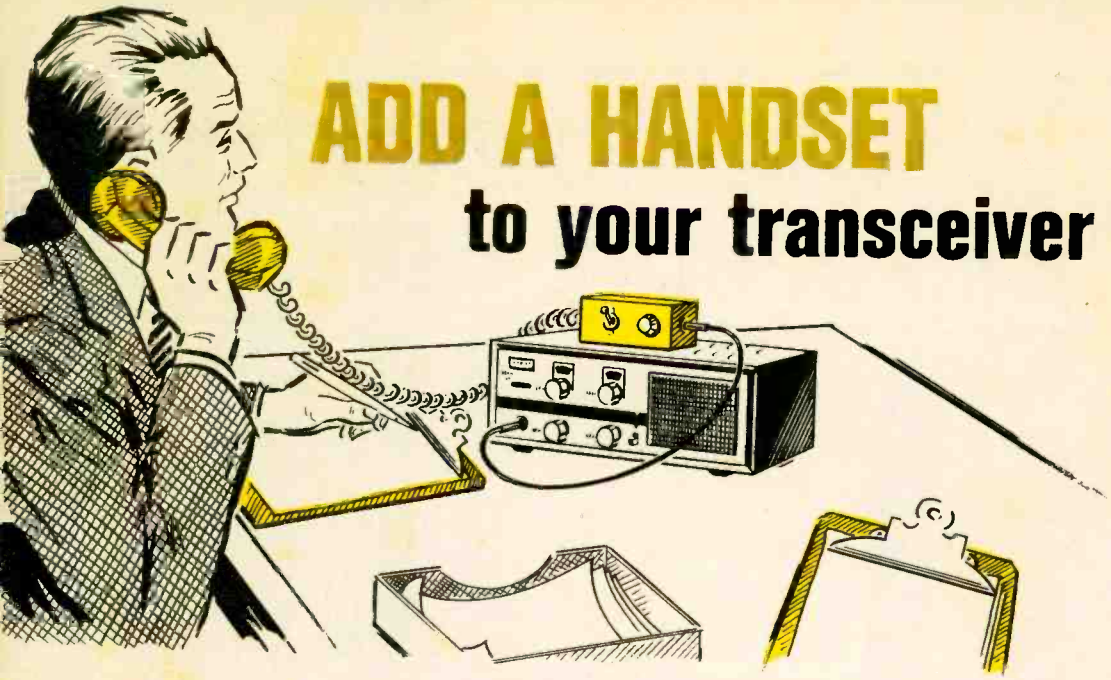
ADD A HANDSET
to your transceiver



Give your Citizens Band rig the look and convenience of a radiotelephone with this easy and inexpensive modification.

By Gerald Wainwright

TO insure privacy or to cut background noise, a handset hooked up to your transceiver is a decided convenience. Handset installation is relatively easy since only minor modifications to your rig are required. It's only necessary to open one speaker lead and to connect the speaker and output transformer leads to a jack or tie point.

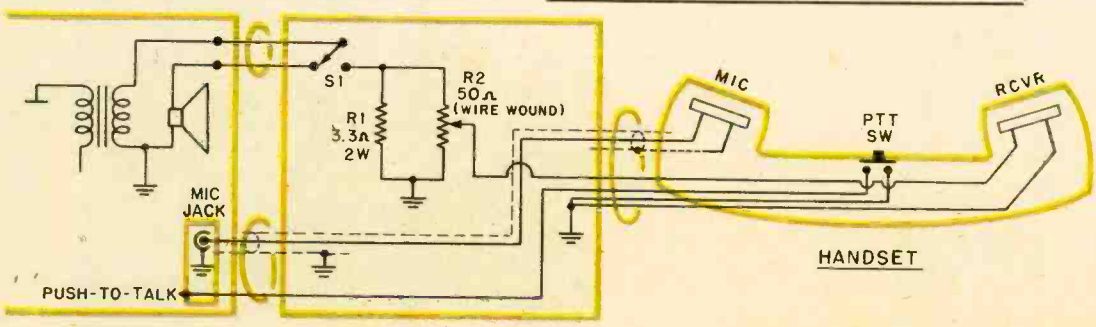
The heart of the modification is in a separate control box which permits either normal or handset operation. In one position S1 connects the speaker to its original wiring. In the other position the speaker is disconnected and the transceiver's output transformer feeds the handset via R1 and R2. R1 supplies the proper transformer load and R2 adjusts the handset earphone to a comfortable volume level.

The handset is a surplus unit avail-

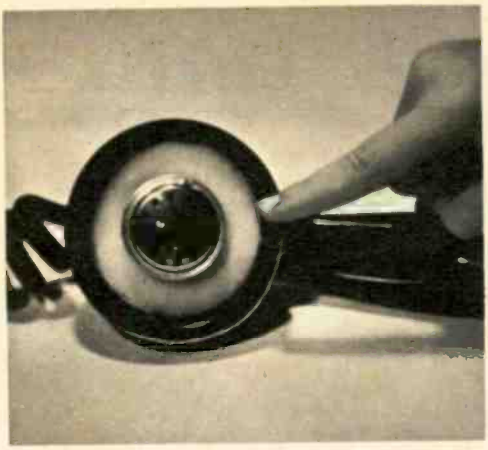
PARTS LIST

R1—3.3 ohm, 2W, 20% resistor
R2—50 ohm wirewound potentiometer
S1—SPDT toggle or slide switch
Misc.—Handset (see text); microphone element; 1 cable—4 conductor plus one shielded conductor; cabinet, any convenient size

The standard handset must be modified by replacing the mike element and rewiring its output cable.



Electronics Illustrated



Replacement microphone cartridge is bedded down in foam rubber. This both provides a snug fit and protects the element against impact damage. Connection to element is made via soldering lugs.

able from Radio Shack, Olson Electronics and elsewhere. The handset microphone is a carbon and it must, therefore, be replaced with a ceramic/crystal or dynamic element. Since the new element requires a shielded lead, you can avoid a rat's nest of wires coming out of the handset by using a retractile coil-cord having four conductors plus a shielded lead, such as Alpha type 696/2.

The new cable from the handset can be led through a grommeted hole in the control box. The output cable from the control box includes a shielded mike cable plus the push-to-talk control lead (s). These could terminate in a plug matching the mike jack on your rig. The two other wires from S1 to the transceiver's speaker can be ordinary zipcord.

Cement the new mike element as shown to a piece of foam rubber, install the new handset wiring and then cement the rubber-mounted element into the handset. Make sure that solder doesn't fall into the mike's air relief holes. The earphone element need not be changed.

To hear an incoming signal set S1 to *normal*. When you hear your unit number called, reset S1 to *handset* and you've got telephone convenience.

11 METERS IN CANADA

TO judge by the first few months of operation, the 11-meter General Radio Service in Canada is experiencing many of the problems faced by the Citizens Radio Service in the United States during its early days. There are other similarities, too. The GRS, a year old next April 1, already has picked up the Citizens Band nickname from U. S. operators.

In its first six months, Canadian CB saw the issuing of 8,691 licenses, and 30 manufacturers (some of them U.S.) got type approval for their equipment. The Department of Transport, counterpart of the Federal Communications Commission, announces solemnly, "We have received no reports of violations." But, as the FCC learned long ago, the official reports don't always give an accurate picture of what is going on in the world of short-range radio.

CB CLUB DE LA PROVINCE DE QUEBEC

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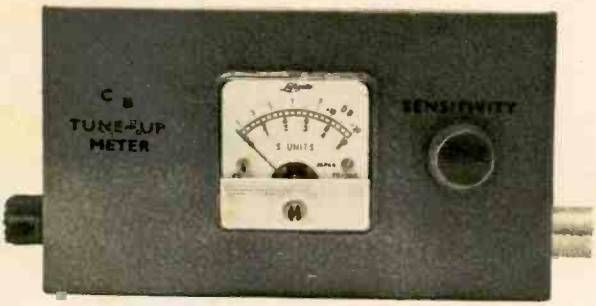
As a matter of fact, a goodly number of Canadian CBers have been making like hams by transmitting CQ calls. And they also are working skip stations. These problems, however, do not appear to be as serious as they once were on this side of the border, probably partly because of the relatively small number of licensees. At this point it is not yet clear whether the GRS will become a mostly-business band or a mixture of businesses, personal users and pseudo-hams.

[*Continued on page* 114]

TRANSMISSION LINE TUNE-UP METER



By Al Toler

OF ALL the methods used for tuning a CB transmitter only the SWR meter (which measures relative power into the transmission line) and the field strength meter (which indicates relative power out of the antenna) are accurate indicators. Light bulbs, terminated power meters and plate input meters just can't do an accurate job.

Unfortunately, it's difficult to tune your transmitter while up on the roof with your field strength meter; and, the cost of an SWR meter somewhat limits its availability for CB. But now, EI's $5 Inline CB Tune-Up Meter brings an accurate tuning indicator within the reach of all CBers.

The Tune-Up Meter samples the power fed into the transmission line. Since maximum power indicates maximum tuning, meter M1 will give the highest reading when the transmitter is tuned on-the-button. The Tune-Up Meter can be left permanently connected in the transmission line.

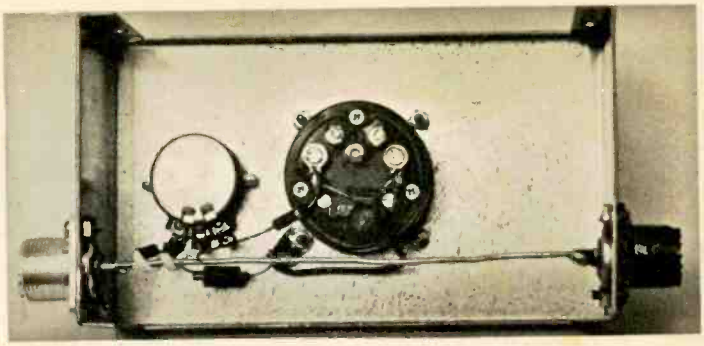
The Meter is built in the main section of a 5¼x3x2⅛-inch Minibox. Coaxial jacks J1 and J2 are mounted on the side panels *as close as possible to the lower rear corner.* A piece of #16 bus bar (or a section of a coat hanger) connects J1 to J2. Connect it as direct as possible and don't use thin wire.

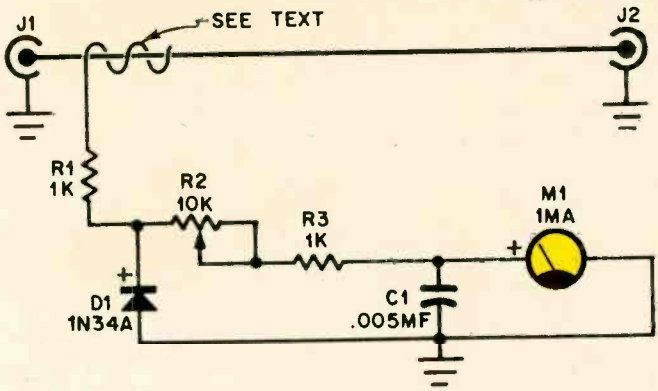
Connect R1 to sensitivity control R2 in such a manner that the top of R1 is ⅜-inch from the bus bar. Insulate R1's free lead with spaghetti and wrap it three times around the bus bar. Make certain the tip of R1's lead does not extend past the insulation.

Checkout and Use. Connect the transceiver antenna jack via a length of coax cable to either J1 or J2. The transmission line connects to the remaining jack. Energize the transmitter and adjust R2 for a convenient M1 reading. Then, adjust the transmitter tuning for the highest M1 reading. At peak reading the transmitter is tuned for maximum power output.

Note: M1's reading depends on both the power output and the transmission line's SWR. Its exact reading is unimportant since low power output and a high SWR can result in a high reading. Similarly, high power output and high SWR can read low. Only the fact that M1 peaks is important.

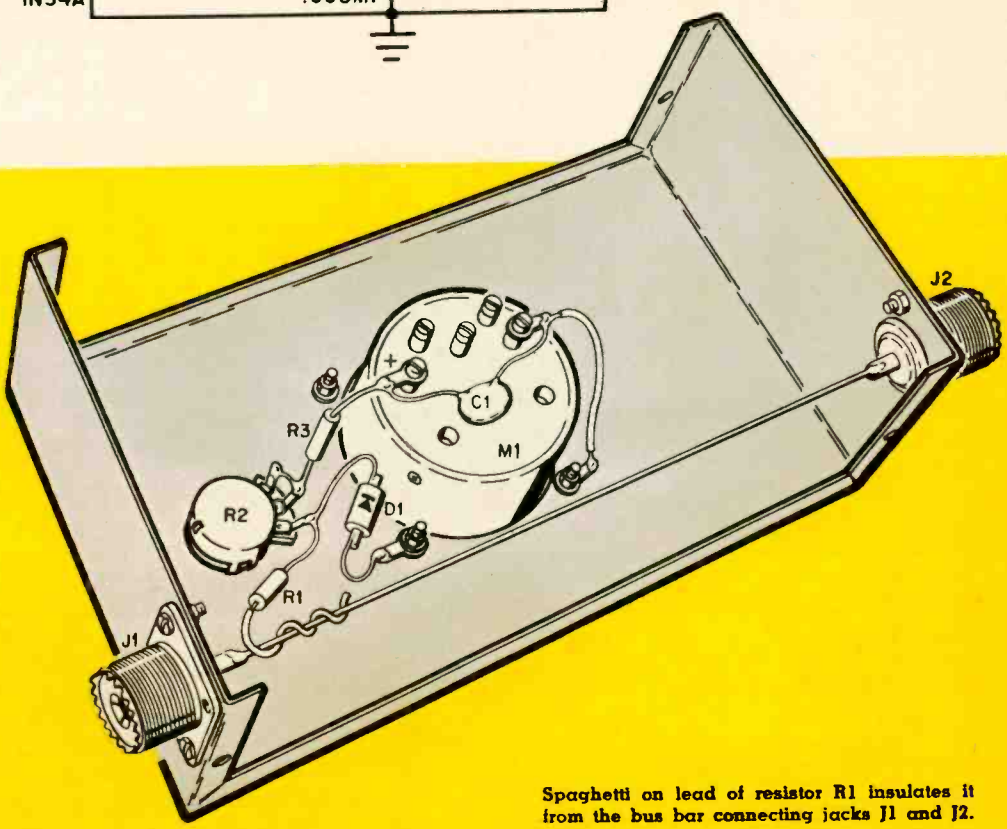
Almost empty Minibox is seen with cover off. Extra terminals on meter connect to its internal lamps which are not used in this application. Any type and size of 1-ma meter will serve.



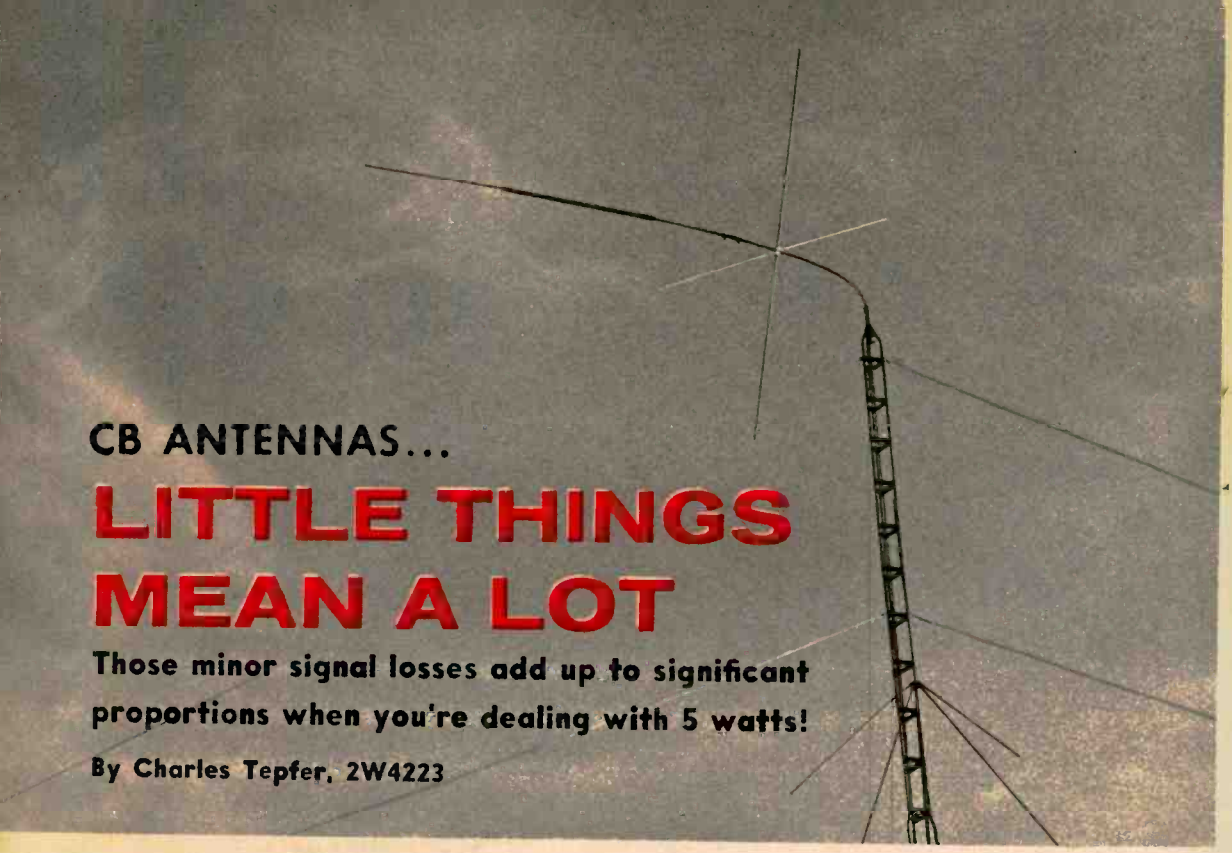


PARTS LIST

R1,R3—1000 ohms, ½ watt
R2—10,000 ohm potentiometer
C1—.005 mf, 500 VDC ceramic disc capacitor
M1—1 ma DC meter movement, any type or size
D1—1N34A crystal diode



Spaghetti on lead of resistor R1 insulates it from the bus bar connecting jacks J1 and J2.



CB ANTENNAS...

LITTLE THINGS MEAN A LOT

Those minor signal losses add up to significant proportions when you're dealing with 5 watts!

By Charles Tepfer, 2W4223

EVERY Citizens Bander knows that 5 watts input to the final of his transmitter doesn't mean 5 watts on the air. He's lucky if he gets something over 3 watts actual RF output. For decent coverage, you have to nurse what little power you have as if it were a rich old aunt making out a will.

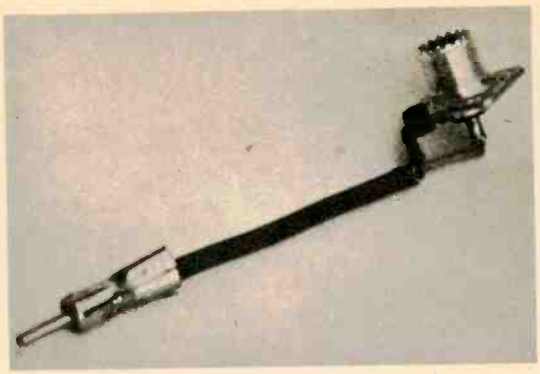
The base station antenna is the most important factor but even the best sky-hook is at the mercy of the installation. It can't radiate power it doesn't get. The wrong kind of transmission line or bad connectors can be draining away power.

Most CBers use RG58/U coaxial cable as transmission line. It's cheap, easy to work with and has a characteristic impedance of 53 ohms, matching most base-station antennas. But RG58/U also has relatively high power dissipation due to resistance and radiation losses. It cuts your signal by 2db per 100 feet when dry, more when wet. The average 35-foot coax run to the roof of a one-story house means a loss of some .7db, which doesn't sound like much but converts to a whopping 15 per cent. On a 100-foot run, the loss amounts to a third of your 3-plus watts.

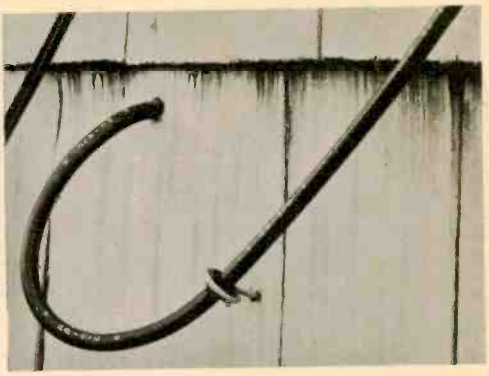
Fortunately, there's a simple remedy. Use RG8/U coax, which costs twice as much (about 12¢ a foot) but has only half the line loss.

Another of those little leaks that add up may lie in your automobile-radio-type connectors. Many transceivers, particularly those designed for car *and* base-stations use, come with this type socket. You'll find the same connector on your car's broadcast radio, and it works well because of high signal levels. But in CB the connector can be forced out of shape easily, destroying multi-point contact. Or it may separate from the coax braid if the set moves much.

The answer is replacement with threaded coax connectors, which is an easy job. Cut off the auto-type plug, strip off 1¼ inches of insulation, clip off ¾-inch of braid and take off ⅜-inch of inner insulation to expose the center conductor. The outer sleeve of the coax connector (with threads toward the end of the cable) then slides on. Solder the braid to the connector at the four holes provided, solder the conductor to the tip and work the outer sleeve back over the connector.



A handy adaptor mating an auto antenna plug to coax socket is easy to make; connect with coax.



Drip loop where transmission line enters house drains off rain; note use of stand-off insulator.

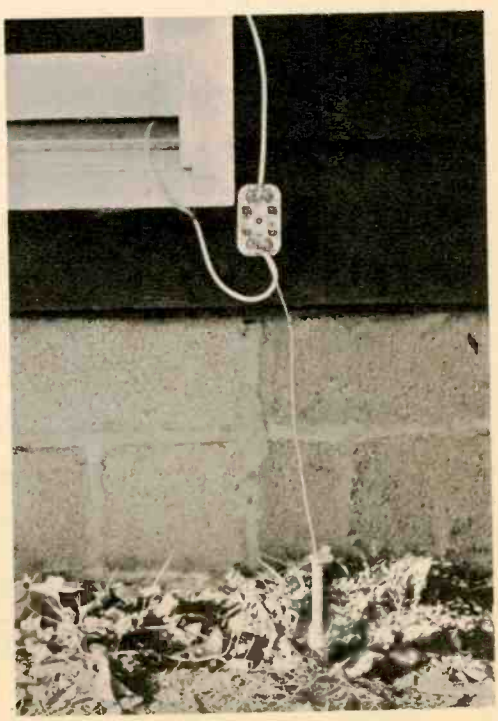
Many transceivers have a punched hole for mounting the coax socket. The leads are then merely transferred from the old socket to the new one. Only the conductor need be soldered. If no hole is provided you can make your own (½-inch diameter) with an expansion bit or hole punch. Drill four ⅛-inch holes for the mounting screws. Mount the new socket as close as possible to the old one.

A useful accessory, if you don't replace the old connector on your mobile, is an adaptor mating an auto-type plug to a coax socket. It permits switching a transceiver from car to base without disturbing the transmission-line coax connector. Use a short length of coax to join the two (see photo).

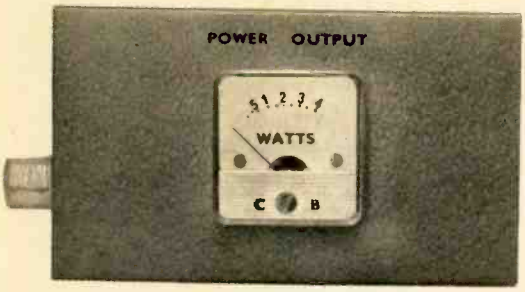
How the transmission line runs from antenna to transceiver is important for keeping down signal losses. If the line gets close to metal gutters or downspouts some RF energy may be drained away. Keep it a reasonable distance also from TV downleads, telephone wires and the like. TV-type stand-off insulators should be used to hold the line away from the wall. A drip loop where the line enters the house keeps the entrance hole dry by forcing moisture to drop off to the earth.

A lightning arrester, though it won't prevent signal losses, is a worthwhile safety measure. Run a heavy wire from the arrester to your ground rod.

A final safety hint concerns the antenna itself. Our lead photograph shows what happened to an improperly guyed half-wave antenna in a high wind. Guying the tower wasn't enough here. The rig should have been guyed also right under the radials. The rule of thumb is a set of guys every 10 feet of height—three guy wires 120 degrees apart and all adjusted to equal tension.



Properly mounted lightning arrester with a heavy wire to ground rod. Coax is cut with this type.



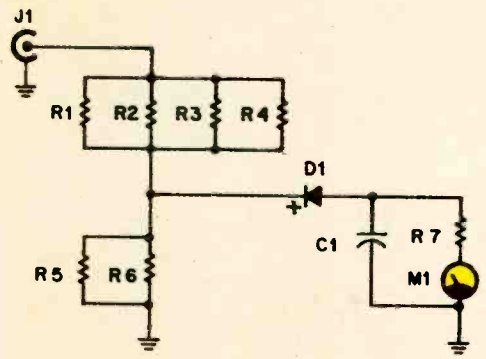
DIRECT-READING POWER OUTPUT METER for CB

FOR transmitter tests and repairs, some means of measuring power into a dummy load is required. The EI CB power Output Meter will enable you to check output at a cost—about $6—well below that of commercial power meters.

To avoid a separate calibration chart, a paste-on meter scale is provided. Note that it is accurate only when the instrument is built with the specified components. All leads should be short, with resistors R1 through R4 mounted as close as possible to J1. Use a heat sink, such as an alligator clip, on D1's leads when soldering.

When the unit is completed with M1 mounted, remove M1's cover by inserting a thin screwdriver blade under the top edge and prying upward. The plastic cover will snap off. Remove the two screws that hold the meter face in place and carefully slide the meter face upward to avoid bending the needle.

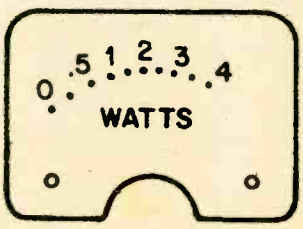
Cut out the new meter face and glue it over the old face with a thin coating of slow-drying cement (such as Elmer's). Adjust the new meter scale to exact registration, install the meter face and cover. Assemble a short length of coax cable with plugs to connect the CB antenna jack to J1, and the power meter is all set.—*Herb Cenan*

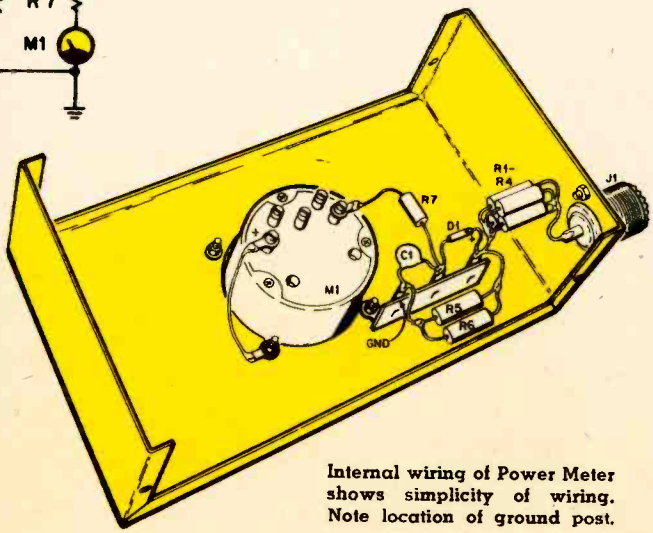


Resistors R1-R6 comprise a 50-ohm dummy load for rig in test.

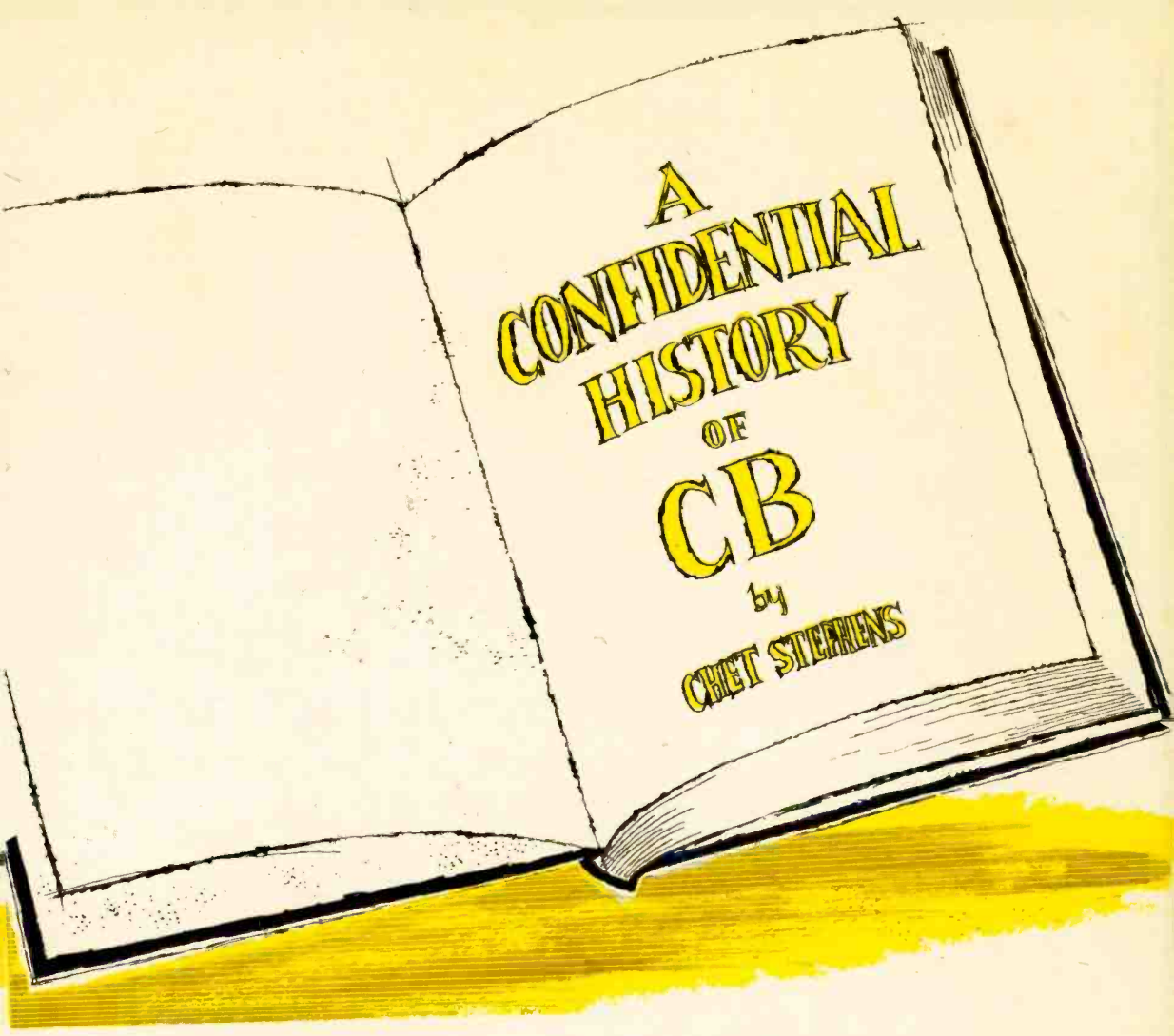
PARTS LIST
R1, R2, R3, R4—150 ohms, 1-watt, 5%
R5, R6—30 ohms, 1-watt, 5%
R7—6,800 ohms, ½-watt, 5%
C1—250mmf, 500 VDC (or higher) ceramic disc capacitor
D1—1N34A crystal diode
M1—0-1 ma S-Meter (Lafayette Radio TM-11)
J1—Coaxial jack
Misc.—Cabinet (5"x3"x2" approx.), terminal strips, etc.

Meter face below should be cut out and cemented directly over the original S-meter dial face.





Internal wiring of Power Meter shows simplicity of wiring. Note location of ground post.



"I WONDER who will be the first to issue a certificate for 'WAS'—Citizens Band (WASCB)?"

Amongst all the millions of words written about the Citizens Band you'd be hard put to find any that have been more influential than those 16. They closed an article in the March 1959 Radio-TV News (now Electronics World), a magazine for electronic servicemen and hobbyists with a circulation around 242,000. The piece was by Don Stoner, now a CB equipment manufacturer in addition to being a writer, and it told how to build a low-cost transceiver for the Citizens Radio Service. His parting reference was to a certificate which might be won by a CRS user who contacted other stations in all states—the ham term for this being *Worked All States*.

As of this writing, and so far as we know, no CBer has qualified for or received a WASCB, a failure assuredly not due to lack of heart. Sometimes half the inhabitants of the band in our bailiwick seem to be trying for one. To those of you who have come late into CB (i.e., since Kennedy was elected), this assignment of credits for popularizing CB may seem strange, or we could simply be prejudiced in claiming wide influence for our own medium (magazines). To answer such doubters, let's take a little tour of CB in its cave-man days. The Citizens Radio Service, to use the formal moniker invented by the FCC, is going on 16

years old. The band, conceived during the last year of the war, opened in 1947. It was assigned to the UHF frequencies between 460 and 470 mc. The event had approximately the same impact on two-way radio as the demise of a cockroach at Ft. Monmouth. The band was as unused as a spittoon at Vassar.

Effective September 11, 1958, the FCC created a new Class D CRS, giving it the chunk of 11 meters then occupied by hams. What happened? Nothing. The Citizens Radio Service dozed on, largely because few people had ever heard of it and even fewer realized its potential. Then came the Stoner article, and the dam burst. Hobbyists by the hundreds for the first time saw CRS as a new form of amateur radio with an examination-free license. Within weeks manufacturers were selling kit versions of the Stoner transceiver and, with the word spreading fast, CB/ham radio was off like a goosed gazelle.

That a couple of hundred thousand people had a concept of CRS which didn't jibe with the official view was not so much the fault of Stoner or the magazine as of Big Daddy in Washington. The FCC, in sweating out Part 19, sat and sat and then hatched a three-footed gooney bird. Never has a set of regulations been so loosely worded, and never has one left so many unasked questions unanswered. A single section, 19.2, has more loopholes than an IOU written on an ice cube. The regs for other services tell you everything but how to unclog the drain, but when it came to Part 19 the rules writers stabbed themselves in the back with their own ballpoints. Like the volunteer faced with his first parachute jump, they've been trying ever since to change that *maybe* to a *no*. The rules have been revised and re-revised, and they're still at it.

Part 19 represented the first time in history that licensees were, in effect, allowed to interpret FCC regulations. Previous regs, as we've said, were so specific that you had answers to questions you never got around to asking. But not Part 19. Here the wording was so loose that even well-intentioned CBers were left in a daze. We won't attempt to analyze the whole bale, since a look at 19.2 (Definitions) makes the point. Among a few hundred other words, the FCC threw in *personal and business radiocommunication* to tell us what CRS was for. The interpretations possible with those four words alone would make up another Gone With The Wind. A little later 19.2 says all Class D units are *mobile stations only*. Even base stations were classed as mobile. The idea apparently (to give our own interpretation) was to reserve CRS for use when no other means of communication was available. At home you'd use the telephone, not your CRS transceiver. But the term was not defined soon enough to head off misinterpretation, and still hasn't been fully defined.

After listening carefully to that mound of misinformation from the coaches, CB radio took a healthy swing at the ball and started running—right at third base. The band rang with CQ calls far into the night, and when word finally got around that somebody up there didn't care for that procedure, the hello-test gambit started. With all the testing, you'd

have thought there wasn't a decent piece of equipment on the band. They tested and tested, and talked and talked, even though few had bothered to learn much about this new miracle medium. Never was there so much technical discussion about something so few understood.

Legitimate CRS users found themselves drowned by the CB/hams. There actually were enough channels available but the superregen receivers of the time could be jammed from channel 1 to 23 by just one local talker, who droned on for hours. The new breed of hams might have choked the band to death if manufacturers hadn't produced receivers with some selectivity. The early transceivers obviously had been designed for business use, having one to three channels crystal controlled. But the CB/hams soon modified them for multichannel coverage and manufacturers, waking up fast to the fact that the talkers were the major market, started producing multichannel jobs with variable tuning (what business needs variable tuning?).

By late 1960 the Citizens Band, as it came to be called after Tom Kneitel gave it that name in Popular Electronics, was a disaster in the cities. In the country and a few urban areas, farmers and salesmen and the police had found CB useful. In the big cities the CB/hams had found it entertaining. Among other sad victims was a company set up to make custom installations of CB equipment for businesses in one community. An oil company was the first customer, and the last. The word passed around like a bottle of hooch at a football game. "If you're really in a fix, try smoke signals," the oil-company people advised everybody. "CB will only give you recipes and pseudo-science."

The curtain came down on 1960 with a farce known popularly as the FCC Hi-Fi Show, a rousing production that must have caused Olsen & Johnson to turn green with envy. The FCC suddenly had become fed up with the CB/hams, to the extent that one field office called in the worst offenders and played them tapes of their on-the-air conversations. Before the performance was half over the recipients of this special attention were shouting angrily that the FCC had violated secrecy-of-communications laws by letting the whole group hear the tapes. They skewered the G-men with a few four-letter words and walked out. At home they immediately fired up the old transceiver, broadcast the news of the day to everyone who could hear and then spent several weeks profaning the FCC on the air.

There were about three good reasons why the FCC didn't bash in a few dozen heads. Everyone realized that Part 19 *was* loosely worded and could be construed to mean nearly anything. Secondly, [*Continued on page* 116]

ALL ABOUT MODULATION

By Herb Friedman, 2W6045

A few facts to clear up the modulation mystery for CBers.

IF YOU LISTEN to all the talk about modulation in Citizens Band circles you might think most transceivers have difficulty producing signals that are even intelligible. That is far from the truth, of course. Most rigs now on the market are capable of good and efficient performance.

Modulation is something of a bugaboo to many CBers, however; they know it's important but are afraid it is too complicated to understand easily. They're likely also to believe *any* modulation system can be improved.

In reality, the facts you need to know about the system of amplitude modulation used in CB are relatively few in number and not a bit complicated. And, while it is true that some improvement can be made in many transceivers, you can't improve them all.

A CB transmitter consists of two basic sections: (1) a radio-frequency (RF) section, which generates a carrier signal capable of leaving the antenna and traveling through space, and (2) a modulator, which takes an audio (voice) signal and impresses it on the carrier. If the strength of the RF remains fixed, the loudness of the signal at the receiver is determined by the amount of audio impressed on the carrier—the more audio, the louder the signal.

This job of impressing audio on the carrier is performed at the plate of the RF power output amplifier tube (called the final). In most transceivers today this is a 6CX8, 6AQ5, 6AU8 or a 5763. When the audio signal is applied to the final, it and the RF signal beat together. The result is a modulated carrier—a carrier plus two new signals. These signals appear as sidebands on the carrier.

If a 1,000-cycles-per-second, or 1-kc, sine wave (single frequency) is used as an audio test signal and the RF carrier is on 27 mc, the transmitter's output is the 27-mc carrier plus one sideband equal to the sum of the audio and RF signals (1 kc plus 27 mc = 27.001 mc) and another sideband equal to the difference between the two signals (27 mc minus 1 kc = 26.999 mc).

In the case of speech, we have a complex waveform to produce the sidebands and the audio is at many frequencies, but the addition-subtraction procedure still holds. It is the two sidebands—and only the sidebands—which carry speech intelligence to the receiver. As a matter of fact, only one sideband is detected to reproduce the original audio. The second sideband is a mirror-image of the first. Both it and the carrier just go along to the receiver for the ride, serving no useful purpose. (In single-sideband radio, which even now is starting to be used on the Citizens Band, both the extra sideband and the carrier are suppressed and all power is concentrated in the one sideband.)

We said earlier that the loudness of the signal at the receiver, if the power of the carrier remains constant, depends on how much modulation is applied to the RF signal. This is true—but only up to a point. There is a limit to the amount of *useful* modulation which can be applied. This limit is called 100 per

cent modulation. Actually, as we'll see, it is 100 per cent negative, or downward, modulation which is the limiting factor.

To show how a modulated signal is produced, we'll go back to the basic components. The drawings that follow are graphic representations of electrical waveforms. As in any text dealing with electronics, graphs or charts don't really show what happens. But they're the best visual aids we can produce to put across the ideas.

Figure 1 represents an RF voltage (or current; it does not matter which you

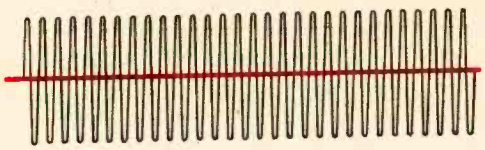


Fig. 1—A 27-mc RF carrier waveform.

consider). It is a sine-wave voltage as generated by a transmitter. In the case of CB, 27 million cycles are generated each second in the RF carrier. Our drawing shows some 30 cycles.

The audio or modulating voltage is represented by the sine wave shown in

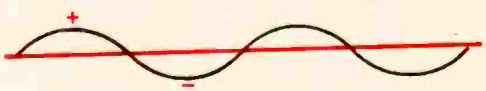


Fig. 2—Sine-wave modulation (audio) signal.

Fig. 2. The frequency here is 1,000 cps. Note that the audio voltage is shown with an axis of its own and has positive and negative peaks (or peaks and valleys) like any normal electrical waveform.

When the RF voltage is modulated by

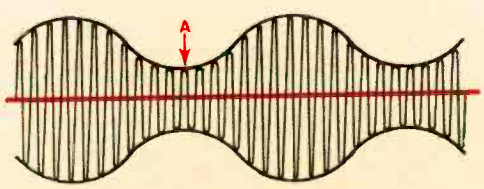


Fig. 3—Modulated carrier.

the audio voltage (when they are mixed together) the result is a modulated carrier, as shown in Fig. 3. You'll notice that the amplitude of the normal, unmodulated carrier shown in Fig. 1 has undergone changes in Fig. 3. What happened? The answer lies in the changing polarity of the modulating voltage. When this voltage is above its own axis, or positive, the amplitude of the carrier is boosted above its unmodulated level. When the modulating voltage is below its axis, or negative, it decreases the amplitude of the carrier voltage. The resulting waveform at the top of the carrier diagram is exactly in phase with the modulating voltage and exhibits the same amplitude (all waveforms here are shown in the same relationship). Below the axis of the carrier is an inverted, or mirror-image, modulating-voltage waveform. This image is eliminated at the receiver. The remaining one supplies the information for demodulation of the signal. In the case shown in Fig. 3, the audio voltage's negative swings decreased the carrier about halfway to the carrier's axis (see point A). This represents 50 per cent modulation.

If the amplitude or strength of the

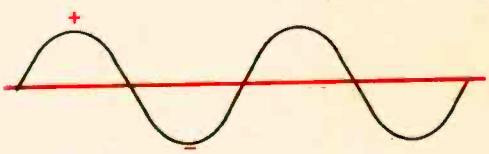


Fig. 4—Audio producing 100% modulation.

modulating voltage is increased, as in Fig. 4, so that at the instant it stands at its maximum negative swing (negative peak) the carrier voltage is col-

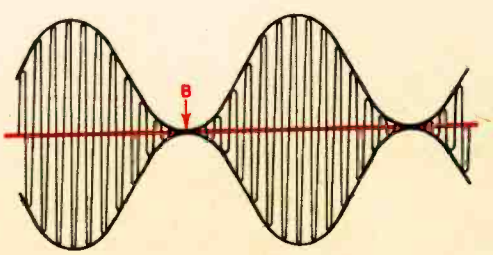


Fig. 5—Carrier showing 100% modulation.

lapsed to zero (its own base line), the carrier is said to be 100 per cent negative

or downward modulated, as shown in Fig. 5 at point B. To achieve 100 per cent positive modulation, the modulating voltage must double the voltage of the unmodulated carrier. A distortion-free transmitter always has a symmetrical waveform, showing the same percentage of both positive and negative modulation.

Modulation of 100 per cent is not only the limit permitted on the Citizens Band, it also gives you the most powerful signal (as represented by the amplitude of the modulating voltage) that you can use efficiently. Modulation of more than 100 per cent produces distortion, besides arousing the ire of the FCC.

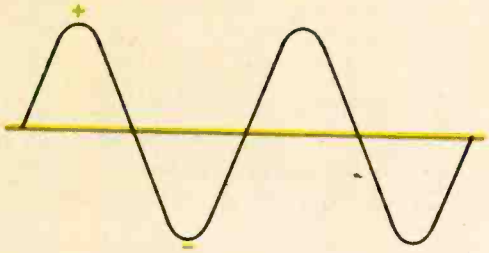


Fig. 6—Excessive modulating voltage.

In Fig. 6 we show a modulating voltage in excess of that required for 100 per cent modulation. Let's see what happens when we apply it to the RF carrier we've been working with.

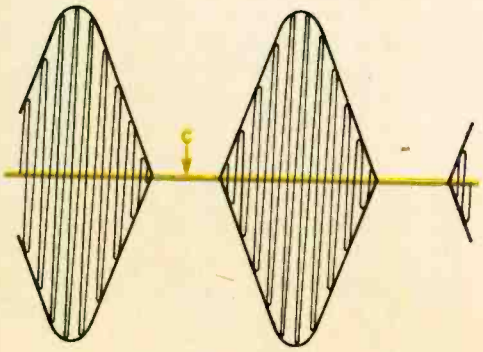


Fig. 7—Carrier modulated over 100%.

The result of this marriage of overly-strong modulating voltage and carrier is shown in Fig. 7. Notice that the carrier is driven to zero (its axis; point C) even before the modulating voltage reaches its negative peak, which would fall below the carrier's axis. The RF output

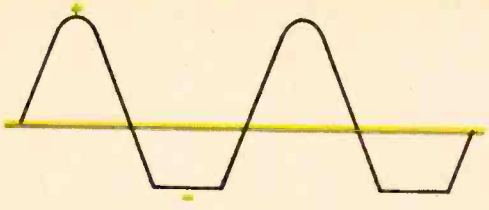


Fig. 8—Distorted signal at receiver.

is cut off completely.

Since the modulation, when recovered at the receiver, will look like the waveform in Fig. 8, the audio will be distorted. A close examination shows that it is the *negative* part of the modulating signal that is distorted. The positive peak does not distort. In practice, you can run 200 or 300 per cent positive modulation and 100 per cent negative modulation and still have no distortion problem. But let your negative modulation go over 100 per cent and all kinds of unpleasant things happen.

A surprising facet of this picture is that distortion of the modulating signal is *in itself* no major headache. Speech clippers cut off the modulating waveform—thus distorting it—but still manage to *improve* communications. Eliminating the higher and/or lower voice frequencies reduces the naturalness of your voice but at the same time increases intelligibility by beefing up the intelligence-carrying midrange frequencies (500-5,000 cps).

The trouble caused by excessive negative modulation has to do with the relationship of the modulating signal to

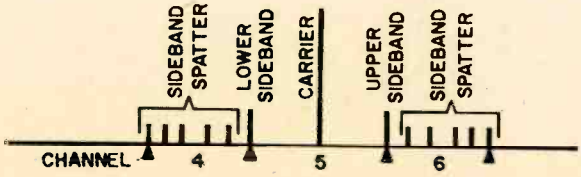


Fig. 9—Sideband spatter in adjacent channels.

the carrier, with distortion of the carrier, and with production of sidebands

ALL ABOUT MODULATION

(see Fig. 9 on opposite page).

When the waveform of the audio voltage becomes distorted it begins to produce harmonics of itself (a 5-kc modulating signal would produce harmonics of 10, 15, 20 kc, etc.). These harmonics then beat with the carrier, with each other and with the new difference frequencies to produce a flock of new sidebands (you will remember that the beating of the modulating signal and carrier produce two basic sidebands). The new sidebands are just like the old ones, although they are less powerful and they're also outside the CB channel you are using. In bad cases they may spread over several adjacent channels, interferring with other stations (which is illegal). The term given to this situation is *sideband spatter*.

Modulation percentages always are given in reference to the *peak* modulating voltage, but you also must consider another factor: *average* modulation. The higher your average modulation runs, the stronger your signal at the receiver. It can be shown mathematically that the *average power* of a complex waveform (such as speech) necessary for 100 per cent modulation is one-fourth the RF input power to the final. In other words, it takes between 1.2 and 1.3 watts, averaged out over many cycles, to achieve 100 per cent modulation when your transmitter is loaded to 5 watts input. An increase above this power results in overmodulation.

On the other hand, a sine waveform must pack one-half the input power to achieve 100 per cent modulation. To insure that the modulator is capable of delivering the peak power necessary for 100 per cent modulation, and to permit the use of sine waves for tests, the modulator in most CB rigs is designed to deliver one-half the RF carrier power.

There's another way to increase your talk-power—the apparent power of your signal at the receiver. Consider this: if you use a speech clipper to cut off the peaks of the modulation waveform halfway to maximum (6db below the peaks) the new peak audio signal would result in only 50 per cent modulation. So now you can add 6db of modulation power (doubling the voltage) to bring the new peak up to 100 per cent modulation. Since the average level of the signal has been increased 6db, its actual power also has increased that much.

Clipping does distort the modulating waveform but you can clip up to 25 db before intelligibility is lost. In practice about 12db clipping normally is used. Clippers do not produce sideband spatter because it is the modulating waveform, not the carrier, which is distorted.

As a last consideration, the frequency response of your entire audio system can be tailored to make the most of the modulating signal. As shown in Fig. 10, the frequency response of the average voice is about 90 to 10,000 cps, with voice power decreasing as the frequency rises. Most of the voice's intelligence is carried in the range from 500 to 5,000 cps. Your audio system can be arranged—beginning with a selective-frequency microphone—to attenuate the high and low frequencies. This, in effect, boosts the power of the intelligence-carrying midrange to 100 per cent modulation, giving you an increase in talk power of at least 6db.

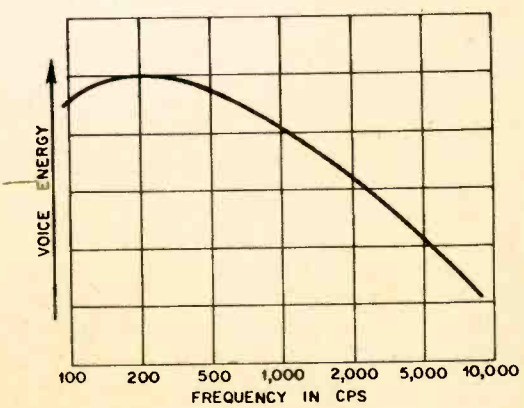


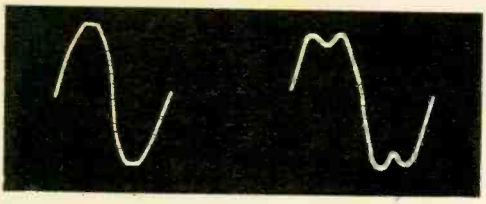
Fig. 10—Voice's power at all its frequencies.

GOOD READING

By John Milder

IT'S EASY TO USE ELECTRONIC TEST EQUIPMENT. By Larry Klein and Ken Gilmore. John F. Rider, New York. 186 pages. $4

Larry Klein, EI's Technical Editor, and Ken Gilmore, a frequent contributor, have collaborated to produce a fine survey of modern test equipment and its uses. The longish title notwithstanding, it is not a book meant for the absolute beginner. It's aimed at hams,



hobbyists and technicians, and its usefulness won't soon be outdated.

The book obviously is meant to be *used,* and the equipment selected to illustrate each section is just what's likely to be found on your test bench. No words are wasted on superfluous topics and obsolete equipment. The style is informal, readable and to the point without being either overly simple or too professional. If you want to make the most of your own test equipment, this is a book to keep handy.

As a kind of bonus, the authors throw in some welcome words on the testing of hi-fi equipment, a subject that has been given far too scant attention elsewhere. (Our illustration, from the book, shows a sine-wave oscilloscope trace with some clipping at left, more clipping at right.)

THE LP/STEREO RECORD GUIDE AND TAPE REVIEW. By Warren DeMotte. Argyle Publishing Corp., 198 Fifth Ave., New York. 320 pages. 95 cents

If you feel lost in a wilderness at a record store, you have reason. You can find a dozen or more versions of almost every major piece of music on mono or stereo discs and tapes. That's why a book like the one at hand is long overdue. It helps you make intelligent choices.

The tome is a survey, via convenient capsule reviews, of virtually *every* available version of major and minor pieces. Mr. DeMotte, who is EI's record reviewer, minces no words when he tells you which version of Beethoven's Fifth or Schubert's Unfinished that *he* prefers, and he goes on to give enough information about other recordings to help you make a choice of your own. He pays attention to both musical and sonic qualities.

The book's unexpected *lagniappe* is some short but valuable sections on folk music and audio equipment. To my way of thinking, however, the most impressive fact is that Mr. DeMotte has *listened* to every recording he talks about (EI can vouch for that). There is no cribbing or second-hand evaluation.

SINGLE SIDEBAND FOR THE RADIO AMATEUR. American Radio Relay League, West Hartford, Conn. 223 pages. $2

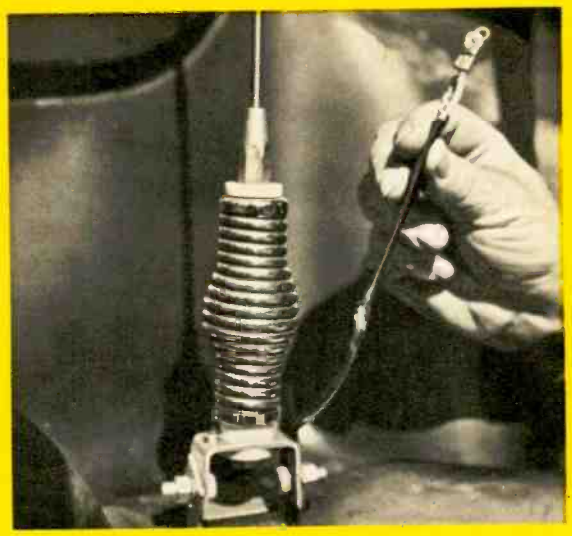
Some eight years ago the ARRL published its first volume on single-sideband radio and, since interest is still a-building, we now have a revised edition. It's up-to-date and fact-packed.

CB RADIO ANTENNA GUIDEBOOK. By David E. Hicks. Howard W. Sams & The Bobbs-Merrill Co., New York & Indianapolis. 136 pages. $2.50

This is an excellent book on the subject of CB antennas, full of pertinent suggestions for making the most of your rig *legally.*

And make note of . . .

HOW TO READ SCHEMATIC DIAGRAMS. By Donald E. Herrington. Sams. 128 pages. $1.50



PERK UP YOUR MOBILE

Careful inspection and repair can give you like-new performance.

By Bert Mann

TAKE a high-quality Citizens Band transceiver, install it in a car or truck, use it continuously and subject it to vibration and bumps—and what happens? After six months you can't even remember its like-new operation.

To get some of the old zip back you need a perk-up job. A CB rig is just like a car in that respect. For maximum performance a twice-yearly tune-up is called for.

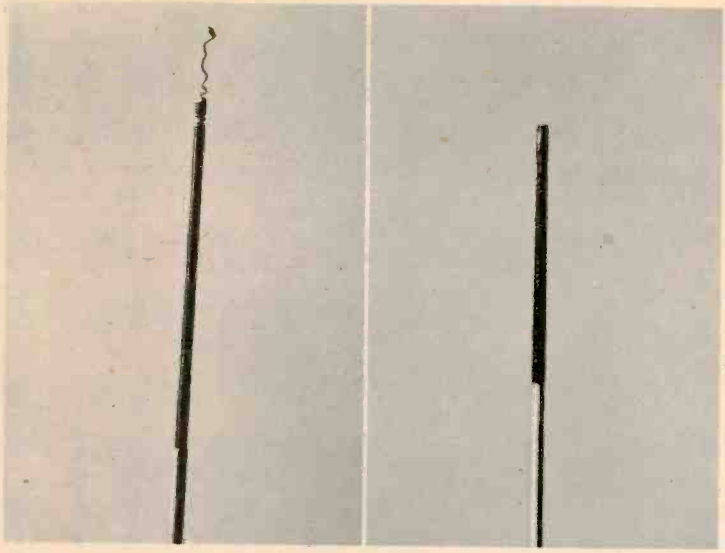
A mobile revamp is considerably different from that given a base station. Dusting, tube-checking and so on may be enough for a home rig but thorough cleaning is required for mobiles.

Start with the tip of your whip and go all the way through your system. That little ball on top of the antenna is more than a decoration. It discharges static electricity built up by air friction, distributing it over a large area. Without it, the discharge is from a sharp point and causes high-intensity noise shots. If the ball is gone get a steel marble, such as those used in toys, and drill a snug-fit hole in it. Then force-fit it on the antenna. A plastic ball also can be used.

Continuously loaded whips usually have a plastic sheath over their coils. If the sheath cracks the coils can be exposed to damage. If there are breaks or cracks in your sheath wrap it with a single layer of plastic tape and saturate it with poly or coil dope for waterproofing. If insulation is chipped off the coil itself saturate it with Glyptal. When that dries, wrap the exposed coil with tape and then waterproof the job.

The spring at the base has an internal braid running from one end to the other, which prevents the spring from acting as a loading coil (the braid shorts out the would-be coil). To check, bend the coil and look inside to make sure the braid is connected to both ends. If the braid appears corroded jam a pencil or screwdriver into it. Replacement of the spring was past due if the braid breaks.

In bumper mounts, check the coax at the base (our lead photo shows a cable damaged by bumper vibration). Look carefully for corrosion on the braid (the ground connection). When you find corrosion remove it with a wire brush, trim the end of the coax and form a new ground with the braid. If the coax must run in a tight bend around the bumper,



If a loaded mobile whip's plastic sheath cracks, it can result in damage to the loading coil, as in the picture at far left. To repair, restore coil and wrap exposed section tightly with plastic tape (see photo right, after repair).

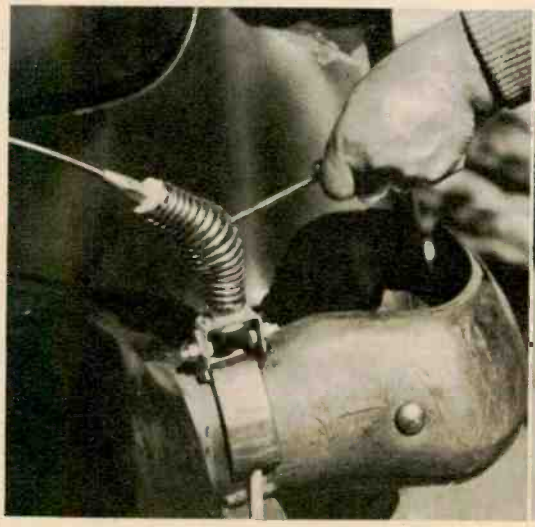
cement some rubber grommets to the cable to prevent direct contact.

Body mounts require especially close checking. It is not unusual for the hard Bakelite insulators used on low-cost mounts to develop fine cracks between the ball (the RF hot lead) and the grounded mounting screws. Dirt and grime, accumulated in the cracks, tend to bleed off some of the RF energy. As a temporary measure you can clean the cracks with carbon tet and cover them with plastic tape. But the only final solution is replacement.

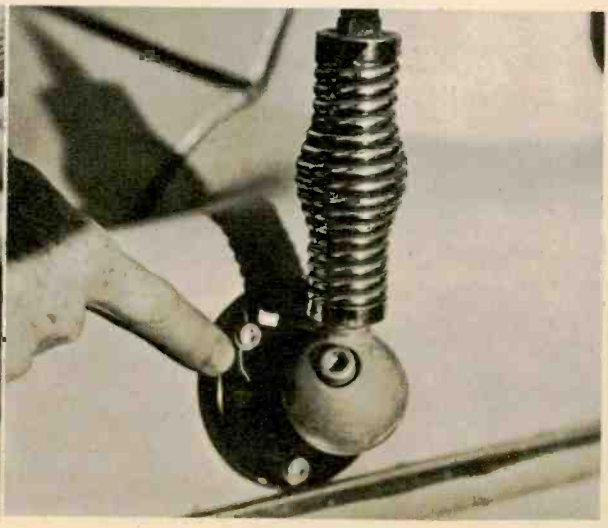
The last check on the antenna is the cable. If it runs under the car, look for rock damage; if under the back seat or floor mats, be on the lookout for a squashed spot. Cable is cheap. Spend a dollar for a new one if you need it.

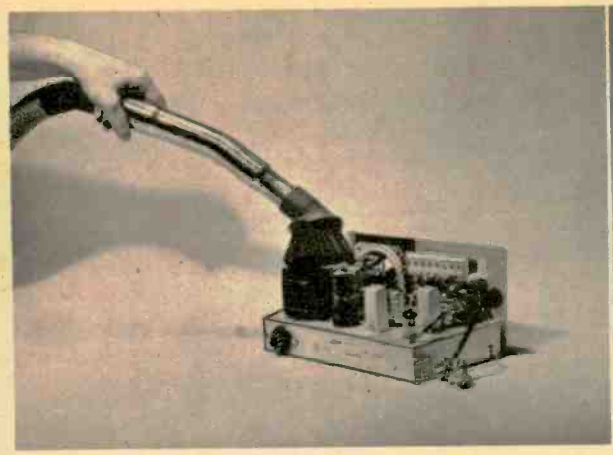
On front cowl mounts, the mounting nut should be tightened because the

A defective or corroded shorting braid in the whip's spring will break when jabbed with tool.



Body mounts should be checked for cracks around mounting screws; grime in cracks shorts out RF.





Thorough vacuum-cleaning removes dust and dirt from mobile transceiver. Cleaning can prevent intermittent operation. Do not blow out dust.

Transmit and receive switches require periodic cleaning for trouble-free operation. A liquid cleaner is being used here; never file contacts.

coax ground connection is determined by the tension of the nut.

Turning to the transceiver, take off the cabinet and vacuum the inside thoroughly. If you find dust in the tuning capacitor, dip a piece of washed linen in solvent and pass it through the plates. Rotary switch contacts are cleaned with contact cleaner, while relay contacts can be put in shape with a business card saturated in the same cleaner (put the card between the contacts and pull it through).

Naturally, you will want to replace any defective tubes. Then check the rig's performance against your base station transceiver. If the set has really had it rough you may have to realign the receiver with a signal generator. After putting the transceiver back in the vehicle, use a standing wave ratio meter to peak the transmitter.

While usually not required, realignment of a CB rig's receiver may sometimes be necessary after a long period of sustained operation. An RF signal generator is being used below to realign a set.

A SURVEY OF CB KITS

Do build-it-yourself rigs save you money? Should beginners try them? What about FCC regulations?

By Len Buckwalter, KBA4480

BUILD-IT-YOURSELF kits have become firmly entrenched as part of the Citizens Band equipment market. As in other areas of consumer electronics, kits are a powerful lure to the CBer. They can save you up to 30 per cent, and at the same time you have the pleasure of building a piece of equipment and the later satisfaction of seeing it work. Along the way, you pick up a little knowledge, too, though the educational value of kits often is overestimated, as EI has said.

A wide range of CB equipment comes in kit form today—everything from a stripped-down, under-$10 handi-talkie to fancy, gingerbread-loaded transceivers. Accessories, too, are starting to appear for the CBer who likes to snip, strip and solder. This survey covers all the major CB kits, though some semi-kits (build-part-of-it-yourself) are not included.

Without doubt, the leading question about CB kits concerns the oscillator section of the transmitter. Part 19, many of us once assumed, would require kit transceivers to come with a wired and sealed oscillator section (the frequency-determining elements). It hasn't worked out quite that way. Virtually all oscillators, apparently with the blessing of the FCC, arrive as bunches of components and are put together by the buyer.

Is CB equipment hard to build? What about alignment? Is it tricky without special instruments? And, in the final analysis, can a pile of coils, resistors and other electronic miscellany be converted by the beginner into a rig that works as well as its factory-built counterpart?

Unlike other electronic kits, those made for CB must not only satisfy the builder, but also some stiff laws laid down by the FCC. There's no relaxation in specs to allow for errors by the hobbyist. Thus, care in construction, especially in the transmitter section, is the rule for CB kits. Some manufacturers have adopted special techniques to help insure legal performance of their completed models.

EICO Model 772 transceiver has 4 transmit channels, a tunable receiver with 1 crystal channel. Squelch, noise limiter. $89.95.

EICO Model 740 handi-talkie offers 100-mw transmit power, has 1 crystal receive channel. Nine transistors; kit, $54.95.

Heath GW-12 transceiver is low-cost, 1-channel rig. Superhet receiver, squelch, push-to-talk. Kit for AC operation only is $39.95.

A typical example is found in the EICO 772 transceiver. Aware that the frequency-determining part of the circuit is critical, EICO supplies a prefab crystal oscillator that is tested and sealed at the factory. During an appropriate point in assembling the kit, the builder bolts the oscillator unit to the main chassis and hooks on a couple of leads. No further adjustments are needed and off-frequency operation is avoided.

Other manufacturers have taken to the printed-circuit board to head off difficulty in the delicate oscillator section. Allied's Knight-Kit C-22 and Radio Shack's TRC-8, for example, overcome the lead-placement problem with copper foil conductors which cannot shift from the position planned by the design engineer. These techniques are by no means universal. If the manufacturer provides no pre-engineered assembly, the builder must follow the manual on proper lead placement.

In other phases of CB kit construction, the prospective builder will find the same techniques that have been applied with success over the years to test equipment and hi-fi gear: simple, step-by-step instructions and clear diagrams. There is no sign that the manufacturers have wavered from the golden rule of kit-making—no matter how complex the job, it should be practical for anyone to build. Nevertheless, a certain number of kitchen-table productions fizzle.

The major reason, everyone agrees, is the cold solder joint. It is *not* wiring error, as generally believed by kit builders. (This takes second-place honors.) Nowhere else is it so important to avoid the powdery, dull-gray and

Heath GW-11 has crystal control on 3 transmitting, 1 receiving channel, plus variable tuning. Kit for AC operation is $69.95.

Heath GW-32: 5 crystal T-R channels, squelch and noise limiter. With selective call, $84.95; without call, $59.95.

Heath GW-31 is low-cost 90-mw handi-talkie; 1 crystal control transmit channel and superregen receiver; 4 transistors; $24.95.

Heath GW-21 is a 9-transistor handi-talkie. It has 1-channel superhet receiver. Transmitter is rated at 100 mw. Kit, $44.95.

Allied's Knight-Kit C-11 rig features tunable superregen receiver; 1-channel, 5-watt transmitter. Kit price is $39.95.

Knight-Kit C-22 has 5 crystal T-R channels, squelch, noise limiter. Kit is for 117-VAC or 12-volt DC operation; the list price is $69.95.

crumbling solder joint as in CB construction. A hi-fi amplifier may work well for years before a poor joint acts up, but a CB rig doesn't always operate under such placid conditions. The rigors of mobile operation soon expose a bad soldering job. This is pointed up lucidly by the experience of one serviceman who specializes in kit repair. He regularly rescues equipment through the simple act of resoldering every joint.

The best way for the beginner to avoid the problem is to stop thinking of a soldering iron as a device to melt solder. Rarely will a cold joint develop if the iron is used only to heat the wire and terminal lug which, in turn, get hot enough to make the solder flow.

With the appearance of the accessory in kit form, the CBer can significantly improve the performance and operating convenience of his station. Two of the most popular units packaged for home construction are selective call and the audio compressor. The first device is typified by Heath's Tone Squelch (GD-162A). It keeps the transceiver silent unless an incoming call carries proper tone. Other traffic on the channel is muted. To make the kit useful for all makes of CB units, Heath provides step-by-step instructions for wiring it to their own and four other leading transceivers. There's a more general installation procedure for the remaining rigs.

The SpeakEasy by Instruments & Communications, Inc., and the Stoner Audio Ram are audio compressors in kit form for boosting modulation percentage. In most rigs, 100 per cent modulation is achieved only for occasional voice peaks, while average levels tend to remain in the 20 to 30 per cent region. Compressors hook into the mike

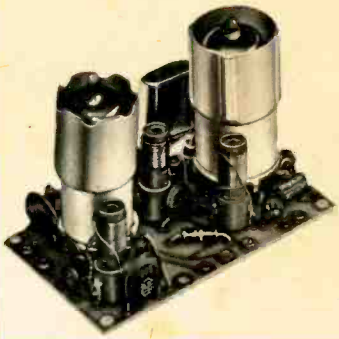
Knight-Kit's C-100 3-transistor handi-talkie features superregen receiver and 100-mw transmitter, uses a 9-volt battery. Price: $9.95.

Knight-Kit KG-4000 has 1-watt transmitting power, 1 crystal channel; basic price, $59.95; battery charger $19.95 extra.

Radio Shack's Realistic TRC-8: 8 crystal T-R channels, dual conversion, squelch and noise limiter, S-meter; costs $109.95.

Stoner Audio-Ram SE-101K is a clipper/compressor accessory for boosting your percentage of modulation. List price of kit is $14.95.

SpeakEasy by Instruments and Communications, Inc., is an audio compressor. Meter shows modulation percentage; $24.95.



International Crystal's FRA-1 converter brings CB calls in on regular broadcast radio. Parts and printed circuit board cost $14.

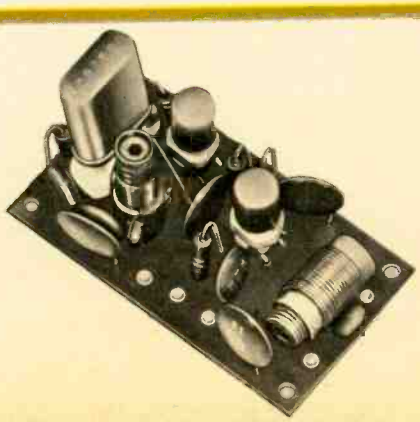
lead and raise average talk power as close to the 100 per cent figure as possible without overmodulating. As in other CB kits, complete assembly and installation instructions are included.

The CBer with technical knowhow has not been overlooked by kit makers. International Crystal makes available a series of printed-circuit boards which may be used in equipment of the CBer's own design. Major items of interest are tube and transistor transmitter sections and an RF converter which brings the 27-mc band in on a standard broadcast receiver. Instructions packed with these units have schematics and circuit descriptions but do assume that the user has knowledge of the associated circuits.

The typical CB kit, as opposed to the circuit boards mentioned above, is engineered to eliminate the need for complex test equipment for final alignment and adjustments. However, it is recommended that the builder have access to at least a sensitive (20,000 ohms/volt) VOM. Virtually all manuals give the alignment procedure with and without instruments but stress that best performance results with a meter. Without the milliammeter, for example, it's impossible to determine the power input to the transmitter precisely. The voltmeter allows needle-sharp adjustments to the various coils and transformers in the receive section.

If you're wondering whether the finished product can work as well as a factory-wired model, the answer is yes, when the kit is purchased from a reputable manufacturer. In fact, many rigs and accessories are offered in wired and kit form and contain identical circuits and components. With careful attention to the assembly manual—and by avoiding the cold solder joint—success is easy.

International's transistorized transmitter unit has 25-mw output; board and parts $24.50 (wired).



Basic 5-watt transmitter is on circuit board. No final tank, crystal. Intl. Crystal. $9.95 (wired).

THE LISTENER

SWL-DX NOTES

BY C. M STANBURY II

LAST CHANCE . . . After May 1 DXers will have one less country to shoot for. Netherlands New Guinea (Irian) on that day becomes part of Indonesia. The territory a few months ago was close to being a battleground between Dutch and Indonesians. The major Irian (*West Irian* is a more popular term) station is RONG, Radio Omroep Nieuw Guinea, on the offshore

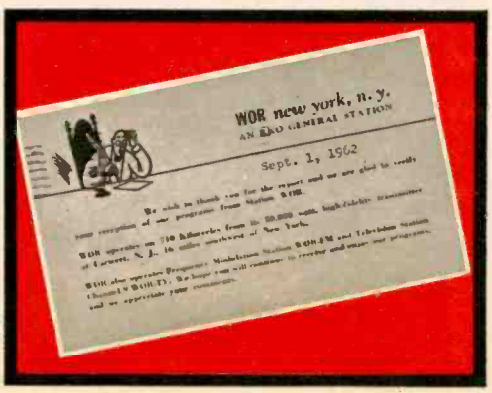
island of Biak. It is best heard on 6070 kc between 0530 and 0830 EST. RONG always has been friendly to DXers. Whether it will remain so under Indonesian control, and which way it goes politically, we'll soon find out.

Meanwhile, you might get some clues by listening to Radio Republik Indonesia at Djakarta. RRI's Voice of Indonesia broadcasts in English at 0600-0700 and 0930-1030 EST on 9710 and 9585 kc; also from 1400 to 1500 on 9585, 11795 and 11710 kc. The station in the past has been erratic in the QSL department, preferring to send out decorative program guides (see cut).

Notes . . . R. Australia, favorite target of DXers, has switched its North American transmission to the evening: 2000-2300 EST on 15370 and 17840 kc, its Sunday DX program to 2115 EST . . . Radio preacher V. E. Howard (see March '62 LISTENER) is suing XERF over a refund he says was due him after his Gospel Hour was taken off the air, and the Mexican station also is having QRM problems with CKLM, Montreal, which operates continuously . . . DXers looking for the Netherlands Antilles should watch 907 kc for PJA6, Radio Victoria, Oranjestad, Aruba. It's a religious station with some commercials.

Long John . . . Every night from 2400 to 0500 EST (0530 on week ends) Long John Nebel holds forth on New York's WOR. The Long John Show is heard regularly in 27 states for, at 710 kc, WOR has QRM trouble only with KMPC, Los Angeles.

Besides being a good DX catch (see QSL card), Long John's show represents some truly unusual listening. He has the most unique guests in radio. For instance, not long ago Long John's listeners were treated to an interview with one Albert Bender, who has some unusual attributes. According to him, when he tuned his radio to a certain spot



on the dial (he couldn't remember just where) he was contacted by beings from the planet Kavik and then transported to Antarctica, where the Kavikites have a flying saucer base. An unusual interview, indeed. But no more odd than many others presented by Long John. You just can't get 'em like that anyplace else.

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SWL

Proprietor of our Prize SWL Shack is Paul B. Silver, Woodbridge, N. J., who's been a radio hobbyist 50 years. He has some 110 countries verified, got all continents in 1935. In his 4,000 QSL's are three from sputniks, 11 from U. S. satellites. He has three receivers and uses two antennas.

CB

Billy K. Hart is the operator at CB station 6W6033. The whole rig is housed in a sliding-door closet in a 10x50-foot mobile home in Augusta, Ga. The panel-mounted transceiver, located below a tape recorder and power panel, is a modified RCA Mark VII, which now has an oversize dial, an S/power meter and a bank of 22 crystals. He really made his trailer space count!

HAM

Most unusual thing about our ham shack is the location—Little America, Antarctica. The operator here is Julian Gudmundson, K6OEE (left). He is a Navy Seabee. The station, a kilowatt Collins SSB rig, is KC4USA. With Mr. Gudmundson is a visiting U. S. congressman.

VOICE-POWER AMPLIFIER

Microphone preamp with adjustable frequency range tailors mike response to any voice.

By Russ Cogan

A SERIOUS deficiency of most CB rigs is that microphone amplification is established at a value which gives eighty-five to one hundred per cent modulation with an "average" voice. Unfortunately, voices are not average, some are loud, others are soft. Some people tend to swallow the mike—others act as though it had halitosis. All these factors help determine the per cent modulation. Frequently, in order to achieve 100% modulation with a comfortable voice level additional microphone amplification is needed.

EI's CB Preamplifier will provide the additional gain needed to fully modulate the transmitter. Since the preamp is transistorized, it is easily connected to either your base or mobile transceiver without tapping its internal wiring. The low current drain will give a battery life of many months. Level control R1 permits adjustment of the preamplification to the exact value required for your voice and mike habits.

As an added feature, the preamp is designed for low-frequency attenuation thereby providing a crisp communications quality. In addition, a variable high-frequency tone-shaping control is provided. By proper adjustment of control R5, audio quality can be varied from sharply crisp to smoothly mellow.

The preamp is wired on a 2x3¾-inch piece of perforated board. Before installing the components drill a hole in each corner of the board for the mounting screws; use a #28 drill for 6-32 screws. Input transformer T1 is held to the board with flea clips. Carefully bend T1's mounting tabs so they are at right angles to T1's frame. Place T1 on the board and insert a flea clip through the tab and board. A small drop of solder applied to the flea clips on the underside of the board will hold T1 firmly in place.

All the other board components are wired to flea clip terminals. The component leads are short so take care not to use excessive soldering heat. Use a heat sink (such as an alligator clip) when soldering transistor Q1.

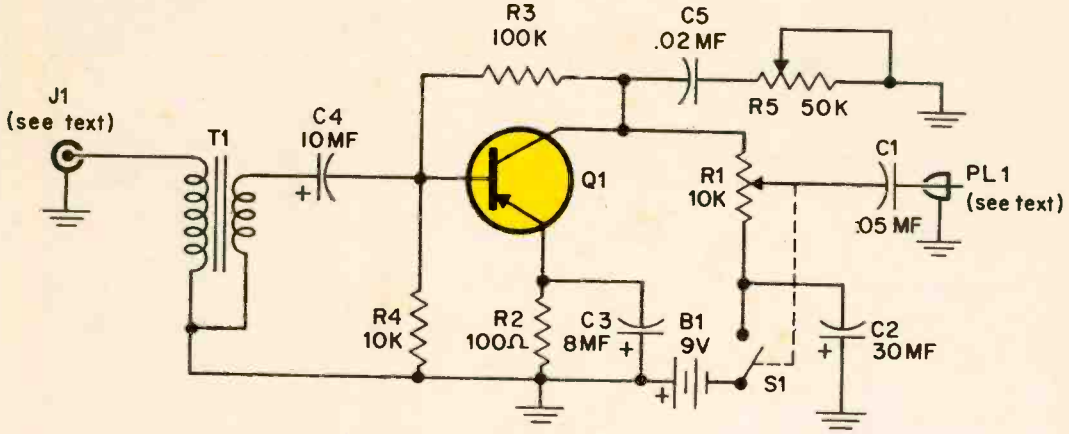
The battery is held in place by brackets made from cable clamps or a strap can be cut from a tin can.

After the battery is in place mount the perforated board in the cabinet. To avoid short circuiting the flea clips which extend through the board, place a quarter-inch spacer or stack of washers between the cabinet and the board at each of the four mounting holes.

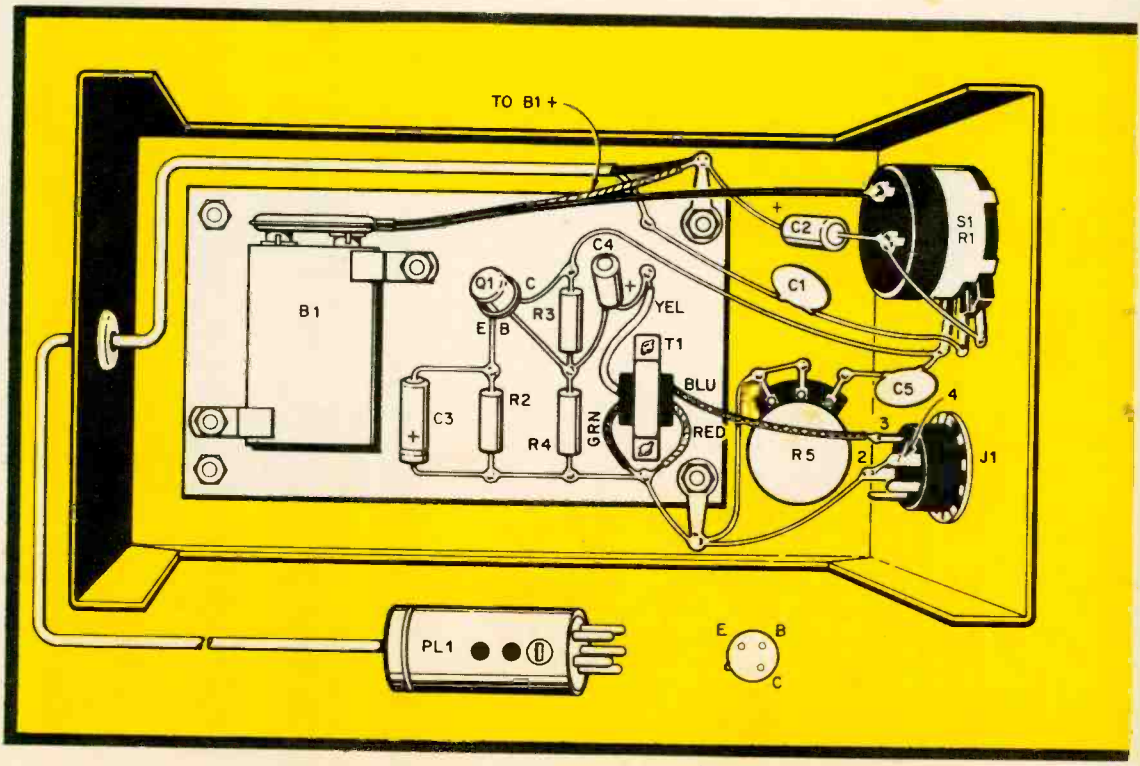
Input jack J1 is selected to mate with

PARTS LIST

Resistors: ½ watt, 10% unless otherwise indicated
R1/S1—10,000 ohm pot with switch
R2—100 ohms
R3—100,000 ohms
R4—10,000 ohms
R5—50,000 ohms miniature pot
Capacitors: All rated at 10 VDC or higher
C1—.05 mf miniature
C2—30 mf electrolytic
C3—8 mf electrolytic
C4—10 mf electrolytic
C5—.02 mf miniature
B1—9-volt transistor radio battery
Q1—2N109, 2N217 transistor or equiv.
T1—Transistor transformer: 200,000 ohms primary; 1,000 ohms secondary (Lafayette Radio TR-120 or equiv.)
PL1,J1—see text
Misc.—Perforated board (3½"x2"); flea clips; Minibox (5¼"x3"x2¼"); etc.



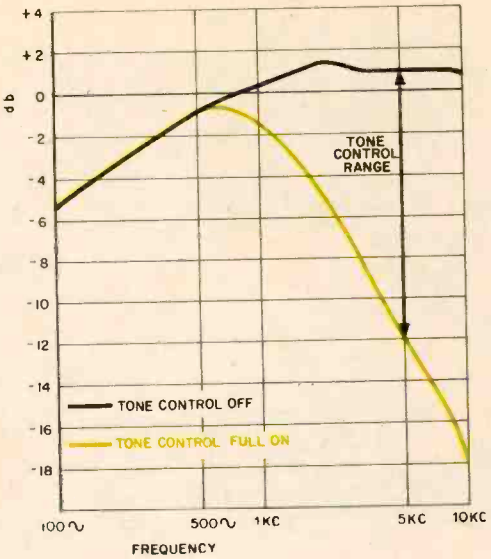
Circuit achieves its frequency characteristic with a fixed bass and a variable treble roll-off.



the plug on the microphone cable. Connect T1's blue lead to the J1 terminal which corresponds to the microphone's hot lead. If your mike has push-to-talk switching, run a pair of control wires from J1 through the output cable to PL1. To avoid hum pickup, the P-T-T leads should be outside the shield used for the microphone's hot lead. *Do not* use an output cable which has all the wires inside a single shield.

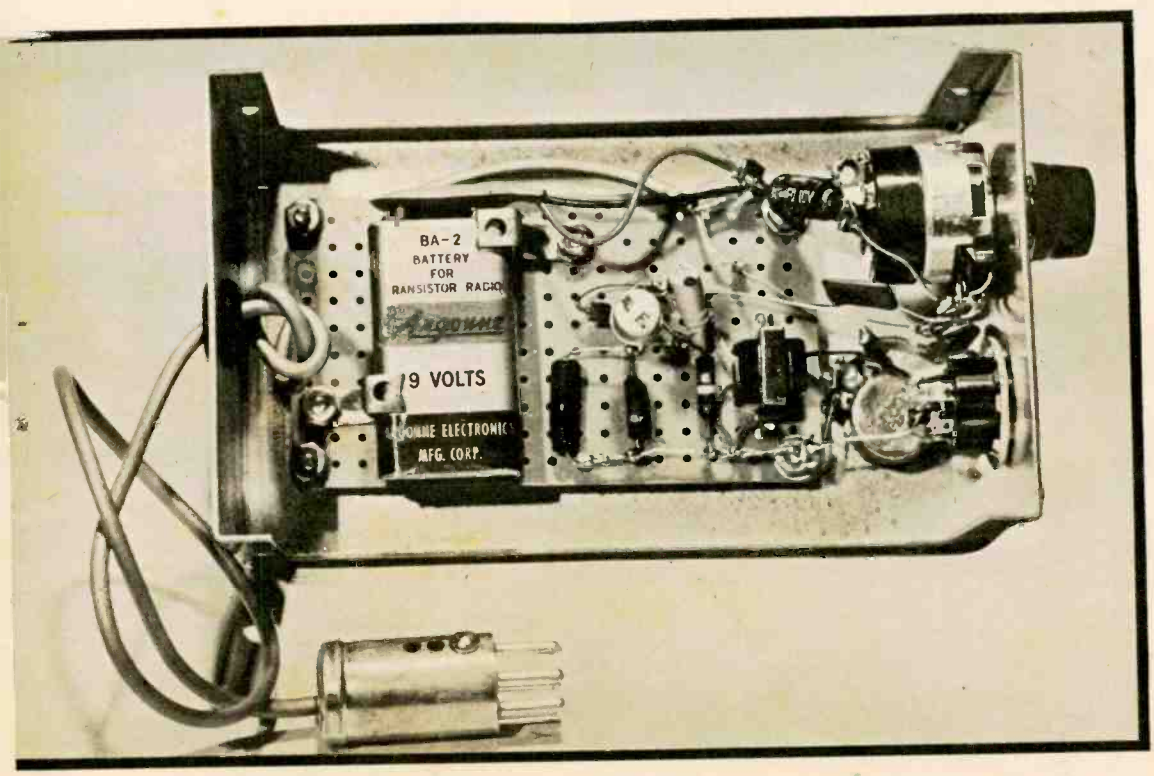
Using the Preamp. Plug the mike into J1 and output plug PL1 into the transceiver. Rotate control R5 full counterclockwise (off). Then, speaking in a normal voice, adjust R1 until the transmitter is 100% modulated. Some form of modulation meter (EI's Monitor Meter, CitizenScope, or CB Modulation Meter) is necessary when adjusting R1 since the preamp provides more than enough gain to overmodulate the transmitter. After R1 is set, R5 can be adjusted to give the desired frequency response.

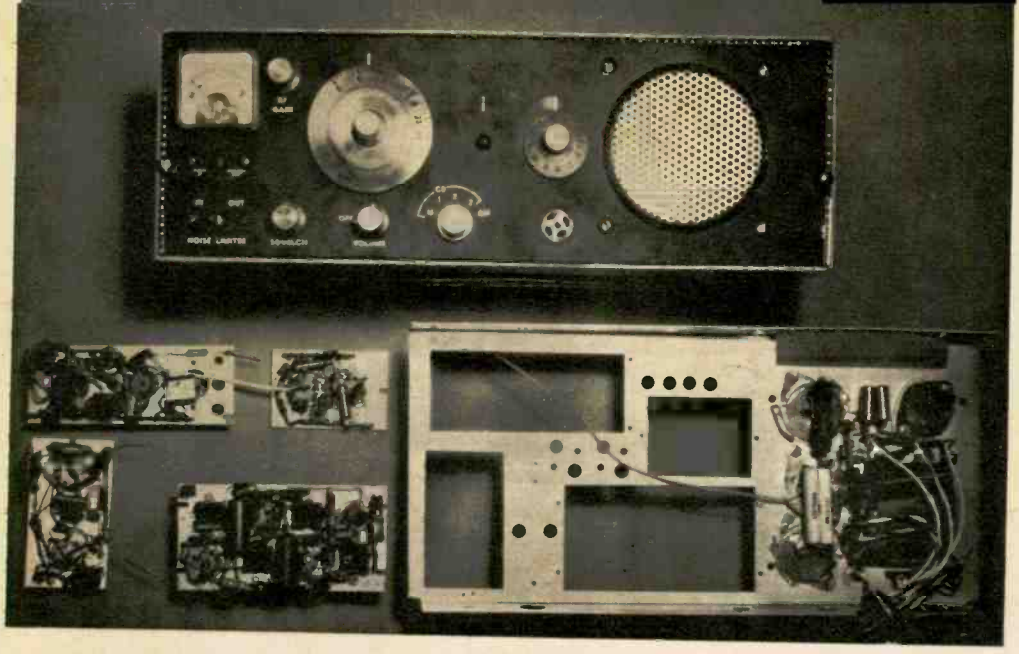
Note that the preamp, is designed for the kind of bass attenuation preferred in communication work. If you desire more bass, use .1 mf for C1.



The graph above illustrates the range of tone control available; the exact curve will depend upon the frequency response characteristics of your mike. The bass attenuation is built in.

Circuit is assembled on perforated board before installation on four ¼" standoffs in the Minibox.



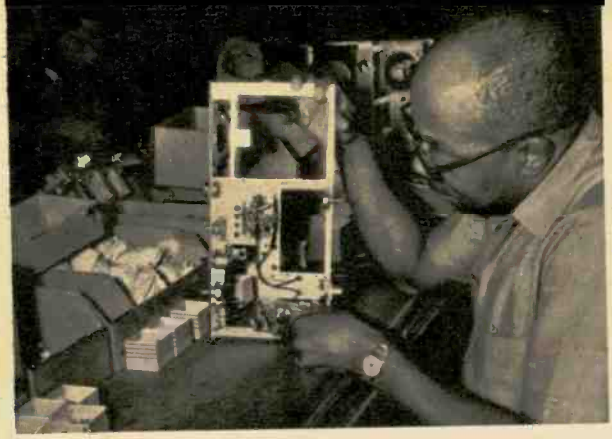


HOW THEY MAKE
MODULAR CB RIGS

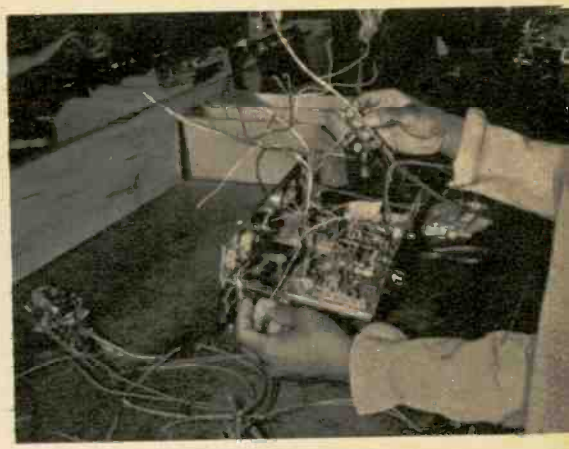
HOW DO YOU go about manufacturing a Citizens Band transceiver? The usual way is to send a chassis down an assembly line, where workers add one component after another. But ECI, Inc., at its factory in Mount Vernon, N. Y., does it in a different way. Watching production of ECI's Courier I is like seeing a block diagram come to life. Five separate modules are built simultaneously at various spots in the plant. After assembly, they are funneled to a central point and mounted on a main chassis, much as a jig-saw puzzle is put together. In the photo at the top of the page is a completed Courier. Just below it is a chassis with the power-supply module in place, and to the left of that are the four remaining modules: two receiver IF strips (upper left and lower right), the modulator (upper right) and the transmitter (lower left).—*Charles O'Neil*

1 Assembly-plant worker puts together typical module for ECI's Courier transceiver. He is soldering the leads in the modulator section of the set. Wire placement is by hand. Later, the module will go to an assembly area with chassis.

2 After the module is assembled, an inspector checks every connection. If the joint makes the grade it is daubed with red marking fluid. Under-chassis eventually has a paint-spattered look. Receiver IF strips get treatment below.



3 The five modules that make up a transceiver are mounted on the chassis at this point on the assembly floor. Chassis has been die-cut to outlines of modules, which simply are set in the holes and bolted in place. Nuts and bolts make removal of sections easy at a later date.



4 After the transceiver's modular chassis is put together mechanically (see the preceding step), the various sections—five in all—must be hooked up electrically. The above picture shows a wiring specialist performing this task. This interconnection job is speeded along by a wiring harness which has leads pre-cut to exact length required. The harness is slid into the chassis and the leads are soldered to modules. Worker above is holding part of harness in his right hand.

5 In final stages (see this step and the next) of transceiver assembly, each rig is aligned and tested . . . then touched up and tested again if necessary. In the photograph at left, taken in the ECI laboratory, an inspector is putting a set through its paces after the first job of alignment. Among other things, he checks the actual power output of the transmitter, adjusts the TVI filter and measures the sensitivity of receiver; fixed receive channels are fine-tuned.

6 At this station each transceiver is aligned and realigned until final approval is given. All the tuned circuits on the wired chassis must track correctly, of course. The quality of the audio is checked and the receiver's S-meter is calibrated with care. In the picture below the technician is trimming a capacitor in the receiver.

7 Last step: completed chassis is slid into cabinet and the transceiver then goes into a shipping carton. An instruction manual is packed in each carton. Any accessories ordered by the buyer, such as extra crystals or power cords, also are put in the box. Cartons are placed on shelves, then go to shipping room; from there to customer.

HI-FI RECORD GUIDE

by Warren DeMotte

CAROUSEL may well be the finest musical written by Rodgers & Hammerstein, though it never achieved the popularity of their Oklahoma!, South Pacific or The King and I. Its characters and situations are more fully developed musically and the words and music are more subtly integrated.

A new recording, with Alfred Drake, Roberta Peters and Claramae Turner heading the cast and Jay Blackton conducting (see cut), is brilliantly performed and engineered. This type of production, done especially for recording, is decidedly worthwhile when done well, as here. It has the spirit of an original-cast performance, plus sound that could not be captured a few (very few) years ago.

Two popular young pianists add little to their reputations with new recordings of standard concertos. Van Cliburn, with Fritz Reiner and the Chicago Symphony, does the Rachmaninoff C Minor, and Philippe Entremont, with Leonard Bernstein and the New York Philharmonic, does the Tchaikovsky. Neither performance gets off the ground—through no fault of either orchestra.

The return of Vladimir Horowitz to recording activity has been brought about by Columbia and the first release is a winner, with magnificent performances of music by Chopin, Rachmaninoff, Schumann and Liszt. The old wizardry is still available in ample supply and the Horowitz tone has never been transcribed so faithfully.

In my recent book, The LP/Stereo Record Guide & Tape Review, I compared 16 performances of Chopin's Funeral March Sonata, mono and stereo, and only Artur Rubinstein's (my choice) is in the same class as this new one by Horowitz. I'll still go along with the Rubinstein, but the margin is mighty slim.

Isaac Stern gains new laurels in Alban Berg's tortured Violin Concerto, which he plays with tremendous conviction and deep involvement. Bernstein and the New York Philharmonic are sensitively cooperative in this work and in the two Bartok Rhapsodies that fill out the disc.

Henryk Szeryng and Antal Dorati, leading the London Symphony, perform the more accessible Brahms Violin Concerto with fervor and rich lyricism. Their reading is accorded excellent engineering assistance.

Erich Leinsdorf is more successful with Wagner's Die Walkuere than he has been with previous operatic ventures. He has a fine cast and orchestra and he leads a strong, well-knit performance that is dramatically convincing and musically compelling.

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

Carousel *Drake-Peters*	Command	RS-843	$4.98
		RS-843SD	5.98
Rachmaninoff: Piano Concerto in C Minor *Cliburn-Reiner*	Victor	LM-2601	4.98
		LSC-2601	5.98
Tchaikovsky: Piano Concerto in B Flat Minor *Entremont-Bernstein*	Columbia	ML-5759	4.98
		MS-6359	5.98
Vladimir Horowitz	Columbia	KL-5771	5.98
		KS-6371	6.98
Berg: Violin Concerto *Stern-Bernstein*	Columbia	ML-5773	4.98
		MS-6373	5.98
Brahms: Violin Concerto *Szeryng-Dorati*	Mercury	MG-50308	4.98
		SR-90308	5.98
Wagner: Die Walkuere *Nilsson-Vickers-Leinsdorf*	5-Victor	LD-6706	29.90
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Millions build Heathkits. People with absolutely no mechanical ability or knowledge of electronics as well as skilled electronic experts—all find value, economy, fun, relaxation, and pride of accomplishment in Heathkits. You can too.

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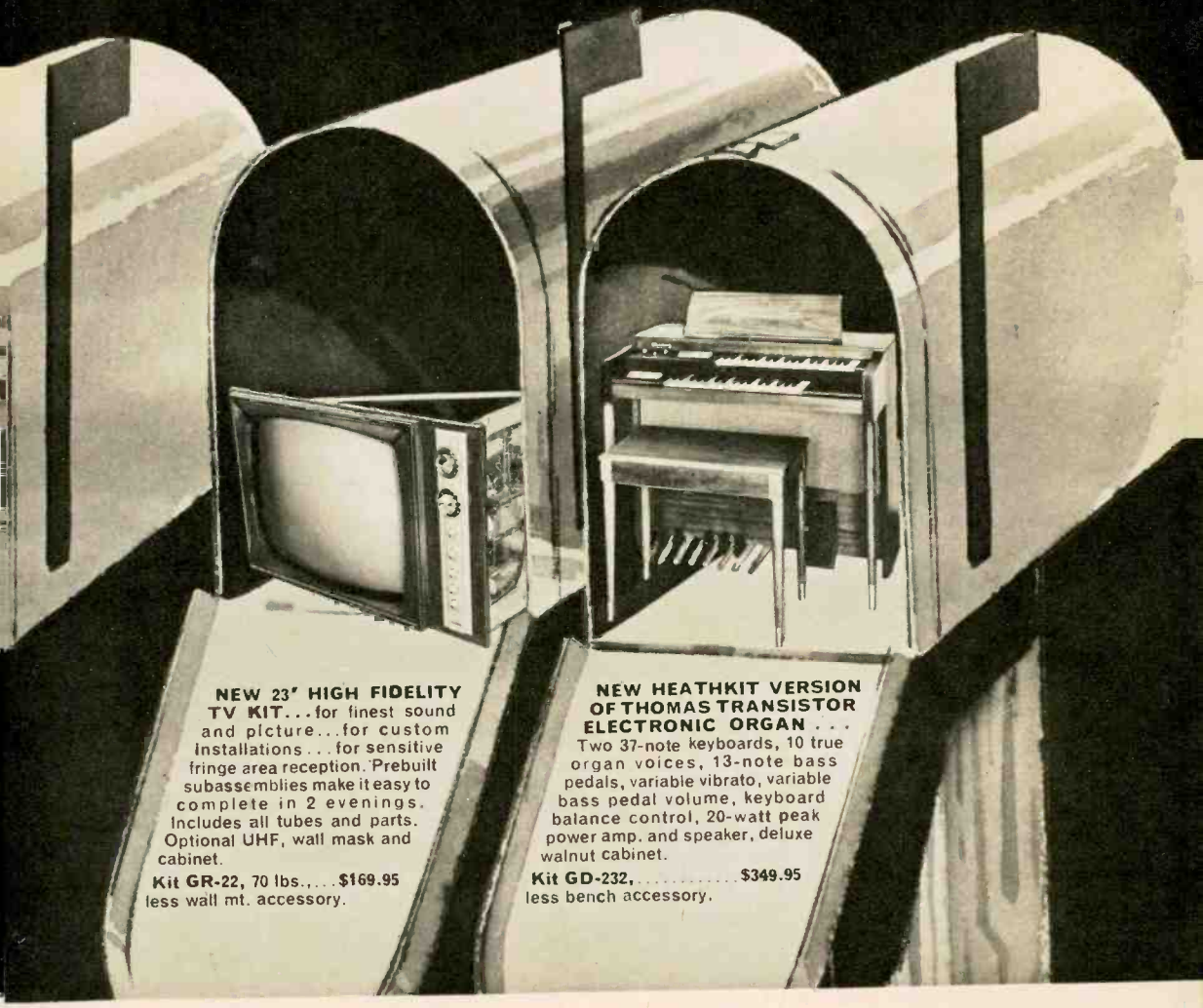

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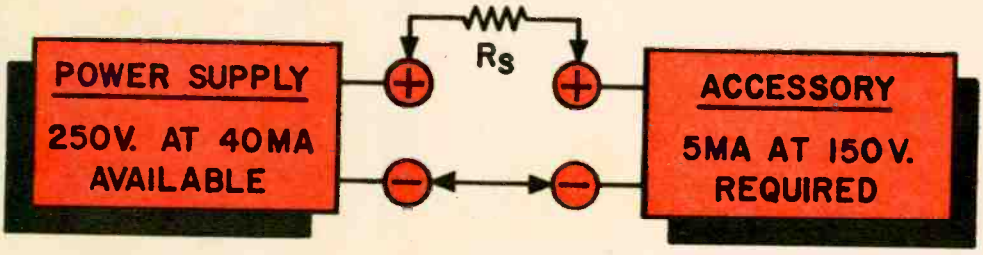
HOW TO DROP A VOLTAGE

LET'S TAKE up a question which confuses many beginning experimenters: how do you reduce power-supply or battery voltages? This becomes a practical problem when you need to steal power from a receiver or a CB rig to operate a new accessory; or when you want to power several circuits with a basic supply.



Say we have a power supply with a 250-volt DC output. The accessory (crystal calibrator, RF preamplifier, etc.) requires 150 VDC. How do we drop the voltage to the required level? A resistor (*Rs*) in series with the DC supply will do the job (see diagram). We determine its value with the aid of Ohm's Law ($R = E/I$) in this way:

(1) Find the current (I) drawn by the accessory. This is given in the manufacturer's literature or can be determined by totaling the current drawn by the tubes or transistors. A tube or transistor manual will provide this information. An easier technique is to measure the current drawn with a milliammeter if you can operate the device at its normal voltage. For example, if you want to operate a 6-volt device on a 12-volt battery, first run it on 6 volts and measure its normal current with a meter in series with either power lead.

If the current value obtained is in milliamperes, it must be changed to amperes to fit into the Ohm's Law formula. To convert, simply move the decimal point three places to the left. In our example, assume the accessory draws 5 ma. I in the formula is then .005 (amperes).

(2) Determine how many volts (E) you need to drop with the series resistor. Just subtract the voltage required by the accessory (150 V) from that of the power supply (250 V). 100 volts becomes the E in the formula.

(3) Then use Ohm's Law to find the value of the resistor (*Rs*) in ohms.

$$R = 100/.005$$
$$R = 20{,}000 \text{ ohms}$$

(4) You'll need one more calculation —the wattage (W) of the resistor, determined by the formula $W = EI$.

$$W = 100 \times .005$$
$$W = .5 \text{ watts}$$

The answer calls for a half-watt resistor, but calculated wattage always should be doubled or tripled for long component life.

Although we haven't discussed it, the amount of current available from the power source should be considered also. Usually, an accessory with one or two tubes draws negligible current. If a supply has a 500-ma capability and the device being powered draws only 5 ma there may be a higher than usual voltage available from the supply. In that case, simply calculate *Rs* for the new higher voltage.—*H. B. Morris*

A REAL SHACK . . . David L. Marks, W2APF, seems to have a thing about shacks, ham and otherwise. The old timer (he's been on the air since pre-WW I days) is proprietor of Uncle Dave's Radio Shack in Albany, N. Y., one of the first electronic supply stores in the country. When traveling (his second hobby) he always looks up hams he's worked on phone or CW. On a recent South African trip he found a different kind of shack, one with a straw roof. The opportunity was too good to pass up, so he got the occupants outside for a gag shot (see cut). According to him, the two men in the center are running a two-drumpower transmitter barefoot.

Flu Fun . . . It's hard to make out a case of flu as an adventure, but during a recent siege I was able, for a change, to get on the air for long periods. Matter of fact, I spent about ten hours a day for almost two weeks doing little but twirling knobs on my SSB rig. Besides the therapeutic effect (it says here), the activity gave me some unusual QSO's. Fr'instance:

Late one afternoon on 15 meters I heard an American voice calling W3TEM, signing OA8I. He was talking about a tape recording he wanted to make for a church at Asbury Park, N. J. When the W3 didn't answer, I tried a quick call: "Break, break . . . this is W2DJJ in New York. Can I help?"

OA8I came right back. Turned out to be a missionary team, Bob and Mary Anderson, at a jungle camp in a remote area of Peru. W3TEM was Mary's father, who was to tape a message from Bob and send it to the church supporting him. The message would tell the congregation about his work and how he was doing. I volunteered to try the tape job and, though the band was noisy, I finally got about four minutes of voice from Bob and Mary. It took numerous attempts over about two hours. Next morning, I shot the reel off to Asbury Park, and I don't mind saying that contemplating my good deed made me feel a lot better.

No Gag . . . I should know better, but I keep associating accents with nationalities and countries. In the middle of the crowded 20-meter band one day I heard two British types discussing their experiences in the Royal Navy during World War II. "No question about where those guys are," I told myself while waiting for a chance to cut in. I almost swallowed my mike when they identified themselves as K5QWZ, Oklahoma City, and VE3CWB/W6, portable somewhere in California.

I finally raised K5QWZ and asked what was going on. Turned out his accent is real, since he hails from Liverpool, but he's lived here a dozen years now. He chuckled about how his voice baffles Americans (like me), who think they are working England, and English hams, who think they have a local.

He Made It . . . A few issues back I mentioned a friend who bought a complete Collins station even before he learned code, then flunked the exam. Well, he finally made it as WA2WXT. More trouble loomed, however. His landlord said nix to an outside antenna. Undaunted, he simply went out and bought a house and had a four-element beam up before he moved in.

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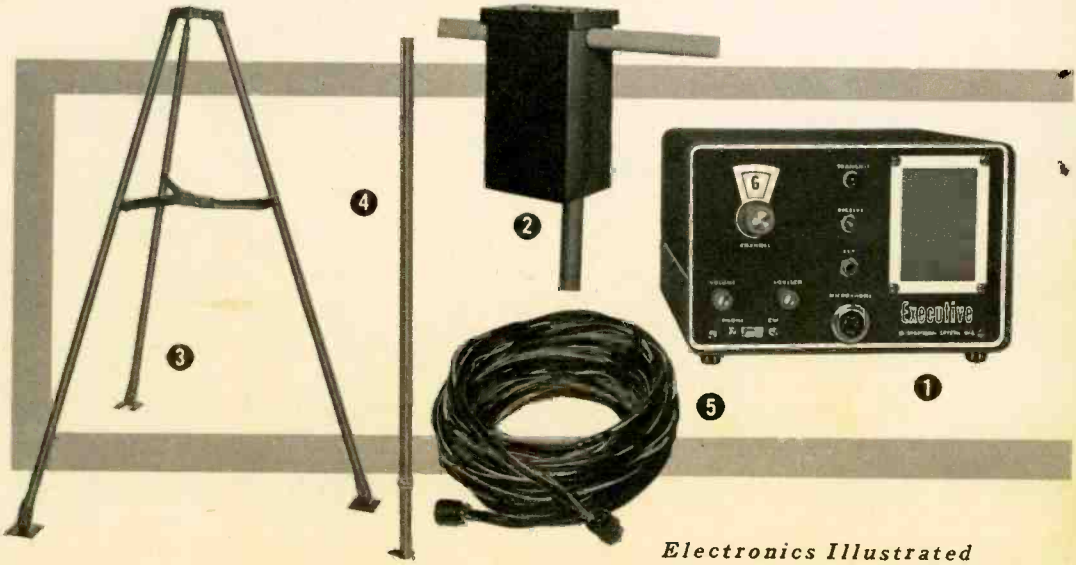
The International Model 1500 transceiver is designed to put the maximum RF power into the antenna. This is accomplished by combining the transmitter and antenna into one unit for rooftop mounting, thus eliminating loss through a transmission line.

The exciter unit remains with the receiver. A receiver preamplifier at the antenna boosts weak signals and helps reception. And in addition, the Model 1500 has a field proven supersensitive receiver with a crystal filter to reduce interference from adjacent channel Class D radio units.



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- Eight channels . . . all crystal controlled
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The Model 1500 is a complete package, ready to go on the air. The package includes: ❶ receiver/driver complete with 8 sets of crystals, ❷ transmitter/antenna assembly, ❸ antenna mount, ❹ 5 foot mast, ❺ 100 feet of control cable, ❻ microphone, ❼ key for (CW).

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11 Meters In Canada

Continued from page 75

Obtaining a GRS license is not at all like getting a ticket from the FCC. Here you wait several weeks while the wheels turn. In Canada the applications are processed in a matter of minutes while the operator waits. Canadians must pay $3 for each unit licensed (every transmitter must have a separate license and call letters). Licenses here and there are alike; both are *station* licenses, not operator licenses.

Montreal has something over 1,000 CBers operating on the GRS channels, which correspond to U.S. CB channels 4 through 22. In the Province of Quebec, most populous in Canada, licenses are being issued at the rate of about 300 per month. Licenses are for three years.

All equipment must be tested and approved by the DOT and kits *per se* are banned. However, one U.S. company, Daystrom, has obtained approval for a kit by a clever setup in which the purchaser gets a transceiver that is minus several important components. After building what he has, the buyer returns the rig to the factory for installation of the missing parts. DOT approval is obtained by the factory and the owner gets back a ready-to-operate unit.

Several CB clubs have been organized. We show letterhead art adopted by two of them (see cuts). Largest are the CB Club de la Province de Quebec (Canada, remember, has many French-speaking citizens) and the Quebec Pioneer 27 Mc Club (Montreal). The former has some 300 members. The president is Roger Trudeau, XM52052. The Pioneer club already has a good reputation for emergency work.

All callsigns begin with XM, but American CBers must pass them by when they crop up on the band. Both the United States and Canada have refused permission for CBers of the two nations to talk with each other. The penalty for this and other rules infractions for Canadians is license suspension for three months to a year.

—Jim Gibson, 2W7610

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For occasional portable use, an inexpensive 12-volt battery works out fine; but we've also designed a highly-efficient rechargeable battery pak accessory, in case you're serious about it. (There'll be a tone-coded squelch accessory, too, in the near future.)

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A Confidential History of CB

Continued from page 83

the money for enforcement was not forthcoming. Lastly, more than a million dollars worth of equipment had been sold, manufacturers were tooled up for production, a big market was available and the electronics industry needed a shot in the arm. Strict enforcement could have meant enough lawsuits to smother a cloud of locusts.

The basement CB dealer was a phenomenon providing a basic economic insight into the business. With or without the knowledge of the manufacturer, he obtained a dealership or secondary dealership and started selling out of his basement. For advertising, this gent turned on his rig at 8 o'clock in the morning and extolled the virtues of his products far into the night. The only time he shut up was when someone came in to buy. His message always had the implication that only by buying his transceiver, with $20 or $30 worth of modifications, could your signal have real punch. His own signal was likely to have enough power to singe the tail feathers of low-flying crows. The real trouble lay in the fact that most of these basement technicians didn't know a tube from a toothpick, damaging many rigs with their modifications. They also encouraged hamming by their incessant yak. If they could do it, why couldn't anyone? In metropolitan areas the QRM was worse than on the 20-meter ham band during an opening to Australia.

A semblance of reason appeared in 1961. Sheer publicity brought CB to the attention of small businesses, garages, druggists, cleaning establishments and so on—people who *had* to stick with Class D radio, once the investment was made, because they couldn't afford a Class A system. This group eventually became the backbone of CB as we know it today. Meanwhile, the more intolerable crew got bored and left, realizing you can't keep saying nothing forever.

But CB had one last fling. This one revolved around the practice of "finking" on fellow licensees. If you didn't conform to what a self-appointed monitor thought was proper CB procedure, he fired off a letter to the FCC, accusing you of everything from cussing to reading the Communist Manifesto. FCC wastebaskets began to look like pregnant hippos. The fact that the beefs were ignored (as gripes from individuals usually are) only infuriated the vigilantes more. One group we know about decided one day that it was illegal for the maintenance crew of a broadcast station to use a channel they claimed for themselves, so they started jamming with carriers powerful enough to fry an egg a block away. On another occasion, the leader of the gang held the air 40 minutes to describe a letter he sent the FCC about a CBer who had violated the rules by talking seven minutes.

Finking seemed to be dying a natural death when CB Horizons jerked it out of the cold, cold ground by organizing its readers in a Voluntary Monitoring Project. Each volunteer was to send "citations" to other CBers who violated specific rules (usually violated by the volunteer himself). Individuals and clubs jumped in with all four feet. Some home-brew citations looked more official than the FCC's forms. Many victims assumed they had caught a bolt from Uncle Sam himself. Another storm was brewing. But this time the FCC swallowed its bemused smile and let it be known that the citations, because of the style and manner of handling (secrecy of communication was involved), might be in violation of postal regulations. So the let's-play-FCC-inspector game ended in a hurry.

In the last year there has been an increase in CB gear aimed at the ham type, carrying price tags equal to those on true amateur rigs capable of working the world. But another type of equipment also has appeared—the business unit with a single-channel transceiver designed only to provide basic communications at rock-bottom price. CB appears to be approaching a combination of what the FCC intended and "useful" hamming. That term might require some explaining. In the country you can drive for hours and hear only a few signals which are strictly business, coming from service stations, taxi

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- **New . . . high efficiency noise limiter circuit!**
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firms and farmers. In the cities it's different. During the day there is much business activity and some unused channels. However, these stations do carry on short social conversations interlaced with business messages. In the evening these same CBers use the gear for straight hamming, joined now by night-time businesses, such as all-night garages, which seem to do it for lack of something more interesting. Spread out around the cities are the emergency-service CB clubs which do provide a needed community service by taking part in disaster and rescue work. While they do ham, their conversations usually concern emergency work. This is what we call useful hamming.

However, there is always a hard core of straight CB/hams because as each group of licensees gets bored with saying nothing it is replaced by a fresh new batch. Sometimes you might think the situation is getting worse, but it's getting better. The anything-goes type of operation is all but gone, and the CB/hams don't stay around long.

In the next few years the Citizens Radio Service is likely to move closer to what was intended, though there always will be a monthly crop of jokers. But the FCC now has an ace in the hole. CBers finally have realized that there is a limit to its patience.

Basic CB Circuit Theory

Continued from page 44

of the transmitter. Now the mike feeds the amplifier (via S1B), which soups up the signal enough for it to serve as a modulation signal. Switch section S1C takes the output of the modulator/amplifier and switches it into the RF amp.

The S1D set of contacts switch the B+ voltage to receiver or transmitter. The modulator, which serves both functions, is powered at all times. In rigs using electronic switching instead of transferring the B+, the transmitter is biased to cutoff in the receive position. In the transmit position, the receiver input circuit is cut off.

Next issue, we'll examine a CB schematic in detail.

CB Corner

Continued from page 52

tion and, as before, can be used only for selective calling—not for attracting attention or controlling remote objects.

Less far-reaching changes would limit any person to one license (if one is suspended you'd best not apply for a new one), and would require you to give a change of address within 30 days before or after moving your station and prior to operating at the new location.

Any messages relating to the performance, capabilities or testing of equipment, or to signal strength or frequency stability, would be outlawed.

Only substantial change in the antenna-height rules says your skyhook can't be more than 20 feet above a *tree* (as well as geological formations and man-made structures, as formerly). The FCC previously said trees didn't count, but the new rule would allow you to mount your antenna on top of a tree.

A new power limitation would be imposed. In addition to holding the input power to the final to 5 watts, you'd also be required to limit actual RF output to 3.5 watts. Since even the most efficient rig can't do much better than that, the new rule obviously is intended to make it easier for the FCC to check on your power—even from a distance. Input power is difficult to calculate but an RF wattmeter hooked to the output gives the facts in a hurry. One connected to the end of the feedline also would reveal any hidden linear amplifiers.

In the record department, each station would have to keep on file copies of reports on adjustments or alterations of equipment made by commercial licensees (signed by them, with license serial number appended). And, in addition to being familiar with Part 19, each licensee would have to keep an up-to-date copy *at the station.*

Last in our brief of the more important changes is one requiring the *complete* callsign to be given distinctly, in English, and to be preceded by the words "this is" or "from."

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CB Skip

Continued from page 51

One of the real troubles caused by skip signals lies in their strength. A direct groundwave, in traveling five miles, is weakened by bumping into hills, buildings, trees and other obstacles, and part of its power is absorbed by the earth. The skip signal follows a path almost clear of obstruction (except for the ionosphere) and arrives a thousand miles away with bulging muscles. If you're trying to call from your car to your house when skip is coming in on your channel, you run into a lot of trouble. The stranger from afar simply clobbers your signal.

What can you do about such interference? Nothing. On the back of your license you'll find a little message wherein you have agreed to accept all interference from CB and other sources. It's a problem you'll have to live with—one that a good many CBers would, unfortunately, like to have.

Working skip on the Citizens Band was serious enough at one time to be covered when the FCC revised Part 19.

That the Commission meant business was demonstrated by a spate of violation notices sent out to erring CBers.

Before ending our piece we must pass on two of the better skip stories currently going the rounds. In one instance, a couple of practical jokers dreamed up a call with a Hawaiian prefix which they began using while driving in a car. After pulling in a victim, who was thrilled at working a station 6,000 miles away, the two made the whole routine even more convincing by driving in and out of an alley, creating the illusion of atmospheric fading.

The other story concerns an Easterner who was driving along some five miles west of Minneapolis when he heard a station with a call that indicated the West Coast. The two began talking, each believing he had hooked a real long-haul signal. As it turned out, the West Coaster also was in his car—traveling the same road less than five miles ahead of the Easterner.

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1J3	.79	6BA6	.50	6SK7GT	.95	12DL8	.88
1K3	.79	6BC5	.61	6SL7GT	.84	12DQ6	1.04
1R5	.77	6BC8	1.04	6SN7	.65	12DS7	.84
1S5	.75	6BE6	.55	6SQ7GT	.94	12DT5	.76
1T4	.72	6BF5	.90	6T4	.99	12DT7	.79
1U5	.65	6BF8	.44	6T8	.85	12DT8	.78
1X2B	.82	6BG6	1.70	6U8	.83	12DW8	.89
2AF4	.96	6BH8	.98	6V6GT	.54	12DZ6	.62
3AL5	.46	6BJ6	.65	6W4	.61	12ED5	.62
3AU6	.54	6BJ7	.79	6W6	.71	12EG6	.62
3AV6	.42	6BK7	.85	6X4	.41	12EK6	.62
3BC5	.63	6BL7	1.09	6X8	.80	12EL6	.50
3BN6	.75	6BN6	.74	7A8	.68	12EZ6	.57
3BU8	.78	6BQ6	1.12	7AU7	.65	12F8	.66
3BY6	.58	6BQ7	1.00	7EY6	.75	12FA6	.79
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4DT6	.55	6CQ8	.92	12A4	.60	12U7	.62
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5EA8	.80	6DK6	.59	12AT6	.50	19T8	.85
5EU8	.80	6DN6	1.55	12AT7	.76	21EX6	1.48
5J6	.72	6DQ6	1.10	12AU6	.51	25AX4	.70
5T8	.86	6DT5	.81	12AU7	.61	25C5	.53
5U4	.60	6DT6	.53	12AV6	.41	25CA5	.59
5U8	.84	6DT8	.94	12AV7	.82	25CD6	1.52
5V6	.56	6EA8	.79	12AX4	.67	25CU6	1.11
5X8	.82	6EB5	.73	12AX7	.63	25DN6	1.42
5Y3	.46	6EB8	.84	12AY7	1.44	25EH5	.55
6AB4	.46	6EM5	.77	12AZ7	.86	25L6	.57
6AC7	.96	6EM7	.82	12B4	.68	25W4	.68
6AF4	1.01	6EU8	.79	12BD6	.50	32ET5	.55
6AQ5	.70	6EV5	.75	12BE6	.53	35C5	.51
6AH4	.81	6EW6	.57	12BF6	.60	35L6	.60
6AH6	1.10	6EY6	.75	12BH7	.77	35W4	.42
6AK5	.95	6FG7	.69	12BK5	1.00	35Z5	.60
6AL5	.47	6FV8	.79	12BL6	.56	36AM3	.36
6AM8	.79	6GH8	.80	12BQ6	1.16	50B5	.69
6AQ5	.53	6GK5	.61	12BR7	.74	50C5	.53
6AS5	.60	6GK6	.79	12BV7	.76	50EH5	.55
6AT6	.49	6GN8	.94	12BY7	.77	50L6	.61
6AT8	.86	6H6	.58	12BZ7	.86	70L7	.97
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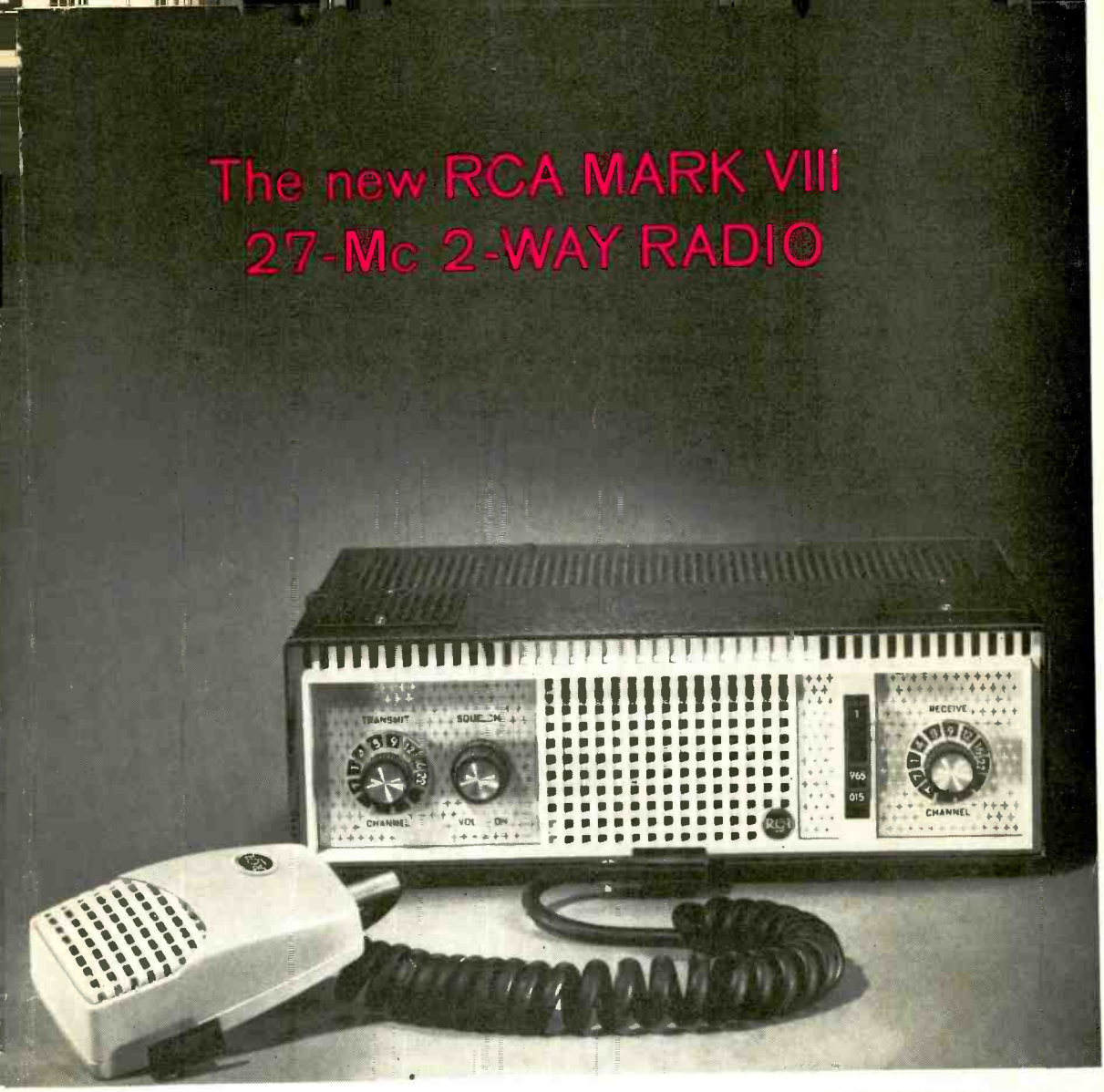

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