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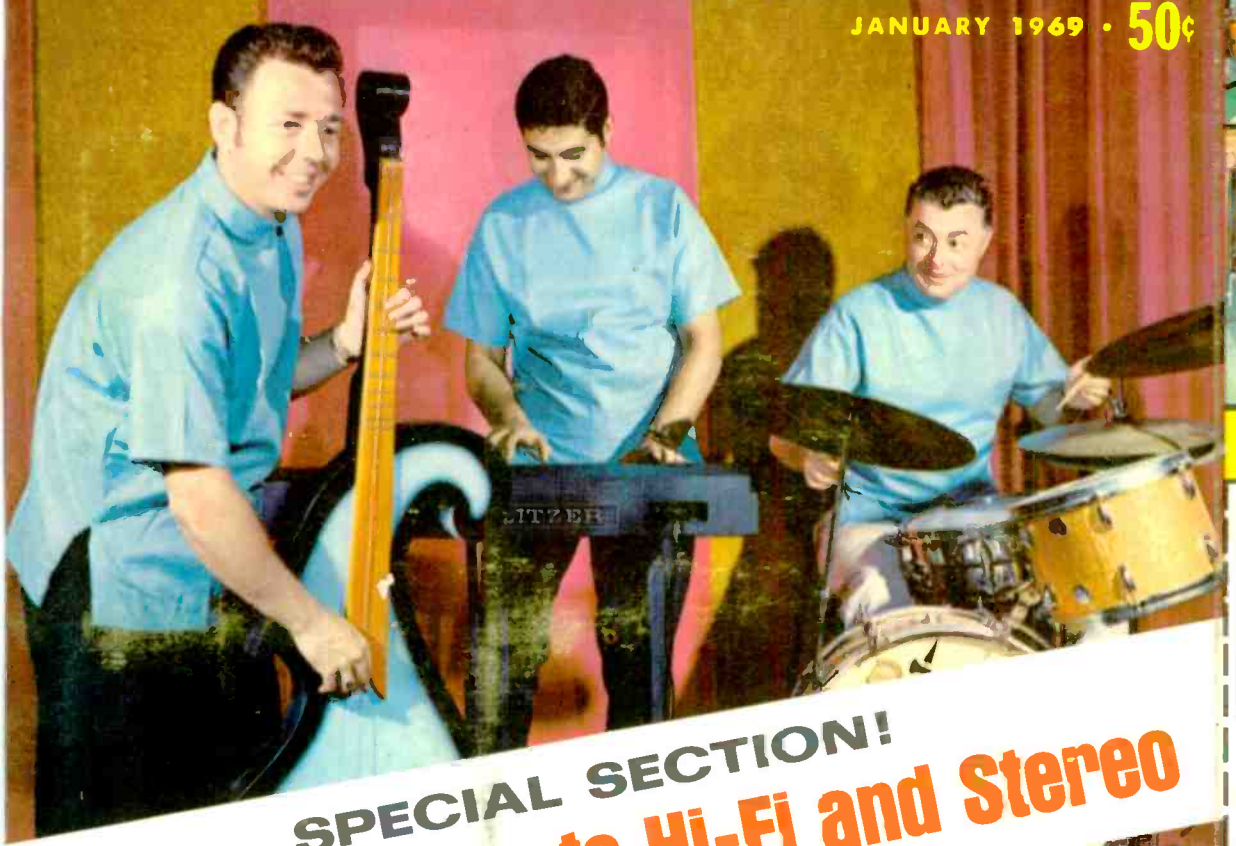
By the Publishers of MECHANIX ILLUSTRATED

JANUARY 1969 • 50¢



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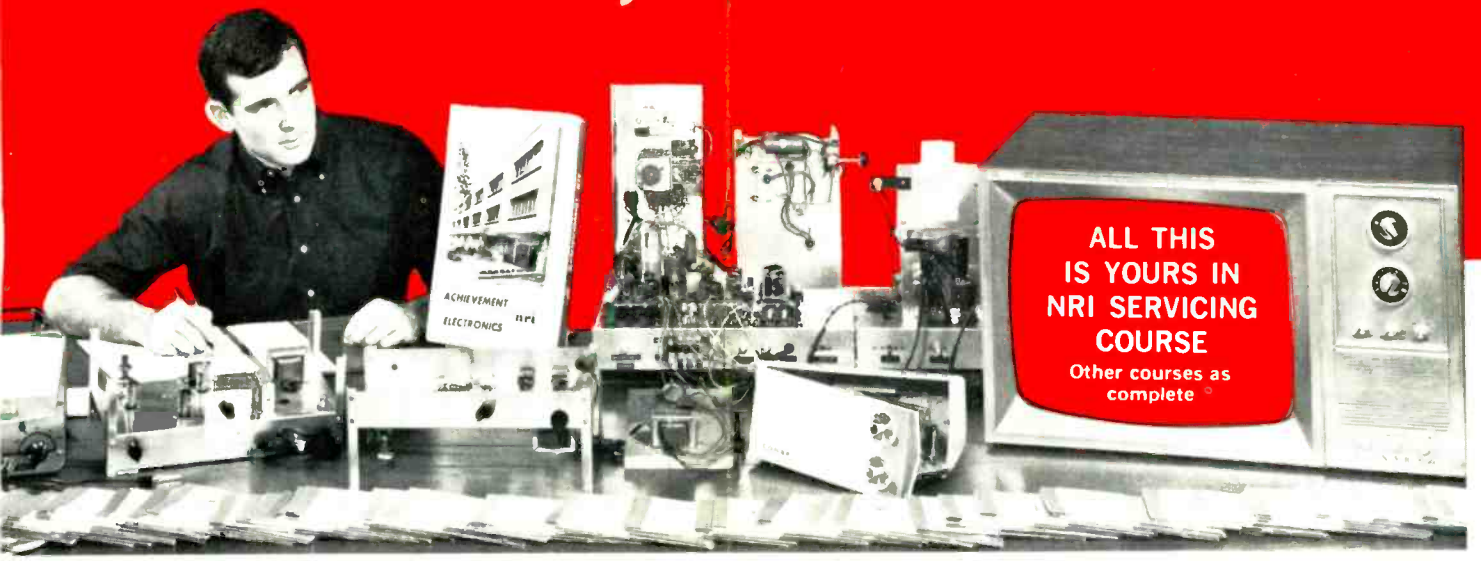

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Programmed lab equipment gives you priceless confidence

You learn with your hands as well as your head

The NRI pioneering "discovery" method of home study is the result of more than half a century of simplifying, organizing, dramatizing subject matter. You learn by doing in each of NRI's major courses, demonstrating theory you read in "bite-size" texts programmed with lab equipment you build and use. Electronics comes alive in a unique, easy-to-understand, fascinating way. You learn with your hands as well as your head. The "why" of circuitry and equipment operations comes clear through demonstration. You gain experience with solid-state devices as well as conventional tube circuits. You progress rapidly to the ultimate goal of NRI training — to make you employable in Electronics by giving you experience equivalent to months, even years, of on-the-job training.

Build the only COLOR TV set totally engineered for training

NRI is the *only* school with a course in TV-Radio Servicing that includes a Color TV totally engineered for training. Build it, learn with it, enjoy years of viewing pleasure. Booming field of Color TV urgently needs skilled TV Technicians. Mail card for free Color Catalog.

Discover how fast and fascinating training at home with NRI can be

There is no end of opportunity for the trained man in Electronics. You can earn extra money in spare time, have your own full-time business, or qualify quickly for career positions in business, industry, government. Discover the ease and excitement of training at home with the leader — NRI. Discover how NRI job-simulated training gives you priceless confidence. Experience is still the best teacher, and that's what you get when you train for Electronics with NRI. Mail the postage-free card today for the new NRI Color Catalog. No obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D.C. 20016.

NRI has trained more men for Electronics than any other school

RONALD L. WOOD, Fargo, N.D., holds a First Class FCC License and is employed as a studio and master control engineer/technician with station KXJB-TV. He wrote to NRI to say, "Many thanks to NRI for the Electronics training I have received."

RANDY ACERMAN, Camden, N.J. has his own TV service business. He is the official TV repair center for the Radio Shack store and Goodyear Tire Co. in his area. He says, "I have seen other schools' texts and most can't hold a candle to NRI lessons."

CRAIG D. SPARKS, Cambridge, Mass., is a Communications technician for AT&T Long Lines Dept. "I was hired because of my NRI training. I was given credit for 18 months experience and my starting pay raised. They were impressed NRI trained me well enough to get a First Class FCC License."

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Take your choice of unique training plans that cover the most important areas of opportunity in TV-Radio, Broadcasting-Communications and Industrial-Military Electronics. NRI also offers you the only home-study course in Amateur Radio. Brief descriptions of 12 NRI training programs below, are explained in detail in the FREE NRI Catalog we send you. Read how NRI has applied more than 50 years of experience developing easy-to-understand programs designed to make you *employable* in Electronics. Proof of the quality of NRI training is tens of thousands of successful graduates and the reputation for high educational standards NRI holds throughout the Electronics industry. Move ahead in this fast growing industry. Mail the postage-free card. No one is going to call on you. NRI does not employ salesmen. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D.C. 20016.

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Learn to fix all TV sets. Course includes your choice of black-and-white or Color TV training equipment. Also learn to fix radios, stereo, hi-fi, etc. A profitable field full or part-time.

ADVANCED COLOR TV

For men who know black & white TV circuitry. 18 lessons, 50 experiments cover all circuits including set-up alignment. Only Color course with equipment specifically designed for training. End product is your own set.

INDUSTRIAL-MILITARY ELECTRONICS

From basic principles to computers. Comprehensive training teaches fundamentals, then takes you into such modern-day miracles as servos, telemetry, multi-plexing, phase circuitry, others.

COMPLETE COMMUNICATIONS *

Teaches and provides actual practice in operation, service, maintenance of AM, FM, and TV broadcasting stations. Also covers marine, aviation, mobile radio, facsimile, microwave, radar.

FCC LICENSE *

Prepares you for First Class FCC Radiotelephone License exams. You begin with fundamentals, advance to required subjects covering equipment, procedures.

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A concise course in Electronic terminology and components. A wealth of useful information to help you better understand the field. For anyone who wants a basic understanding of Radio-TV Electronics.

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Not for beginners, but for men with some knowledge of Electronics who want an understanding of process control, ultrasonics, telemetering and remote control, electromechanical measurements, other subjects.

AVIATION COMMUNICATIONS *

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MOBILE COMMUNICATIONS *

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Includes all new lessons and training equipment so you can build your own 3-bank phone/cw receiver and transmitter. Basic and Advanced training prepares you for FCC Novice, Advanced and Extra Class Licenses.

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Prepares you quickly to repair all types of appliances, including air conditioning, refrigeration, small gasoline engines. An easy, practical course leading to profitable part-time or full-time business of your own.

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You MUST PASS your FCC License exam (any Communications course marked) or NRI refunds in full the tuition you have paid.

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Over 50 Years of Leadership in Electronics Training

ELECTRONICS ILLUSTRATED

A Fawcett Publication

January 1969 Vol. 12 No. 1

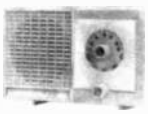
Member Institute of High Fidelity, Inc.

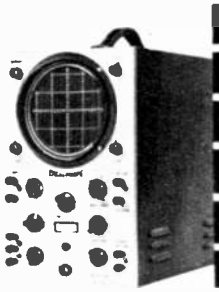
COVER: Ektachrome by John Capotosto, Combo Organ by Wurlitzer. Photographed at Motif Cocktail Lounge, St. James, N.Y.

This is the biggest coupon in this magazine because we wouldn't want you to miss a big opportunity to make something of yourself.

Here is the chance of a lifetime to start earning extra money fast. All you need is just a few weeks' training in your own home and in your spare time and your income will go up $10, $20, $30 a week or more. RTTA will show you how easily and how quickly you can do this.

You'll get a complete set of easy-to-read, easy-to-understand lessons that will let you earn money almost from the very beginning. You'll get a complete set of the most modern test equipment; a vacuum-tube voltmeter, a scope, a signal generator — everything you need to help qualify you as a highly-paid electronics technician.





WITHIN ONE WEEK AFTER YOU START YOU'LL BE WORKING WITH ELECTRONICS!

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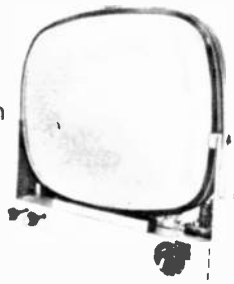
Act now! All of this equipment and the bonus extras can be yours to keep and to use. The extra money you earn or a new or better job can be yours. Fill in the coupon for full information and start your way up.



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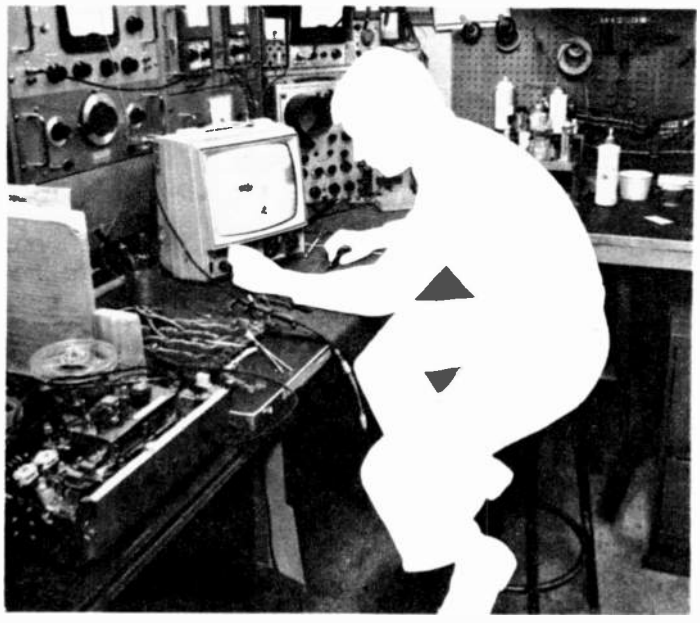
Put yourself in this picture!

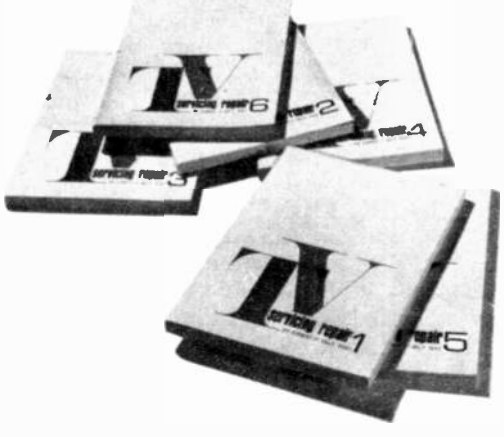


In a matter of months, this new ICS course can have you doing advanced troubleshooting on color sets!

Lowest priced TV Servicing and Repair Course available! Costs less than $100. After just two lessons you'll be able to repair 70 percent of all TV troubles!

Build yourself a business in your spare time! Start with repairing your own TV set, then your neighbors'—and you're off and running. At end of course, you should be able to handle multiple TV troubles of all kinds, including color!

Complete, practical, makes learning easy and fun! 6 texts, 936 pages of concise, easy-to-follow instruction. 329 illustrations show you how to recognize and identify TV troubles right from the screen. Texts tell you how to remedy each trouble, and why that remedy is best! Self-examinations enable you to check what you learn as you go along. Coveted ICS diploma upon completion.



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Feedback from Our Readers

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

● A WORD BEFORE YOU GO-GO

An electronic rhythm section [Nov. '68 EI]—great idea! All I need is some psychedelic lighting and a go-go girl and I can have a big night out right in the rumpus room. But my go-go girl would have to be as screwy as your project to recognize the rhythms I get on it. What gives?

Neill Winkel
Paoli, Pa.

A couple of crossed wires in the Decoder and Differentiator pictorial, Fig. 10, cause the trouble. (The schematic in Fig. 3 is correct.) Connect the collector of the transistor in the left column below to the emitter of the transistors in the right column.

Collector	*Emitter*
Q10	*Q9, Q12*
Q11	*Q10, Q14*
Q14	*Q13, Q15*
Q17	*Q16, Q19*
Q18	*Q17, Q21*
Q21	*Q20, Q22*

● WHO GOOFED?

Your article, Who Goofed on Stereo FM? [Sept. '68 EI], was well-done and most informative. However, you made a serious mistake in stating that there are no significant FM networks. The American Broadcasting Co. has had an ABC-FM network since Jan. 1, 1968.

W. R. Garrett
Augusta, Ga.

Right, W. R. At last count the net included 168 stations. One little thing, though—the only programming on the network is news. The rest of the time is filled with local programs of member stations. So it's not a full-scale network like ABC-TV or the old WQXR radio network mentioned in the article as no longer in operation.

● NO OBIT

I have just seen Larry Orr's letter in Uncle Tom's Corner [Sept. '68 EI]. I believe Mr. Kneitel greatly exaggerated the demise of subscription TV (to paraphrase Mark Twain). The FCC is considering a report by a special subscription TV committee that has recommended authorization of pay TV on a national scale.

William A. Nail
Dir. of Public Relations
Zenith Sales Corp.
Chicago, Ill.

By the way—what ever happened to Pat Weaver?

● SIGHT FOR SORE EYES

Thanks for publishing that thing about the bugged pigeons [Nov. '68 EI]. I saw one in the park and thought I was having hallucinations. Now I know better.

A. Adams
New York, N.Y.

Sorry to break the news but those pigeons were a Canadian project. None could have reached New York fully equipped, we're told. What else have you seen lately?

● CHECK THE PRICE

Just a note to thank you for the nice write-up you gave our Electronic Circuit Design Handbook in the Sept. '68 issue of EI.

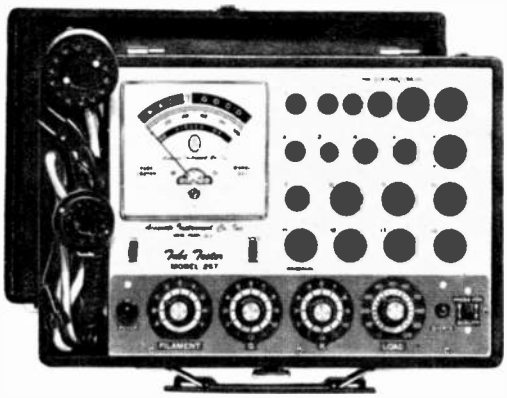
Mel Parks, Jr., Pres.
Tab Books
Blue Ridge Summit, Pa.

P.S. The list price is $14.95, not $12.96.

[*Continued on page* 8]

The New 1969 Improved Model 257 **A REVOLUTIONARY NEW**

TUBE TESTING OUTFIT



- Tests all modern tubes including Novars, Nuvistors, Compactrons and Decals.
- All Picture Tubes, Black and White and Color

ANNOUNCING... for the first time

A complete TV Tube Testing Outfit designed specifically to test all TV tubes, color as well as standard. Don't confuse the Model 257 picture tube accessory components with mass produced "picture tube adapters" designed to work in conjunction with all competitive tube testers. The basic Model 257 circuit was modified to work **compatibly** with our picture tube accessories and those components are not sold by us to be used with other competitive tube testers or even tube testers previously produced by us. They were custom designed and produced to work specifically in conjunction with the Model 257.

COMPLETE WITH ALL ADAPTERS AND ACCESSORIES, NO "EXTRAS"

STANDARD TUBES:

- Tests the new Novars, Nuvistors, 10 Pins, Magnovals, Compactrons and Decals.
- More than 2,500 tube listings.
- Tests each section of multi-section tubes individually for shorts, leakage and Cathode emission.
- Ultra sensitive circuit will indicate leakage up to 5 Megohms.
- Employs new improved 4½" dual scale meter with a unique sealed damping chamber to assure accurate, vibration-less readings.
- Complete set of tube straighteners mounted on front panel.

BLACK AND WHITE PICTURE TUBES:

- Single cable used for testing all Black and White Picture Tubes with deflection angles 50 to 114 degrees
- The Model 257 tests all Black and White Picture Tubes for emission, inter-element shorts and leakage.

COLOR PICTURE TUBES:

- The Red, Green and Blue Color guns are tested individually for cathode emission quality, and each gun is tested separately for shorts or leakage between control grid, cathode and heater. Employment of a newly perfected dual socket cable enables accomplishments of all tests in the shortest possible time.

The Model 257 is housed in a handsome, sturdy, portable case. Comes complete with all adapters and accessories, ready to plug in and use. No "extras" to buy. Only $47.50

NOTICE *We have been producing radio, TV and electronic test equipment since 1935, which means we were making Tube Testers at a time when there were relatively few tubes on the market, way before the advent of TV. The model 257 employs every design improvement and every technique we have learned over an uninterrupted production period of 32 years.*

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Try it for 10 days before you buy. If completely satisfied then send $10.00 and pay the balance at the rate of $10.00 per month until the total price of $47.50 (plus P.P., handling and budget charge) is paid. If not completely satisfied, return to us, no explanation necessary.

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Please rush me one Model 257. If satisfactory I agree to pay $10.00 within 10 days and balance at rate of $10.00 per month until total price of $47.50 (plus P.P., handling and budget charge) is paid. If not satisfactory, I may return for cancellation of account.

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Address_____

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☐ Save Money! Check here and enclose $47.50 with this coupon and we will pay all shipping charges. You still retain the privilege of returning after 10 day trial for full refund.

CIRCLE NUMBER 41 ON PAGE 15

Feedback from Our Readers

Continued from page 6

● LOOK, UP IN THE SKY!

Your article on weather satellites [July '68 EI] was of considerable interest to me. I'm a senior in high school and have built an APT readout station. The only problem is I haven't been able to secure tracking data for the weather satellites. Do you know where I can get this information on a regular basis?

Also, I would like to get in touch with other amateurs having a similar interest in this fascinating hobby.

Conrad J. Baranowski
109 Peterborough St.
Boston, Mass. 02215

APT daily weather predictions are transmitted over the meteorological teletypewriter network's services O and C around 1400 EST under the headings TBUS-1 and TBUS-2. These are available at Weather Bureau offices. W1AW also transmits APT satellite orbital data containing orbital information for tracking the satellite and geographically orienting the pictures obtained from it.

The APT User's Guide (C52.8: AU8) contains data on tracking and gridding procedures. Copy is $1 from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Grids for geographic orientation of satellite pictures are available on 35mm film for $8.50 per 100 ft., sprocketed or unsprocketed. These are available from the National Weather Records Center, ESSA, Asheville, N.C. 28801.

● LOSSERS

Could you tell me what a tube cathode-follower amplifier and a transistor emitter-follower amplifier are?

Stephen C. Keating
Topeka, Kan.

They aren't. Both more appropriately might be described as lossers rather than amplifiers, since neither provides gain. Like transformers, they are useful for impedance matching.

● TOUGH ONE

Will you please tell me how to hook up an AM-FM tuner to an amplifier?

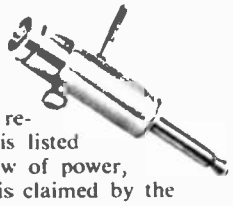
Walter Grace
Elizabeth, N.J.

Try wire.

SIGHT & SOUND . . . The model 1000 is a combination helical-scan video and 4-track stereo audio recorder using ¼-in. magnetic tape for both modes. VTR tape speed is 11¼ ips; audio records at 3¾ and 7½. The audio portion has three heads (erase, playback, record) and automatic reverse in playback. Maximum reel size, 7 in. Model 1000, $995; with monitor and camera, $1,500. Califone-Roberts Div., Rheem Mfg. Co., 5922 Bowcroft St., Los Angeles, Calif. 90016.

Electronic Marketplace

Guitarcaster . . . Electric guitars can be freed of trailing cords with an FM broadcaster that plugs directly into the guitar's output jack. Frequency of the transmitter can be set anywhere in the FM broadcast band (88-94 mc) for reception on any standard FM receiver. Frequency response is listed as 20-15,000 cps. With 6 mw of power, 50-ft. transmission distance is claimed by the manufacturer. The device is solid-state, battery-powered, measures 3¼ in. long and ⅝ in. in diameter (plus antenna). Catalog No. A-999, $14.95. Saxton Products, Inc., 215 N. Rt. 303, Congers, N. Y. 10920.



Multi-Meter . . . The FE-16 Field Effect Meter has an accuracy of 1.5 per cent on seven DC and 3 per cent on seven AC ranges —0-1 to 0-1,000 V—according to the manufacturer. It measures peak-to-peak AC ranges. A zero-center DC range measures to ± 0.5 V or ± 1.5 V. Other scales measure 0-100 ma to 0-1 amp DC, resistance to 1,000 meg. Optional probe, model 39A19, extends range to 30 kv. Powered by 9-V battery (not included). FE-16, $84.50; 39A19, $9.95. Sencore, Inc. Addison, Ill. 60101.

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

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

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

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

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

THE KIT FOR EVERYONE

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

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PROGRESSIVE TEACHING METHOD

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

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

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

THE "EDU-KIT" IS COMPLETE

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

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

FREE EXTRAS

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

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

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

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

PRINTED CIRCUITRY

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

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

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

Progressive "Edu-Kits" Inc., 1186 Broadway, Dept. 899AE, Hewlett, N. Y. 11557

UNCONDITIONAL MONEY-BACK GUARANTEE

Please rush my Progressive Radio "Edu-Kit" to me, as indicated below:
Check one box to indicate choice of model

☐ **Regular model $26.95.**
☐ **Deluxe model $31.95 (same as regular model, except with superior parts and tools plus Radio & TV Parts Jackpot worth $15.)**

Check one box to indicate manner of payment
☐ **I enclose full payment. Ship "Edu-Kit" post paid.**
☐ **Ship "Edu-Kit" C.O.D. I will pay postage.**
☐ **Send me FREE additional information describing "Edu-Kit."**

Name _____

Address _____

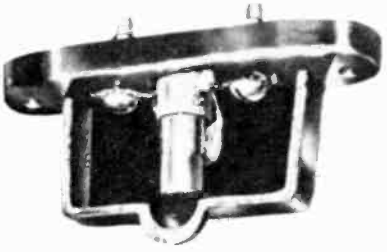
City & State _____ Zip _____

PROGRESSIVE "EDU-KITS" INC.
1186 Broadway, Dept. 899AE, Hewlett, N. Y. 11557

CIRCLE NUMBER 10 ON PAGE 15

Electronic Marketplace

Skyhook Kit . . . The SWL-7 is a dipole receiving antenna kit designed to cover 11, 13, 16, 19, 25, 31 and 49 meters. The kit includes eight weatherproof resonating trap assemblies (cut



away in photo), transmission line center connector, 50 ft. of antenna wire, glazed porcelain insulators, 100 ft. of 75-ohm transmission line and assembly instructions. Assembled, they produce a multi-band trap antenna 39 ft. 10 in. long (plus downlead) weighing 2 lbs. $17.37. Mosley Electronics, Inc., 4610 N. Lindbergh Blvd., Bridgeton, Mo. 63042.

Got Rhythms . . . The X-81 is a solid-state electronic rhythm instrument capable of producing the sounds of a bass, conga or snare drum, tom-tom, claves, cymbal or maracas. Combinations of these instruments are selected automatically for nine popular rhythms—waltz, swing, surfin, twist, bossa nova, samba, rhumba, mambo and

cha-cha. The X-81 has push-button rhythm selector switches, volume, snare drum and cymbal level and tempo controls mounted on its front panel. It can be played through almost any musical instrument or audio amplification and speaker system in much the same way as an electric guitar. (A stereo system might be used with a guitar on one channel, the rhythm section on the other.) It has facilities for an optional on/off foot switch. The unit measures 14 x 13 3/16 x 7½ in. Powered by 117 VAC. $199.99. Olson Electronics, Inc. 260 S. Forge St., Akron, Ohio 44308.

Electronic Marketplace

Build It . . . The model 2002 Scallon AM Table Radio kit is a consumer version of a unit used to teach basic electronics in primary and secondary schools, according to the manufacturer. It's designed for hobbyists 12 and over and comes with all necessary parts and fittings. The instruction manual contains test procedures enabling the builder to check his progress at various stages of construction and assuring a working radio when it is completed. $21.95. (Model 2001 Comancho transistor radio, $19.95.) Graymark Enterprises, Inc. Box 54343, Terminal Annex, Los Angeles, Calif. 90054.

Metered . . . The Cobra 98 is a 23-channel CB transceiver featuring a three-scale front-panel meter—unusual in a CB receiver—for SWR-bridge, power-output and S-level readings. Included in its design is a limiter circuit, dubbed Dyna-Boost by the manufacturer, for increased talk power. Front-panel controls include illuminated channel selector, adjustable squelch, fine tuning, Dyna-Boost on/off, meter function switch, calibration control and PA switch. The Cobra 98 measures 5¼ x 13 7/16 x 8½ in. and comes with a solid-state power supply for 117 VAC and 12 VDC plus both power cables and push-to-talk microphone. $239.95. B & K Communications Div., Dynascan Corp., 1801 W. Belle Plaine Ave., Chicago, Ill. 60613.

ELECTRONICS ILLUSTRATED — Product Information Service

If you want more information about one or more of the products advertised in ELECTRONICS ILLUSTRATED, this service is for your convenience. The product information you request will be sent to you promptly free of charge.

Just complete the name and address portion of the handy coupon below and circle the PRODUCT INFORMATION SERVICE number or numbers you find beneath the advertisements in this issue.

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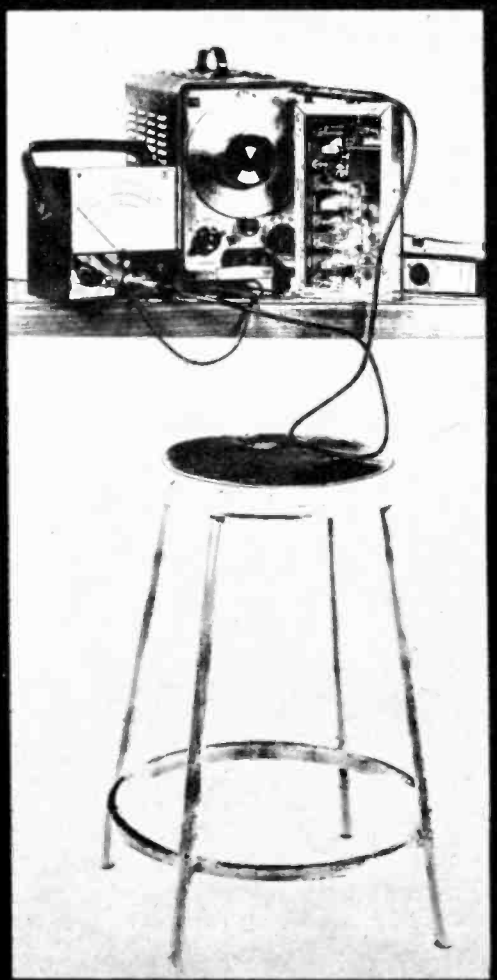
1/69

Someone should develop an easy way to learn electronics at home



RCA Institutes did!

Here is a whole new approach to learning electronics at home! RCA Institutes, one of the nation's largest schools devoted to electronics, has developed a faster, easier way for you to gain the skills and the knowledge you need for the career of your choice. Here for the first time is a student-proved, scientifically designed way to learn. If you have had any doubts in the past about home training in electronics—if you have hesitated because you thought you might not be able to keep up—or that electronics was too complicated to learn—here is your answer! Read how RCA Institutes has revolutionized its home training ideas!

NEW CAREER PROGRAMS BEGIN WITH "AUTOTEXT" INSTRUCTION METHOD!

Start to learn the field of your choice immediately! No previous training or experience in electronics needed!

With this new revolutionized method of home training you pick the career of your choice—*and RCA Institutes trains you for it.* RCA's Career Programs assure you that everything you learn will help you go directly to the field that you have chosen! No wasted time learning things you'll never use on the job! The Career Program you choose is especially designed to get you into that career in the fastest, easiest possible way!

And each Career Program starts with the amazing "AUTOTEXT" Programmed Instruction Method—the new, faster way to learn that's almost automatic! "AUTOTEXT" helps even those who have had trouble with conventional home training methods in the past. This is the "Space Age" way to learn everything you need to know with the least amount of time and effort.

CHOOSE A CAREER PROGRAM NOW

Your next stop may be the job of your choice. Each one of these RCA Institutes Career Programs is a complete unit. It contains the know-how you need to step into a profitable career. Here are the names of the programs and the kinds of jobs they train you for. Which one is for you?

Television Servicing. Prepares you for a career as a TV Technician/Serviceman; Master Antenna Systems Technician; TV Laboratory Technician; Educational TV Technician.

FCC License Preparation. For those who want to become TV Station Engineers, Communications Laboratory Technicians, or Field Engineers.

Automation Electronics. Gets you ready to be an Automation Electronics Technician; Manufacturer's Representative; Industrial Electronics Technician.

Automatic Controls. Prepares you to be an Automatic Controls Electronics Technician; Industrial Laboratory Technician; Maintenance Technician; Field Engineer.

Digital Techniques. For a career as a Digital Techniques Electronics Technician; Industrial Electronics Technician; Industrial Laboratory Technician.

Telecommunications. For a job as TV Station Engineer, Mobile Communications Technician, Marine Radio Technician.

Industrial Electronics. For jobs as Industrial Electronics Technicians; Field Engineers; Maintenance Technicians; Industrial Laboratory Technicians.

Nuclear Instrumentation. For those who want careers as Nuclear Instrumentation Electronics Technicians; Industrial Laboratory Technicians; Industrial Electronics Technicians.

Solid State Electronics. Become a specialist in the Semiconductor Field.

Electronics Drafting. Junior Draftsman, Junior Technical Illustrator; Parts Inspector; Design Draftsman Trainee Chartist.

SEPARATE COURSES

In addition, in order to meet specific needs, RCA Institutes offers a wide variety of separate courses which may be taken independently of the Career Programs, on all subjects from Electronics Fundamentals to Computer Programming. Complete information will be sent with your other materials.

2 CONVENIENT PAYMENT PLANS

RCA Institutes offers a unique tuition plan that lets you progress at your own pace. You only pay for lessons as you order them. You don't sign a contract obligating you to continue the course. There's no large down-payment to lose if you decide not to continue.

However, if you desire, RCA Institutes also offers a convenient monthly payment plan.

VALUABLE EQUIPMENT

You receive valuable equipment to keep and use on the job—and you never have to take apart one piece to build another.

New—Programmed Electronics Breadboard. You now will receive a scientifically programmed electronic breadboard with your study material. This breadboard provides limitless experimentation with basic electrical and electronic circuits involving vacuum tubes and transistors and includes the construction of a working signal generator and superheterodyne AM Receiver.

Bonus From RCA—Multimeter and Oscilloscope Kits. At no additional cost, you will receive with every RCA Institutes Career Program the instruments and kit material you need to build a multimeter and oscilloscope. The inclusion of both these kits is an RCA extra.

CLASSROOM TRAINING ALSO AVAILABLE

RCA Institutes maintains one of the largest schools of its kind in New York City where classroom and laboratory training is available in day or evening sessions. You may be admitted without any previous technical training; preparatory courses are available if you haven't completed high school. Coeducational classes start four times a year.

JOB PLACEMENT SERVICE, TOO!

Companies like IBM, Bell Telephone Labs, GE, RCA, Xerox, Honeywell, Grumman, Westinghouse, and major Radio and TV Networks have regularly employed graduates through RCA Institutes' own placement service.

SEND ATTACHED POSTAGE PAID CARD FOR COMPLETE INFORMATION, NO OBLIGATION.

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Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

Uncle Tom answers his most interesting letters in this column. Write him at Electronics Illustrated, 67 West 44th St., New York, N.Y. 10036.

★ *A few issues back you had a reader who complained about a baseball-sized fingerprint on the face of his color set's picture tube. You'll be interested to know that this problem is caused by a defective deflection or convergence yoke.*

Nathan Gregory, Jr.
Flemingsburg, Ky.

. . . . the problem is the bond between the faceplate and picture-tube face. It's bad and slowly separating.

S. L. Clements
St. Louis, Mo.

. . . . it's a defect in the laminating gelatin on the front of the picture tube.

Frederick Steurer
Hamilton, Ohio

Did it ever occur to anybody that maybe a guy with greasy baseball-sized fingers touched the set?

★ **Signs of The Times Dept.** When driving through Arizona, be sure to read the sign language—speed-limit signs, that is. The Navajos are taking a giant step into a technological society and adding tourist wampum to the treasury by means of two radar speed meters.

★ *I have heard that most crystals used in radios are synthetic and that natural clear quartz crystal is in demand. While prospecting I have found clear quartz and tossed it away. Should I have kept it?*

William L. Robins
Paupack, Pa.

You'd probably have to dig through about 10,000 lbs. of quartz to come up with 1 lb. of top-quality radio-crystal material, for which the price is about $3.50 per lb. Almost all natural quartz comes from Brazil and Italy and, with their supplies running low, manufacturers have turned to the synthetic stuff which gives excellent results. Unless you've stumbled on a big rock candy mountain of quartz you won't be likely to prosper in this industry.

★ *I get WWV's 25-mc transmission on exactly 25 mc and also, simultaneously, on 24.762 mc. The receiver (a Collins 51J-4) was checked and rechecked and the mystery signal isn't an image or a spurious radiation from within the set. Is this a new service of WWV?*

Grady Melneck
Buffalo, N. Y.

Nope. It's just that someone goofed in the design of the WWV transmitter's driver stage. WWV actually is sending out your mystery signal. They are aware of it and even have verified some reception reports on that frequency. You'd better hurry if you want the QSL because WWV's engineers are fixing the rig pronto.

★ *Is there any specific FCC regulation against my using two CB rigs simultaneously on two different channels in order to transmit in stereo?*

Maurice Wandover
Tallahassee, Fla.

I can't find one but I'm sure the FCC will.

★ *Can you give me any info on a net control station operating at about 4350 kc and using the call-sign AF4WZP or AF4WBP?*

Bob Martin
Hickory, N. C.

This is a USAF MARS (Military Assistance Radio Service) net. There are many such networks throughout the spectrum. They usually are located on frequencies near the ham bands since the MARS stations are ham-

[*Continued on page* 22]

Our CB success has gotten out of hand.

Introducing our first great line of 5W base/mobile rigs.

Fanon, world leader in hand-held CB and intercommunication is ready with its first great line of base station/mobile rigs.

Not the largest line in the field—but the finest. Carefully and skillfully developed and engineered for top performance. Units you can place your confidence in...and all made in the U.S.A.

and the finest hand-held CB rig ever produced.

MODEL IC-5000. 3 space age IC Circuits for the ultimate in range and performance. 5 watts & 6 channels. Power boost antenna. Range booster. PA facility. Converts to base station with optional AC power supply. **$99.95**

MODEL M 2300—18 tube performance. Unique modulation sampler. Range expand. All 23 channels. Dual conversion. Built-in PA system — transistorized power supply. **$189.95**

MODEL XM 2300 — 19 tube performance. Cascade front end. Nuvistor mixer. All 23 channels. Our most sensitive and quiet rig. **$199.95**

MODEL T 23 — Solid state engineering for unsurpassed reliability. 23 channels. Fiberglass expoxy circuit board with silicon transistors. Beautiful wood graining. Light-compact-powerful. Unique signal light tells you when S6 signal or better is received. **$159.95**

MODEL XT 23 — The finest solid state mobile rig on the market. All 23 channels. Unsurpassed adjacent channel rejection. Designed to help pierce "skip".

Protected against overload, mismatched antenna and incorrect polarity. Base reflex type audio. Push/pull on-off switch with volume control.

Push/pull noise limiter and squelch. True PA system. (All prices shown are East Coast suggested retail.) **$199.95**

FANON

FANON ELECTRONIC INDUSTRIES, 439 Frelinghuysen Ave., Newark, N.J. 07114

Your new line looks great! Please send me additional information. I'm especially interested in: **EI-169**

M 2300 ☐ XM 2300 ☐ T 23 ☐ XT 23 ☐ IC 5000 ☐

Name _____ City _____

Address _____ State _____ Zip _____

CIRCLE NUMBER 45 ON PAGE 15

UNCLE TOM'S CORNER

Continued from page 20

staffed. In fact, the MARS call-signs often are concocted by replacing the standard ham prefix. If a fellow with the call W1XAA joined USAF MARS he would use the call AF1XAA. Other ham prefix conversions in USAF MARS are: K to AFA, WA to AFC, WB to AFD; Army: W to A, K to AA, WA to AD, WB to AL. Navy MARS calls begin with N and are a complete new call assignment, bearing no similarity to the ham call.

★ *I know you're a CIA agent. You have to be. It all adds up—like the pin in the May issue. And the CIA wouldn't have let you see that much of Radio Americas if you weren't an agent.*

Bob Mark
Louisville, Ky.

Buddy, if I were a CIA employee connected in any way whatsoever with the Radio Americas disaster my next assignment would be trouble-shooting defective U-2s over Peking.

★ *Can you tell me what frequency the USAF Strategic Air Command uses and what mode?*

William Spallina
Wayne, N. J.

At 0145 GMT tonight I tuned across the 8-mc marine band and heard an SSB net using calls like Skyking, Napoleon, and McClellan. The transmissions were coded but seemed to consist mainly of geographical coordinates. What's this all about?

Frank O'Donnell
LaHabra, Calif.

Bill, meet Frank. The Skyking messages, heard on many frequencies in the 4-, 6-, 8-mc and other bands are part of the SAC communications net. Most of the messages are from ground stations since transmissions from aircraft are too vulnerable to pin-pointing with DF gear. As a matter of fact, ground stations often begin their messages "do not answer" just to remind the airborne radio operator not to come back with a quick Roger and blow the whole secret-location bit.

★ *I've come across several stations transmitting unmodulated CW but I've been stumped in my efforts to track them down.*

Even the FCC won't answer my requests for information. The stations all run repeating ID tapes. They send a series of Vs and then ask QRU? [international code for "have you any traffic for me?"]. *I'm really intrigued now. Who, what, and where are these stations? Some of them are NBA on about 17.700 mc, WCC on about 6.375 and WMH on about 6.522.*

Paul Rubin, WA2JVH
Massapequa Park, N. Y.

Sorry, but they aren't nearly as exotic as they seem. The FCC probably was too busy chasing CBers to get around to your letter. Fact is, the stations are part of a large number of coastal telegraph transmitters used to communicate with ships-at-sea—sending and receiving telegrams, weather reports, docking instructions, etc. MBA is operated by the U.S. Navy in Balboa, C.Z., while WCC and WMH are operated by RCA in Chatham, Mass., and Baltimore, Md., respectively. Trying to see how many of these stations you can log can be a lot of fun, especially since most will QSL. My best QSL on these bands is from LYG in Kaunas, Lithuanian SSR.

★ **Situation of Gravity Dept.** Don't look now but one of science's oldest brain busters may well be on the verge of being busted itself. I'm talking about gravitational forces. The subject has been a real whatzit ever since Ike Newton got bopped on the beanie by a McIntosh. Now science theorists are speculating that the newly discovered outer-space pulsars possibly may be strong sources of gravitational radiation—yes *radiation!* The idea is that gravity waves could be produced by large bodies under acceleration. If so, waves striking an object should be detectable by the stresses they cause. Well, Prof. Joseph Webber of the U. of Maryland has been on the trail of gravity knowledge for years now and now is using 4,500-lb. aluminum cylinders as gravity-wave receivers. Prof. Webber feels that some of the things he has encountered while tuned to a frequency of 1.66 kc could be part of the gravity phenomenon. The whole thing is hush-hush for the moment; the military and communications potentials of such a discovery are beyond comprehension. -30-

Broadsides

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

A HOST of new items plus the old standbys are in the new **electronic distributor catalogs.** Free copies available from: Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680; Asco Sound Div. of Sonocraft Corp., 115-17 W. 45th St., New York, N. Y. 10036; Walter Ashe Radio Co., 1125 Pine St., St. Louis, Mo. 63101; Burstein-Applebee Co., 1012-14 McGee St., Kansas City, Mo. 64106; Harrison Radio Corp., 20 Smith St., E. Farmingdale, N.Y. 11735; Lafayette Radio Electronics, Dept. PR, Box 10, Syosset, N.Y. 11791; Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60624; Olson Electronics, 982 S. Forge St., Akron, Ohio 44308; Radio Shack Corp., 730 Commonwealth Ave., Boston, Mass. 02217; World Radio Lab., 3415 W. Broadway, Council Bluffs, Iowa 51501.

A wide variety of **audio accessories** is shown in two catalogs. Number 6807 has open-reel and cassette tape, tape accessories and phonograph accessories. Catalog A6806 contains patch cords, adaptors and connectors. For copies send a stamped, self-addressed 8½ x 11 envelope to Robins Industries Corp., 15-58 127th St., Flushing, N.Y. 11356.

The RCA solid-state **Hobby Circuits** Manual has information on semiconductor theory and operation plus schematics for varied construction projects. $1.75 from RCA Electronic Components, 415 S. 5th St., Harrison, N.J. 07029.

A catalog of **prerecorded tapes**—open-reel, four- and eight-track cartridge, cassette—includes short articles on the music and how tape is made. It also describes the manufacturer's recorder/player line. Free copy from Ampex Corp., 2201 Lunt Ave., Elk Grove Village, Ill. 60007.

Breadboarding kits and accessories, including a printed-circuit etching kit are in a free catalog from Waldom Electronics, Inc., 4625 W. 53rd St., Chicago, Ill. 60632.

Musical-instrument loudspeakers are described in a free brochure from Jensen Mfg. Div., The Muter Co., 5655 W. 73rd St., Chicago, Ill. 60638.

How To Select a **Recording Tape** contains hints on splicing, editing, tape selection and care. Free from Audio Devices, Inc., 235 E. 42nd St., New York, N.Y. 10017.

Catalog #17 contains **construction accessories**—soldering iron tip cleaners and holders, heat sinks, pliers, cutters, probes, etc.—in the Little Joe line. Free copy from Macdonald & Co., 213 S. Brand Blvd., Glendale, Calif. 91204.

EI at Large

BINAURAL'S back. In case you didn't know it had gone, binaural once was interchangeable with stereo as a word to describe the then-new two-channel hi-fi medium. Then somebody pointed out that binaural means two-eared, whereas the system we now call stereo might better be described as two-speakered. After all, we hear mono with two ears.

So binaural was redefined as dealing with recording systems that shut out room acoustics during listening, feeding to each ear (via a headset) only the precise signal it would receive in the concert hall—or wherever the sound originated. This turned out to be a tougher job than would appear at first glance. Mikes had to be spaced exactly like human ears. Moreover, to produce correct attenuation with respect to the direction from which a sound arrived, the mikes had to have between them something that would approximate the acoustic properties of the human head.

A company called Listening, Inc., in Arlington, Mass., recently lit into the problem with something named, appropriately, Environ-Ears—a gadget that looks like a pair of black plastic ears (or, more properly, pinnae—those odd ruffles of cartilage each of us has attached to the sides of his head) connected to the ends of a metal tube. The pinnae, says Listening, Inc., diffract sound selectively depending on the direction from which it comes. So audio recorded by the

[*Continued on page* 112]

It's a color bar generator, too.

You're looking at the only tube tester that can check out almost every receiving tube and throw an alignment signal into the picture tube.

It's a combination tube tester and color bar generator.

So now all you need is a single instrument to do two of your most important servicing jobs: Make sure the tubes in a set are good. And make the adjustments you need to get a good, sharp picture on color and black-and-white TV sets.

We built it like a brick. (After you've carried it through a thousand doorways, you'll know why.)

And we've done everything to make it accurate and stable.

The new instrument starts off with a regulator-type transformer that doesn't give a hoot how the line voltage is acting up. (It doesn't even need a fuse.) There are 73 tube sockets that let you run all kinds of tests on all kinds of tubes. All you have to do is set 3 knobs. You can even check each section of a multisection tube separately.

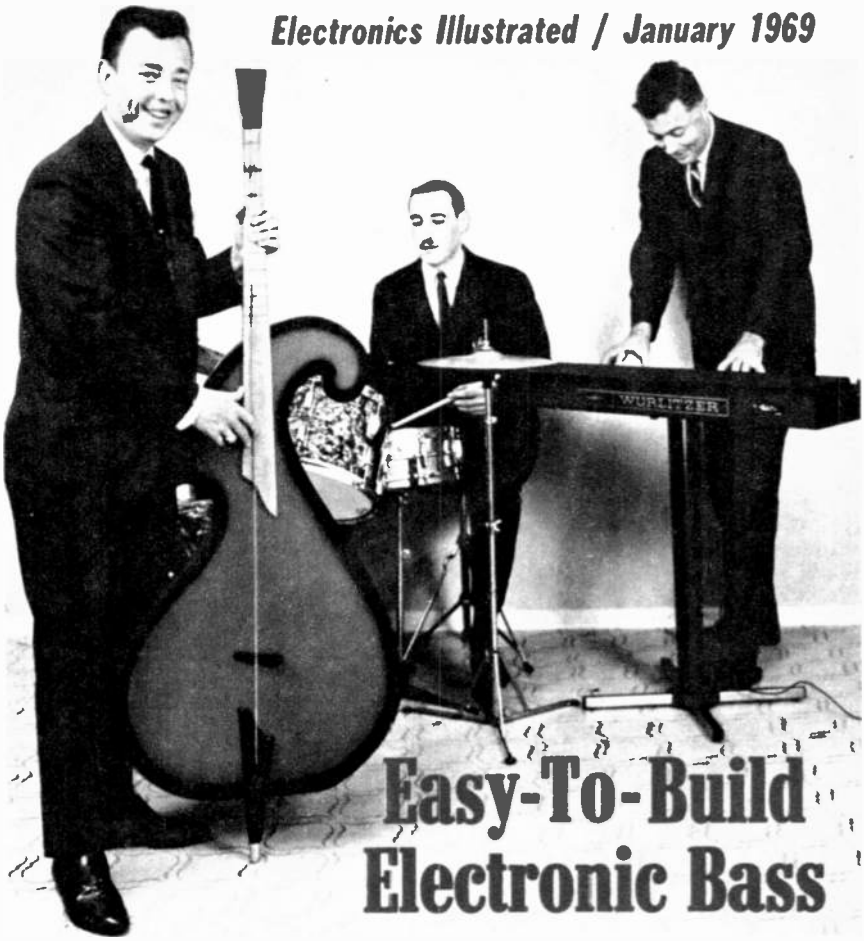
The color bar generator is all solid state. It puts out 6 crystal-controlled, rock-stable test patterns: 10 color bars, a clear raster, 10 vertical lines, 13 horizontal lines, 130 dots and a 10 x 13 crosshatch. All operating and calibration controls are right in front of you on the panel.

Putting both instruments into one package also gives you a small bonus.

It leaves your other hand free to carry something else.

For more information, see your Sylvania distributor or write to: Sylvania, CADD, 1100 Main Street, Buffalo, N.Y. 14209. SYLVANIA

CIRCLE NUMBER 46 ON PAGE 15



Easy-To-Build Electronic Bass

. . . and even easier to play, because it has only one string!

By FRED MAYNARD

IT looked as though it would be duck soup at first. Playing a string bass, that is. The feeling started that time you watched the bass player in the combo. He didn't seem to be working at all. He appeared to be just standing there holding the instrument with his left hand while beating out the rhythm with his right. You felt encouraged because you always wanted to play an instrument but didn't feel you could master it. The bass, however, looked simple.

You gave it a good try. To your dismay you found you were all thumbs because it's not just a matter of slapping or plucking the strings. There's a good deal more to do with your left hand on the instrument's neck. Upshot of the adventure was that you took up the kazoo.

We have a solution which will get you a musicians-union card yet—a one-string electronic bass which you could learn to play in a week or two. What happened to the other three strings? We did away with them since it takes only one to make electrical contact with the frets on the neck. There's a small price to be paid for this simplification—the bass has a range of only one octave, starting at C_2 and going up to C_1. (The 2½-octave range of a real string bass goes from E_3 up to B_1.)

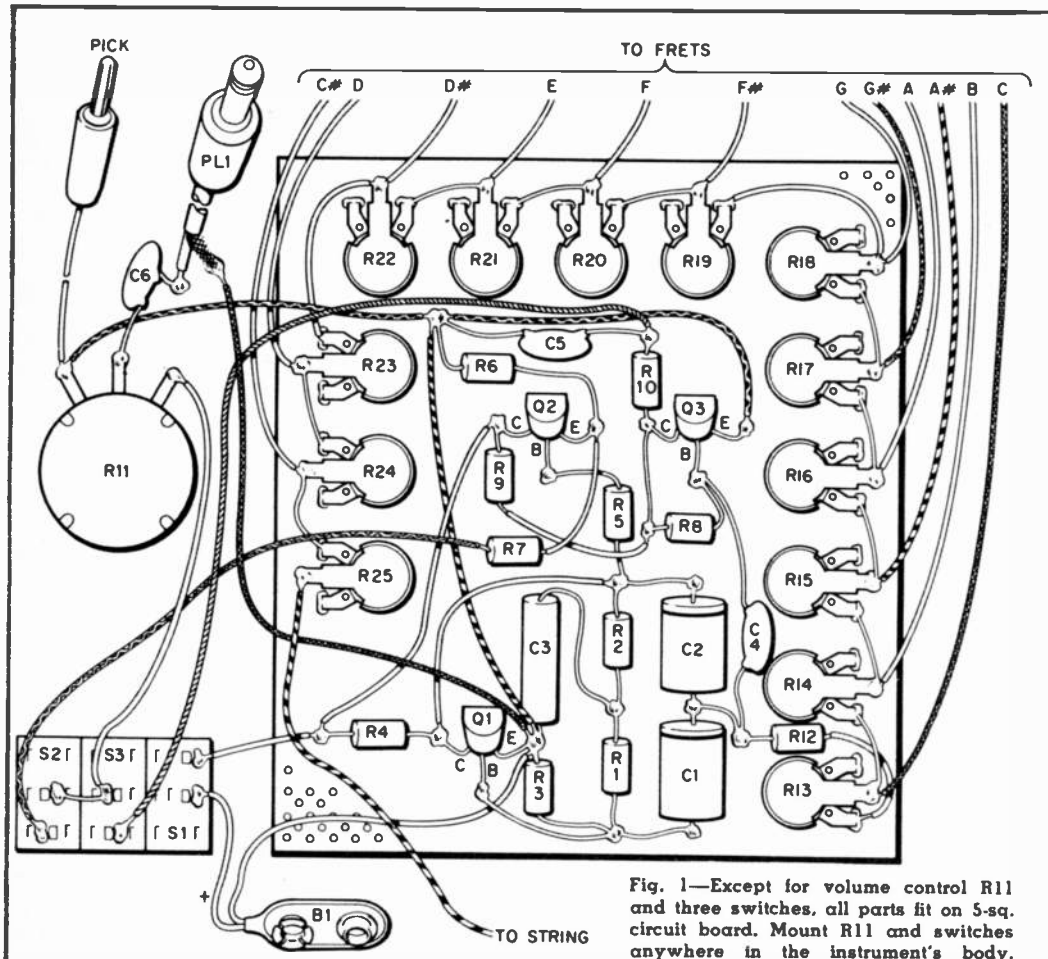


Fig. 1—Except for volume control R11 and three switches, all parts fit on 5-sq. circuit board. Mount R11 and switches anywhere in the instrument's body.

Electronic Bass

However you could expand the circuit to add another octave or two.

Another feature of the bass is that it could be made almost as small as a cigar box. True, our model on the cover and above looks almost as unwieldy as a real bass. However, we built ours for show.

You can build your model the same size as a conventional bass, about the size and shape as ours or, as we said, about the size of a cigar box. And if you build it this small you could eliminate even the single string and install push buttons.

Our one-string bass will put a solid bottom in your combo or spike up your musical-fun evenings at home. It costs only a few dollars and, except for its limited range, produces a sound almost as good as a real bass.

The Circuit

The electronic part is a simple twin-tee oscillator circuit. In the schematic (Fig. 4), transistor Q1 and its associated R/C network form the oscillator. The frequency-determining network is composed of C1, C2, C3, R1 and R2. The tuning network consists of resistor R12 and potentiometers R13 to R25. As far as parts go, the capacitors should be good paper or mylar units and R1 and R2 should have a tolerance of five per cent. The trimpots (R13 through R25) are low-cost Mallory MTC-series units.

Transistor Q2 is an emitter-follower buffer and Q3 is a buffer amplifier. The purpose of these two stages is to prevent amplifier load-

ing from affecting the tuning of the oscillator. The output of Q2 is a nearly pure sine wave, having a deep-tone sound. A tone rich in high harmonics from Q3 provides a string or reed-like sound. Either or both of these transistors may be switched into the output by switches S2 and S3. Potentiometer R11 is a volume control. The power is supplied by a large 9-V battery or six penlite cells. Switch S1 controls power.

The playing part of the instrument is a fret board similar to that on a guitar. The frets are wired to the tuning pots, as will be described later. A metal guitar string or picture wire mounted over the frets contacts the frets as the string is pressed to them. This string is connected to the last tuning pot, R25.

The instrument plays whenever a fret is grounded by the pick. When the pick touches only the string, C_2 (lowest C) sounds. The other chromatic notes, C#, D, D#, etc., are played by simply pressing the string to the frets with the pick. The pick is simply a banana plug on the end of a flexible wire which is connected to circuit ground and which comes up through the top panel of the instrument.

Construction

The construction consists of two parts; first, the circuit board and second, the neck-piece fret board.

Our circuit was built on a 5-in.-sq. piece of perforated board. We used flea clips for tie points. Any layout will do, but you might as well follow ours. The switches, pot, battery, holders, etc., can be mounted in the body of the instrument.

Notice in Figs. 2 and 3 how our neck is made. It is a tapered piece of wood about 20-in. long. The 12 frets are 2-in. long pieces of No. 14 bare solid wire. To the middle of each fret solder a 25-in. length of flexible insulated hookup wire as shown in Fig. 2. Slip the wires through the holes in the neck, and after making sure the fret bars seat in the saw scores, fasten them in place with Duco cement. A component box can be made out of plywood and can be about 2x9x9 in. The top panel can be ¼-in. plywood.

Connect the 12 fret wires to the tuning pots in the proper order, starting with the fret nearest the bottom, which goes to R24. If you become confused by all the wires coming out of the neck, you can locate which is which with an ohmmeter. After the wiring to the switches, batteries, etc., is complete, the instrument is ready to be tuned.

Make sure, after the instrument is finished, to clean off the fret bars by lightly sanding them since they may be covered with cement. If you run into noise while fingering the string, it is because of a dirty fret or a dirty string.

Tuning

The scale the bass plays goes from C_2 to C_1 —the second to the first octave below middle

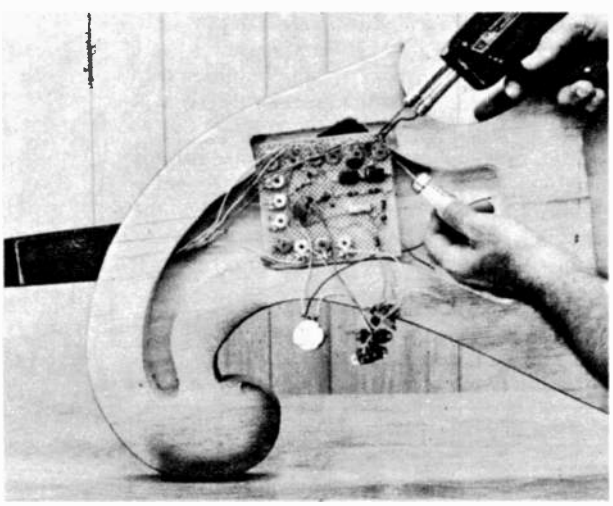


Fig. 2—Circuit board is in upper part of our instrument's body. Note wires going up to neck to frets. Switches, R11 were mounted behind left hand.

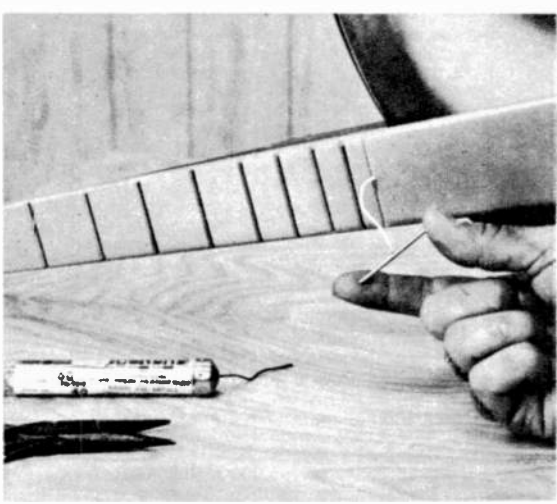


Fig. 3—Fret is 2-in. piece of No. 14 wire to which wire is soldered. Fret is glued in groove cut in neck. Note decrease in spacing near the bottom.

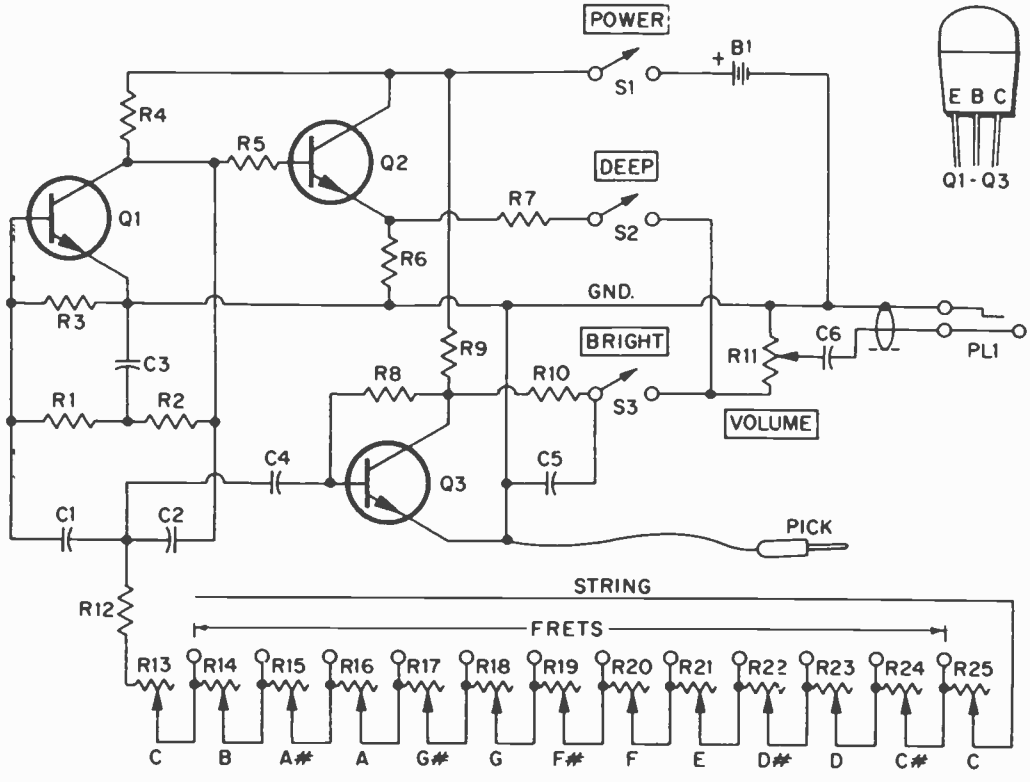


Fig. 4—Schematic. To simplify wiring to frets, we show lowest C at right. To have same range as four-string bass, oscillator (Q1) has to operate from 41.2 to 247 cps. Its range is now 65.4 to 130.8 cps.

Electronic Bass

PARTS LIST

B1—9 V battery (Eveready 266 or six penlite cells in series)
Capacitors: 50 V or higher unless otherwise indicated
C1,C2,C4—.05 μf mylar or ceramic disc
C3,C5—.1 μf mylar or ceramic disc
C6—1 μf 200 V mylar (not electrolytic)
PL1—Phone plug
Q1,Q2,Q3—MPS6514 transistor (Motorola, available from Allied Radio and others. Order Allied Stock No. 49 R 26 MOT MPS6514. 60¢ plus postage. Not listed in catalog)
Resistors: ½ or ¼ watt, 10% unless otherwise indicated
R1,R2—100,000 ohms, 5%
R3—47,000 ohms
R4,R6,R9—6,800 ohms
R5—5,600 ohms
R7—330,000 ohms
R8—100,000 ohms
R10—150,000 ohms
R11—20,000 ohm linear-taper potentiometer
R12—910 ohms, 5%
R13 through R21—1,000 ohm, linear-taper miniature potentiometer (Mallory MTC-13L4 Trimpot, Lafayette 33 T 1671 or equiv.)
R22 through R25—5,000 ohm, linear-taper miniature potentiometer (Mallory MTC-53L4 Trimpot, Lafayette 33 T 1675 or equiv.)
S1,S2,S3—SPST slide switches
Misc.—Perforated circuit board, shielded mike cable, penlite-cell holders, No. 14 solid wire, metal-wrapped guitar string, glue, eyebolts.

C. The table at the end of this article gives the frequencies of these tones in cps. You can tune the bass with a frequency counter, calibrated oscillator, or by direct comparison with a piano or organ. Whichever way you choose, tune R25 first, and follow with R24, R23 etc. in order, adjusting each pot until its tone is in tune to your satisfaction.

In patching the bass to an amplifier, obtain a plug for the shielded cable that will fit the amplifier input jack.

You may have to play with the volume and bass controls on the amplifier to get a good solid tone, and yet not overdrive the amplifier. Once you get this right, it will sound great, and you will have a good enough bass to play anywhere.

FREQUENCIES

Note	Freq. (cps)	Note	Freq. (cps)
C_2	65.4	G	98.0
C#	69.3	G#	103.8
D	73.4	A	110.0
D#	77.8	A#	116.5
E	82.4	B	123.5
F	87.3	C_1	130.8
F#	92.5		

Pocket FSM for CB

By JOSEPH RITCHIE

NO matter what features you've looked for in a FSM (field-strength meter)—super sensitivity for low-power walkie-talkies or ultra portability—the Pocket FSM for CB is the answer to your dreams.

Tired of having a FSM's antenna stab holes in your pockets? No problem—the pocket FSM doesn't have an external antenna.

Want full-scale indications from a flea-power walkie-talkie's signal? No sweat—the pocket FSM is more sensitive, even without an external antenna, than most commercially-made FSMs.

Want the FSM to fit easily into a pocket, without giving a two-way stretch to the cloth, or into your car's glove compartment? It's the pocket FSM again. In short, you name it, the pocket FSM has it.

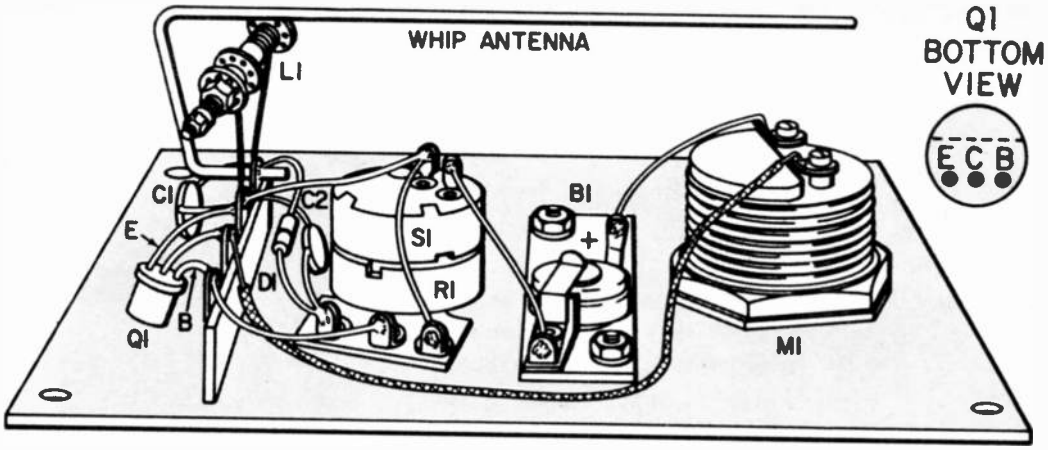
The pocket FSM is a diode-type meter with a very-high-gain DC amplifier. The small sample of RF picked up by the internal antenna is rectified by diode D1. The resultant DC, which is proportionate to the RF level, is amplified by Q1. Transistor Q1 is normally operated without base bias; the rectified RF provides the bias; hence Q1's collector current is determined by the RF signal level. Since M1 is connected in Q1's collector circuit, the greater the applied RF the greater the base bias and the higher M1's indication. Potentiometer R1 is a gain control. It allows M1's highest indication to be set at any convenient spot on the meter scale.

While a FSM's simplified meter arrangement—no balanced bridge—usually results in a residual meter indication even when RF is not applied, there is absolutely no such indication in our FSM. This is because Q1 has a normal collector-emitter leakage current of just a few microamperes; too little for even a slight meter indication.

Battery B1 is a 1.35-V button-size mercury cell, which under normal use will last several years. However, B1 must be mounted in a battery holder. Do not attempt to solder wires directly to the cell or you will sharply reduce its life, or even destroy it.

Construction. The pocket FSM is assembled on the aluminum panel supplied with a 4 x 2⅛ x 1⅝-in. Bakelite case. Under no circumstances substitute a Bakelite panel; the front panel must be metal.

The parts will just fit on the front panel; therefore, determine all component mounting holes before drilling. Meter M1 should be mounted



The internal antenna should be routed from the terminal strip toward what will be the bottom of the cabinet, then around L1 and up to the top of panel. Keep the wire close to L1 so it doesn't prevent the panel from fitting into the cabinet.

Pocket FSM for CB

as close as possible to the top of the panel, but allow about ⅛ in. between the top of the panel and the top of the meter case. To be sure M1's mounting nut does not interfere with the panel's mounting screws, position the meter exactly on the panel's centerline, then temporarily mount the meter.

The meter mounts in a 1-1/16-in. dia. hole. Do not punch a 1⅛-in. dia. hole as the meter will go through it. Instead, punch a 1-in. dia. hole and then file the edge until the meter slips into the hole easily. Note that the meter is secured with a nut which screws directly on the body of the meter. You must position the fiber washer supplied with the meter between the mounting nut and the panel and not between the meter and the panel. Failure to use the washer can result in permanent damage to the meter. And screw the nut on only finger tight. Do not use a wrench or pliers—the washer will provide a secure friction mount.

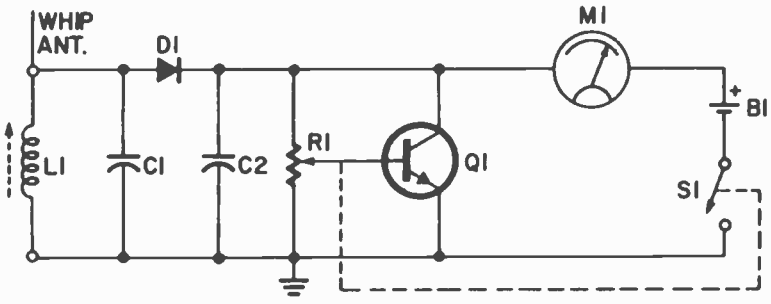
With M1 mounted, position B1's holder close to the meter case, then position R1 close to B1's holder. Finally, locate the terminal strip at the bottom of the panel. To get everything to fit, R1 must be a miniature pot; a standard-size pot will take up too much room and will make it impossible to mount the terminal strip. The terminal strip must be positioned so it does not block the panel's mounting holes.

Remove M1 and drill the holes for the remaining panel components. Then install the panel components in this order: M1, the battery holder, R1 and the terminal strip.

Complete the wiring in the following order: First, install C1, C2 and D1. Then complete all wiring except for L1. Note that S1's ground wire is connected to the terminal-strip ground lug; therefore, make certain the lug is securely connected to the panel. If necessary, install a lockwasher between the terminal strip's ground lug and the panel.

Double check the cell holder's connections before installing L1 or the cell. The holder's negative terminal is the spring clip on the top, the well is the cell's positive terminal. Make certain a mounting nut on the holder does not contact the positive terminal. (The holder is made in such a manner that the cell cannot be installed incorrectly.)

Finally, install L1 and the antenna. Solder two 1-in. solid-wire leads to the terminal strip and push the wires through the appropriate coil lugs. Slide L1 directly on the wires and position it so it is directly above the terminals and then solder. Don't attempt to solder



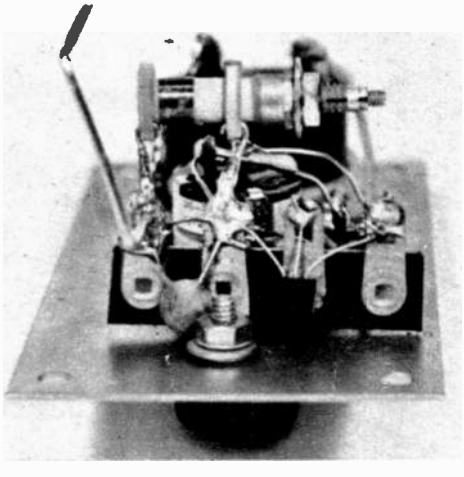
Signal picked up by antenna is tuned by C1,L1 and detected by D1. DC is proportionate to RF level and forward biases Q1 causing it to conduct. Since M1 is connected in Q1's collector circuit, the greater the RF signal the greater will be M1's indication.

PARTS LIST

B1—1.35 V mercury cell (Mallory RM625R)
C1—30 μμf, 500 V silvered-mica capacitor (Elmenco DM10-300 or equiv.)
C2—100 μμf, 500 V ceramic disc capacitor
D1—1N34A diode
L1—0.730-1.25 μh subminiature adjustable RF coil (J. W. Miller 40A106CB1)
M1—0-1 ma DC milliammeter (Alco P-1000 Mini-Meter)
Q1—2N3391 transistor (GE)
R1—50,000-ohm miniature potentiometer with SPST switch (Lafayette 32 T 7367 or equiv.)
S1—SPST switch on R1
Misc.—Mercury-cell holder (Keystone 117), 4 x 2⅛ x 1⅝-in. Bakelite utility case with aluminum panel (Lafayette 99 T 8078 or equiv.)
The following parts are available from Custom Components, Box 352 Aldon Manor Br., Elmont, N.Y. 11003: L1—$2.25, M1—$4.95, Keystone 117 mercury-cell holder—$1.00. Postage and handling—65¢. N.Y. State residents add tax. Canadians add $1.00. No foreign orders.

L1's lugs to the terminal strip without using the 1-in. leads (cut away the excess after soldering) as L1 is easily damaged by excess soldering heat. Drill a hole in the side of the cabinet opposite L1's slug-adjustment screw to facilitate alignment when the panel is installed in the cabinet.

The built-in antenna should be made from a short piece of No. 16, No. 18 or No. 20 solid wire. Solder one end of the wire to the terminal strip, bend it up, as shown in the photograph and around L1. Then cut it so the end is almost at the top edge of the panel. Bend the antenna so it runs approximately along the panel's center line. The antenna should pass very close to L1. If it is spaced too far from L1 you will not be able to fit the assembly into the cabinet. Do not try to force the panel into the cabinet as the antenna might bend and touch other components.

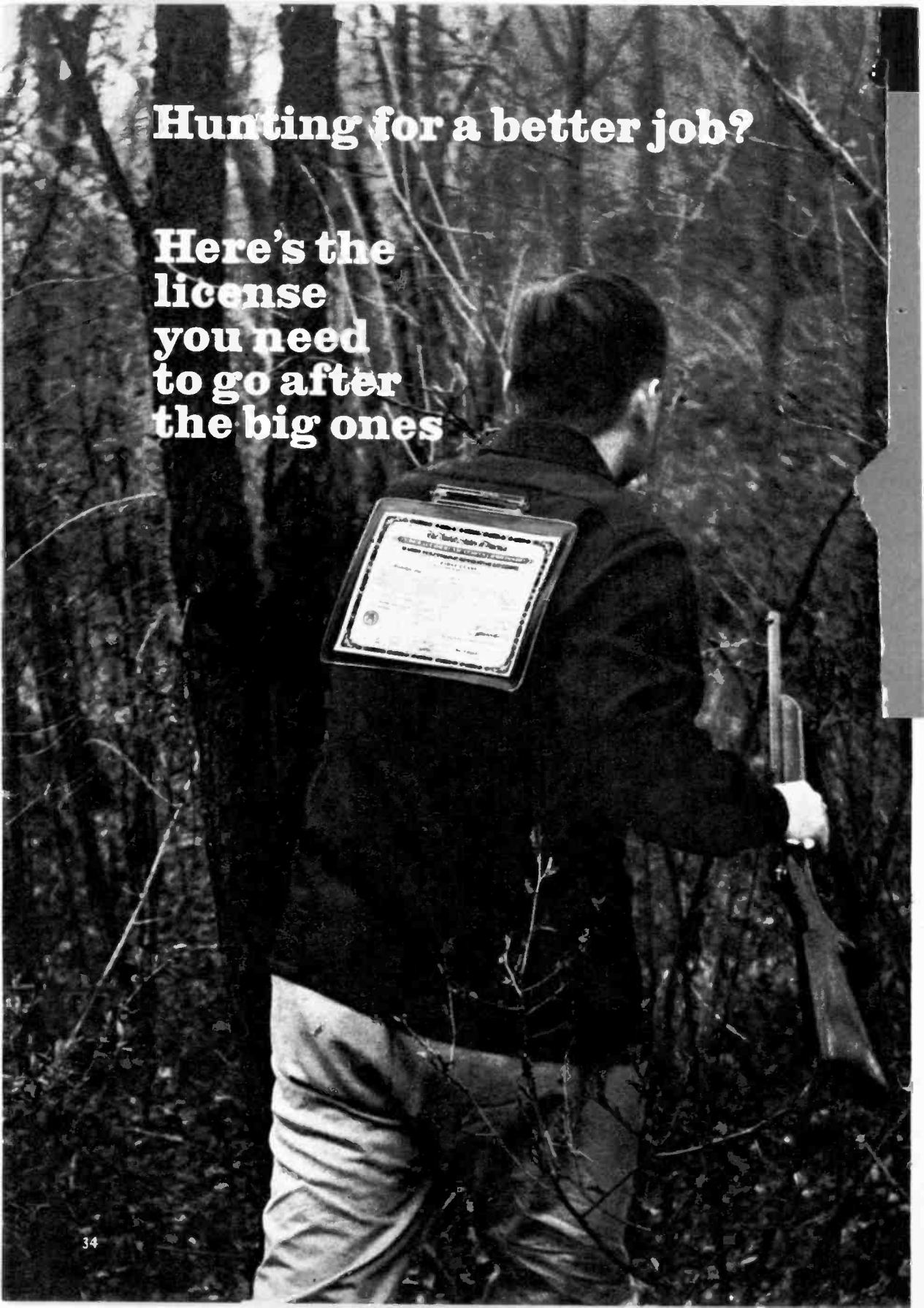


Mount L1 as close as possible to terminal strip. To avoid damage to L1, don't solder its lugs to terminal strip; install 1-in. wire leads first.

Alignment. Install B1, turn the unit on and advance R1 full clockwise. Holding the FSM by the *sides* (keep your hand away from the back and top), position the FSM near a CB transmitter or walkie-talkie which is set to transmit. Using an insulated alignment tool, turn L1's slug for maximum meter indication. To secure optimum adjustment of L1, keep M1's indication between ⅓ and ⅔ of full scale by reducing the sensitivity with R1.

Using the Pocket FSM. To avoid detuning, always hold the FSM by the sides, not by the top and bottom. Do not place your hand on the back of the cabinet.

Place the FSM near the transmitter or antenna and advance R1 until you get some meter indication. If M1 fails to indicate, the transmitter may not be working. Set R1 for a convenient meter indication, about half-scale, and then make your transmitter or antenna adjustments. When M1's pointer reaches almost full-scale reduce the gain with R1 to prevent the pointer from being driven off-scale. If this happens, the meter could be permanently damaged.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An FCC License is a legal requirement if you want to become a Broadcast Engineer, or get into servicing any other kind of transmitting equipment—two-way mobile radios, microwave relay links, radar, etc. And even when it's not legally required, a license proves to the world that you understand the principles involved in *any* electronic device. Thus, an FCC "ticket" can open the doors to thousands of exciting, high-paying jobs in communications, radio and broadcasting, the aerospace program, industrial automation, and many other areas.

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Daniel J. Smithwick started his CIE training while in the service, and passed his 2nd Class exam soon after his discharge. Four months later, he reports, "I was promoted to manager of Bell Telephone at La Moure, N.D. This was a very fast promotion and a great deal of the credit goes to CIE."

Eugene Frost, Columbus, Ohio, was stuck in low-paying TV repair work before enrolling with CIE and earning his FCC License. Today, he's an inspector of major electronics systems for North American Aviation. "I'm working 8 hours a week less," says Mr. Frost, "and earning $228 a month more."

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Tele Remote Control

Dial your home, transmit a tone and you can switch on almost anything.

By VINCE DANIELS YOU stroll out of an air-conditioned theater and find the temperature has soared to 100 degrees and the humidity has risen to 98 per cent. Do you stand and groan with the rest of the crowd? Not at all! You hop into the nearest phone booth, pay a dime, dial your home, and then feed a tone into the phone with a small black box. At the other end of the line your Tele Remote Control turns on your air conditioner. When you arrive home you walk into heaven.

Or, you might want to turn on the coffee to have it steaming hot as you walk through the door. You even can work your CB gear through the phone. Use one tone and the CB transceiver—which is connected to the phone line through a patch—turns itself on and feeds the received signals into the phone. Press another button and the transceiver flips to transmit so you can transmit whatever you speak into the telephone.

The control's operation depends on different-frequency tones. The receiver (which is connected to a standard Western Electric phone you've bought and plugged into your extension phone's outlet) automatically answers the phone and feeds the incoming signal to the built-in amplifier. This drives a resonant-reed relay, a special type of relay which has five independent circuits, each of which can be activated by a different tone. If your tone generator can produce five different tones you can control up to five different circuits or appliances.

The number of circuits you can control is up to you. For example, the tone generator shown provides two tones. We show more than one circuit (Rx, Sx) so you know how to add additional tones. The receiver we show here has a single controlled circuit, but there's plenty of room on the front panel for additional relays for extra circuits.

The receiver does not directly control the appliance. Instead it provides a single pulse of 117 VAC, which actuates an external 117-VAC latching relay (such as Potter & Brum-

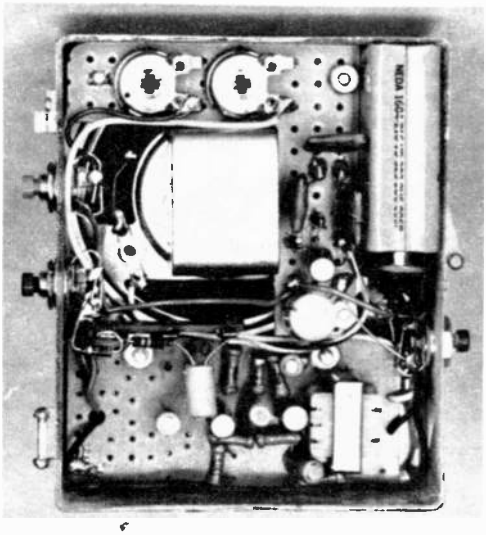
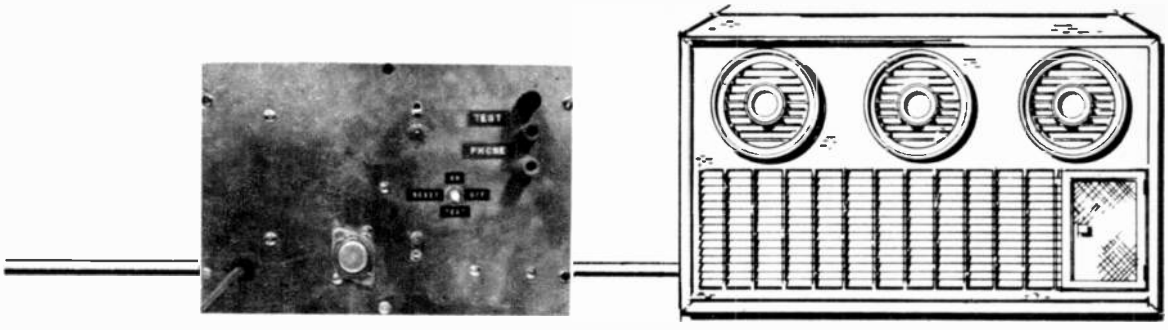


Fig. 1—Tone generator. Oscillator circuit is on L-shaped perforated board at top and right of speaker. Modified ready-made amplifier is at bottom.



field PC11A. This way, both on and off operation is possible. For example: The power to your air conditioner is controlled by a latching relay which is connected to power socket SO1. A single tone burst causes a short 117-V burst to appear at SO1 which causes the latching relay to flip to the *on* position. Even after power is removed from the latching relay it remains in the *on* position.

Something comes up and you can't get home early, so why run up the electric bill? You call your home again and once more transmit a tone. The second 117-V burst at SO1 causes the latching relay to flip to the *off* position, thereby turning off the air conditioner. Of course, you can utilize control relay RY5 in any way you want. You can wire it to be self latching, control DC, start a recorder, etc.

Getting The Parts. To avoid the problems associated with obtaining special or obscure parts, the system has been designed to use components readily available from mail-order parts distributors. However, in some places the circuitry is special and will work only with the components specified. Unless specifically permitted, do not substitute for components in the Parts List.

Relay RY4 has two reeds which can't be used in this application. The relay we specify for RY4 will, therefore, provide for only three control circuits. If you can get one, a resonant-reed relay with a 2,000-ohm impedance coil (at 400 cycles) and reed frequencies between 500 and 1,000 cycles should be substituted for five-circuit operation. The tone generator, whose tones are designed around the reed relay, has a top frequency of slightly under 400 cycles. It can be modified for a 500 to 1,000 cps. range by substituting .01-μf capacitors for C1, C2 and C3.

Construction. Since the tone generator is needed to check out the receiver, build it first. Ours, which will fit into a jacket pocket, produces a maximum of two tones and is assembled in a 3⅞ x 3⅛ x 1⅛ in. plastic box. If you are not experienced in tight wiring or you need more than two tones, use a larger cabinet.

Mount all components in the tone generator box with No. 4 hardware. Assemble the unit in the order given. Do not mount any components until all cabinet holes have been drilled. Since the plastic cabinet is easily shattered, back it with a block of wood when drilling and use a very sharp bit and a slow-

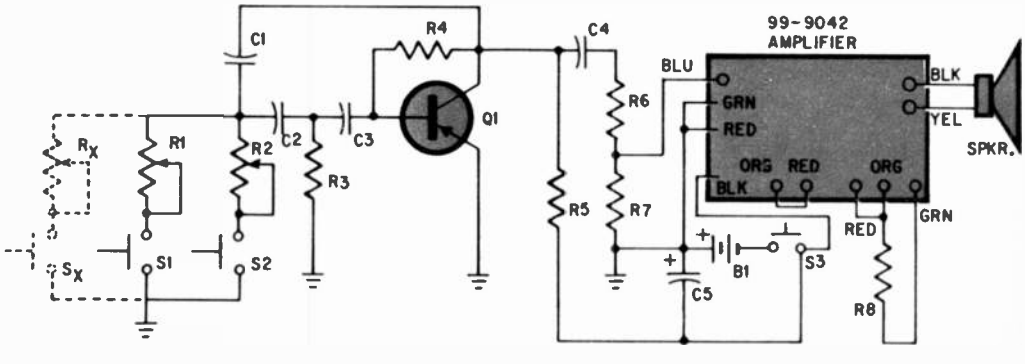


Fig. 2—Tone generator schematic. Add Rx and Sx for each extra tone. S3, under amplifier, turns on power.

Tele Remote Control

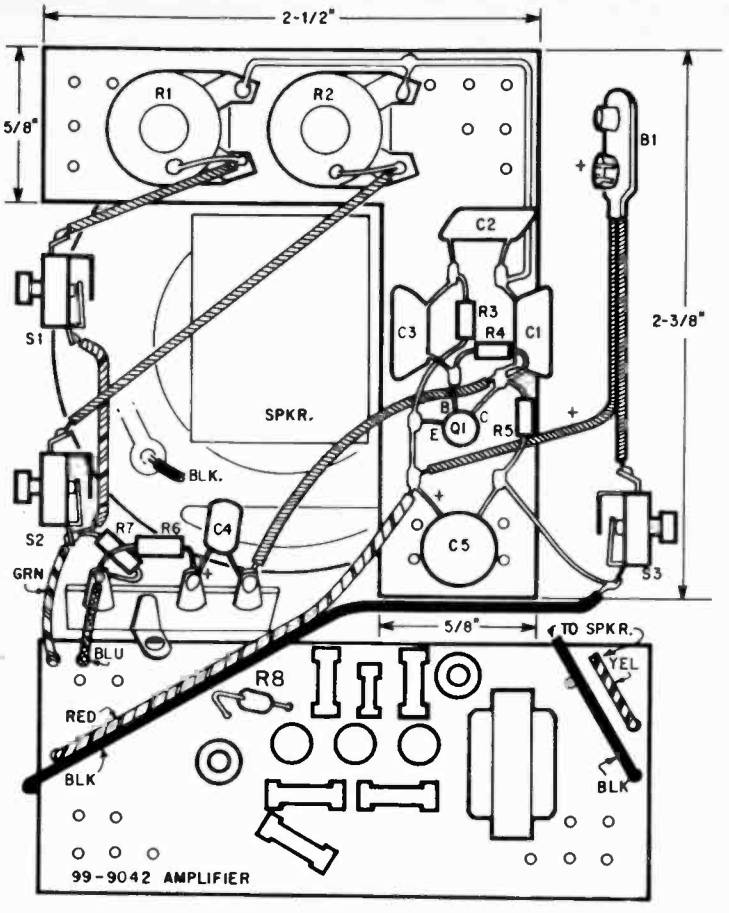
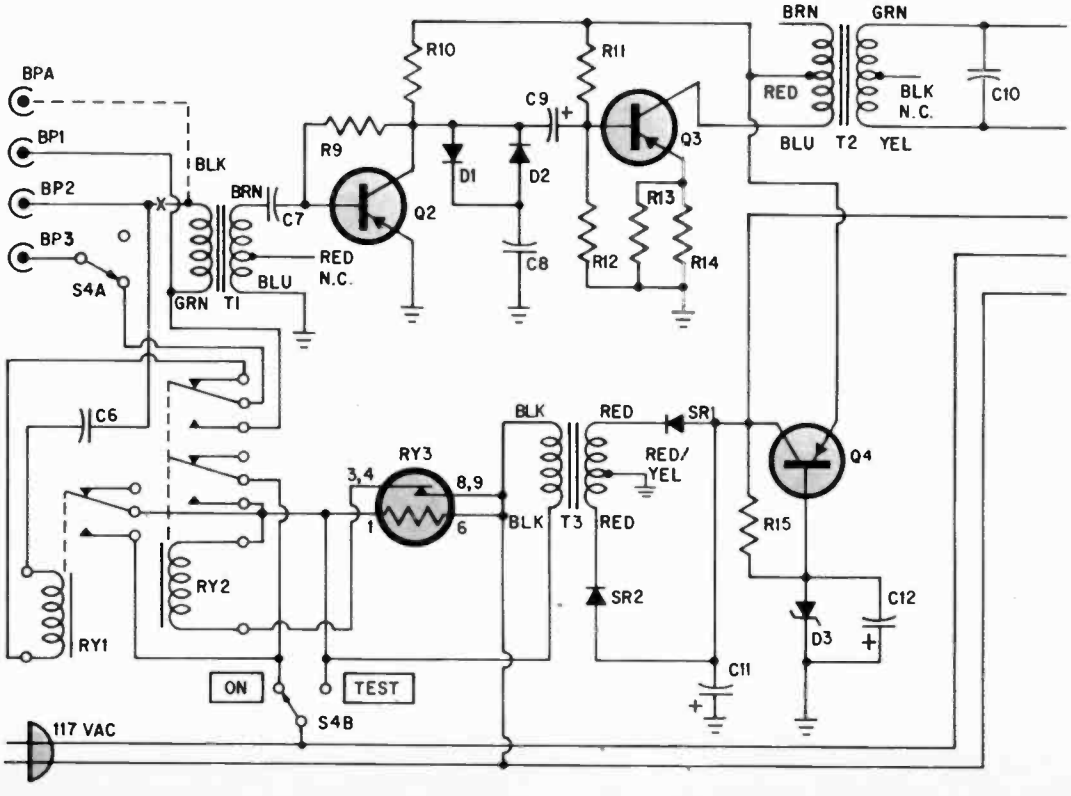


Fig. 3—Tone generator. Oscillator should be built on L-shaped perforated board (2½ x 2⅜ x ⅝ in.) before installing board in plastic box. Switches S1,S2 and S3 mount in left and right side of box. Note where ¼-watt resistor R8 is installed on amplifier. Note on trimmer pots R1 and R2 that you must solder a wire from the bottom lug to the case of the pot. In our model R3, R4 and R5 are installed under the board.



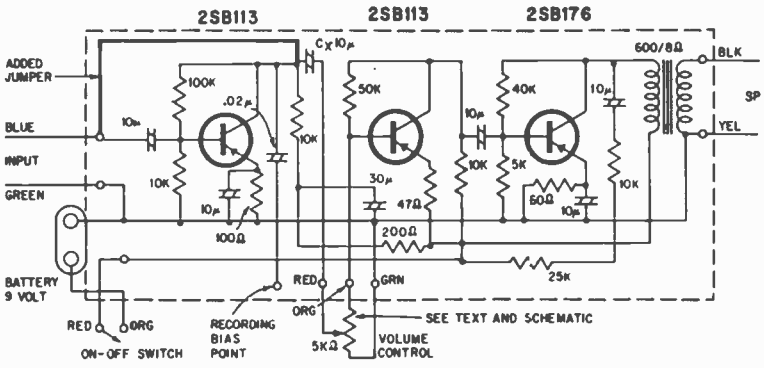


Fig. 4—Schematic supplied with Lafayette modular amplifier. Components and wiring in color must be removed. Add a jumper from the input point to an existing 10-μf electrolytic capacitor. Remove the leads for the volume control and solder one lead of R8 in the hole from which you removed GRN lead. See text for other changes.

drill speed. A high-speed drill will melt the plastic and gum up the bit.

Position the cabinet as shown in Fig. 1. fit the speaker flush against the corner and drill the four mounting holes. Using the four holes as the corners of a square, scribe horizontal and vertical lines on ½-in. centers. Drill through the cabinet with a ¼-in. drill at the intersection of each horizontal and vertical line to make a speaker grill.

The tone generator's amplifier is a ready-made amplifier that you must modify. Position the amplifier's two mounting holes so they are close to the speaker and mark and drill two mounting holes. (It may be necessary to cut away part of the speaker's two mounting flanges to provide clearance for the amplifier's mounting screws.)

Before proceeding, modify the amplifier by eliminating the first stage and its associated components as shown in Fig. 4. Using wire cutters, clip out the components indicated in color. Next, solder a jumper from Cx (10 μf) to the printed-circuit terminal to which the blue input lead is soldered. Eliminate the wires for a volume control—red, orange and blue. Solder one end of a 4,700 ohm ¼-watt resistor (R8, Fig. 1) to the red and orange wire holes and solder the other end of the resistor to the green-wire hole.

Temporarily install the speaker and the amplifier using a ¼-in. standoff or stack of

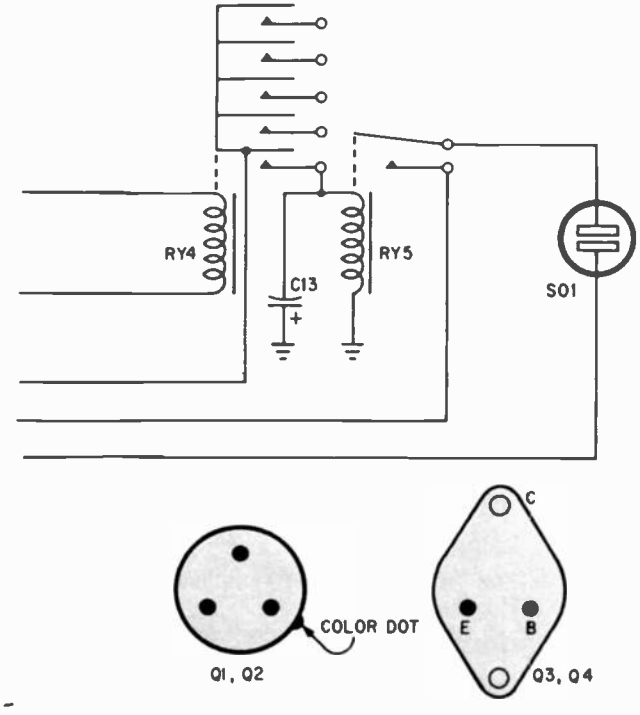


Fig. 5—Receiver. To test unit, connect speaker to BP1,BP2 and set S4 to test. To operate, set S4 to on. Connect two two-wire phone to BP2,BP3. If three-wire line, connect T1's black lead to BPA; connect BPA,BP3 to talking pair, BP2 to ringing wire.

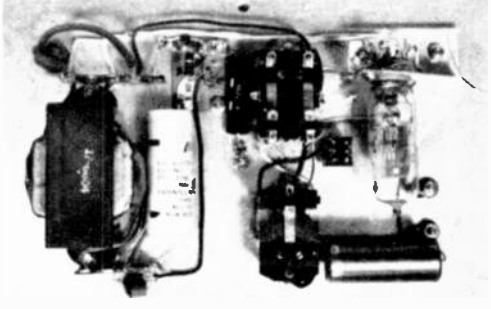


Fig. 6—Power-supply panel. Time delay relay RY3 is the tube at the upper right. Its socket is mounted on a small L-bracket made of scrap aluminum.

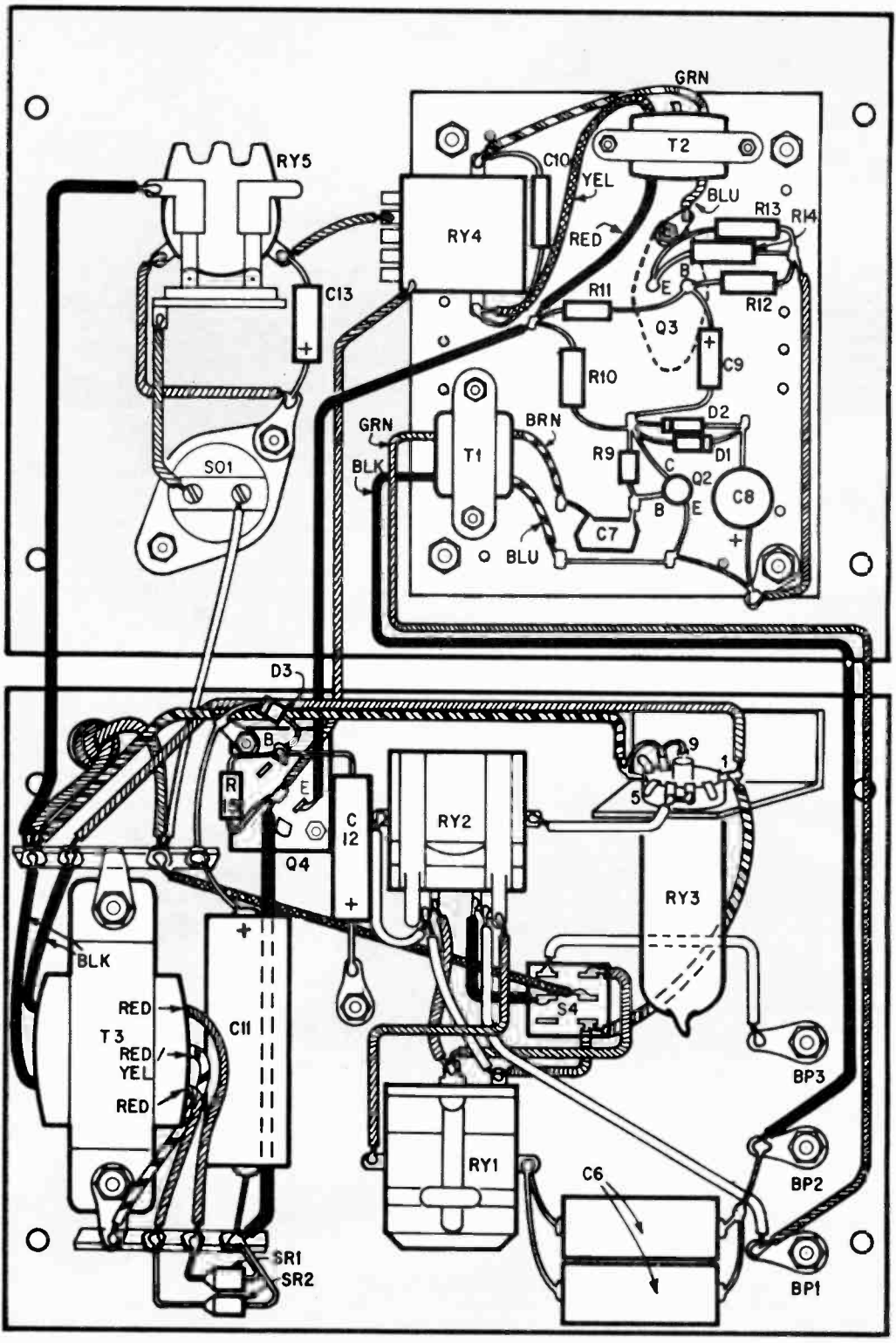


Fig. 7—Amplifier panel, top and power-supply panel, bottom. Note on amplifier circuit board that Q3 is mounted on underside of board and wires are soldered directly to its leads. Make sure Q3's case (collector) doesn't touch aluminum panel. Transistor Q4 is installed on panel with a special mounting kit.

Tele Remote Control

washers under the amplifier's mounting holes. Slide a 9-V battery into the upper right corner. Mark off the holes for the tone push-button switches and power switch S3.

Note that the schematic shows three push-button switches, Sx, S1 and S2. Switches S1 and S2 are required for each tone. If you use a single tone, position S1 opposite the speaker magnet. If you want two tones position S2 between the first switch and the amplifier. Additional tones would be produced by Rx and Sx shown in the schematic as dotted lines.

With the speaker, amplifier and battery in position, cut an L-section of perforated board, with the dimensions shown in Fig. 3. Drill three mounting holes to line up with the speaker's mounting screws. Remove the board and assemble the oscillator.

Wire most of the oscillator, Q1, R1, R2, R3, R4, C1, C2 and C3. The lugs of pot R1 will fit the spacing between two holes. Drill the holes for the mounting tabs with a No. 4 bit. Note that R1 has only two terminals—the body is the wiper contact. Make certain you solder a jumper between the body and one terminal, as shown.

Mount the speaker with ⅝ in. long screws. Then, run down a second set of nuts on three of the screws until they're ¼ in. from the top. Install the amplifier on its standoffs and then mount the oscillator on the speaker's mounting screws. Only two nuts are used to hold the oscillator board; do not use a nut at the upper left corner as it may jam R1. Mount a miniature terminal strip on the left amplifier mounting screw. Finish the tone-generator wiring.

Checking The Tone Generator. Connect the battery and press both S1 and S3. Press S3 with your thumb and S1 with your third finger. Using a small screwdriver adjust R1. If you hear the tone when the switches close, adjusting R1 should change the frequency. If there is no tone when the switches are closed, adjusting R1 should start the oscillator. If the oscillator doesn't start, check for a wiring error in the oscillator or in the connection to the amplifier.

Finally, drill six or more 3/16-in. holes in the cabinet cover directly behind the exposed part of the speaker cone. This is necessary because closing the cover loads the speaker and slightly alters the output tone.

PARTS LIST

B1—9-V battery (Burgess 2U6 or equiv.)
BPA,BP1,BP2,BP3—Five-way binding post
Capacitors:
C1,C2,C3—.05 μf, 30 V or higher ceramic disc
C4—10 μf, 6 V electrolytic
C5—100 μf, 12 V electrolytic
C6—4 μf, 100 V electrolytic (see text)
C7—.25 μf, 30 V or higher ceramic disc
C8,C12—100 μf, 12 V electrolytic
C9—1 μf, 12 V electrolytic
C10—.5 μf, 30 V or higher ceramic disc
C11—500 μf, 25 V electrolytic
C13—160 μf, 25 V electrolytic
D1,D2—1N34A diode
D3—9.1 V zener diode (Motorola HEP-104)
Q1,Q2—2N2613 transistor (RCA)
Q3—2N301 transistor (RCA)
Q4—Power transistor (Lafayette 19 T 4205)
Resistors: 10% unless otherwise indicated (R3 through R8, ¼ watt. Others ½ watt)
R1,R2,Rx—3,000 ohm, linear-taper trimmer potentiometer (Mallory MTC-4 Minitrol, Lafayette 33 T 1674, or equiv.)
R3,R8,R10—4,700 ohms R4,R9—470,000 ohms
R5,R12—3,300 ohms R6—22,000 ohms
R7—150 ohms R11—33,000 ohms
R13,R14—10 ohms R15—560 ohms
RY1—SPDT relay; 115 VAC, 1,500-ohm coil (Allied 41 B 4652 or equiv.)
RY2—DPDT relay; 115 VAC, 1,500-ohm coil (Allied 41 B 4657)
RY3—20-second miniature time-delay relay; normally-closed contacts, 115-V heater (Amperite 115C20T, Allied 41 B 5296 C-115C20T)
RY4—Five-channel resonant-reed relay (Lafayette 42 T 6101)
RY5—DPDT relay, 12-VDC coil (Potter & Brumfield KT11D-12 VDC, Lafayette 30 T 8696 or equiv.)
S1,S2,S3,Sx—Miniature pushbutton switch
S4—DPDT switch (center off)
SP1—10 ohm, 2½-in. speaker
SR1,SR2—Silicon rectifier; 750 ma, 50 PIV
T1—Transistor driver transformer; primary: 1,000 ohms, secondary 100 ohms. (Lafayette 33 T 8549)
T2—Transistor interstage transformer; primary, secondary: 500 ohms (Allied 54 B 4174)
T3—Filament transformer; secondary 24 V center tapped @ 1 A (Allied 54 B 4710)
Misc.—Three-transistor miniature audio amplifier (Lafayette 99 T 9039. Modified, see text)

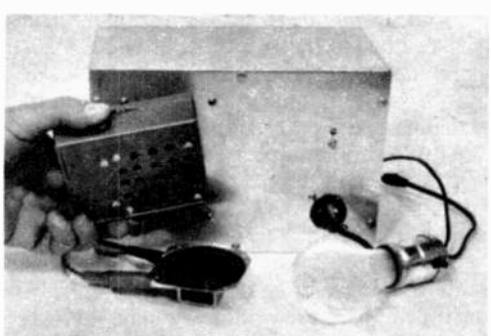


Fig. 8—To test receiver, plug a small lamp in SO1 and connect speaker to BO1,BP2. Press S1 and S3 on tone generator and light should come on.

Tele Remote Control

Building The Receiver. The receiver is built on the front and rear panels of a 6 x 9 x 5-in. aluminum utility cabinet. One rear panel contains the regulated power supply and telephone-answering relays and the other panel contains the amplifier-limiter, resonant-reed relay, the control relay and the power outlet.

For two-wire phone lines, that is, where two wires are used for both the talking and ringing, install three binding posts—BP1, BP2 and BP3. If yours is a party line, where the ringing and talking pair are separate, install binding post BPA, break the connection to transformer T1 as shown, and install the connection to BPA as indicated by the dotted line. BPA and BP3 will then be connected to the talking pair and BP2 is connected to the ringing wire.

Build the power supply first, close to the right edge of the panel. Regulator transistor Q4 uses the panel as a heat sink, but it must be electrically insulated from the panel. Use a mounting kit (Lafayette 19 T 1531) which includes a thin mica insulator to fit between the transistor and the panel.

While Q4 may be any inexpensive PNP power transistor, such as a 2N301, do not substitute for the specified D5—a Motorola HEP-104 zener diode. Relay RY5's contact arrangement depends on how you use the control; we show only a single set of contacts used to switch 117 VAC for the latching relay.

Relay RY3 is an Amperite time-delay relay (it looks like a tube) which disconnects the receiver from the line, to permit additional incoming calls to get through. The RY3 specified in the Parts List provides a 20-second delay before disconnect—plenty of time to get your tones through. If you need more time use a relay with a longer on-time —up to several minutes is available. Additional types are listed in Allied's catalog. Just make certain you get one with normally-closed contacts.

Switch S4 is a DPDT with a center-off position. A standard DPDT switch may be substituted if you're willing to pull the AC plug each time the receiver is reset from the test position.

When the power supply panel is completed check it out as follows: Connect the positive lead of a VOM (10-VDC range) to the panel and connect the negative lead to Q4's collector terminal. Plug in the AC plug and, using an insulated screwdriver, press down RY2's armature. If RY2 fails to lock-in there is a wiring error at RY2's contacts. As soon as RY2 closes the meter should indicate from 9.1 to 9.6 V. If you fail to get an indication set the meter to measure 25 VAC and connect it across T3's secondary. If the meter indicates 24 VAC check for a wiring error in the power supply. If there is no voltage across T3's secondary, check that the line voltage is being fed into and through RY3.

After 20 seconds, or whatever time RY3 is rated for, RY3 should open and release RY2. After about 15 seconds RY3 will close, allowing the power supply to be re-cycled.

The amplifier is assembled on a 3 x 4¼ in. piece of perforated board. As with the tone generator, flea clips or Vector T28 terminals can be used for tie points. Since the frame of reed relay RY4 is also a contact, it must be mounted on the amplifier board to avoid a short to the chassis. Relay RY4's frame is drilled for 6-32 mounting screws. While T1 can be any 100 to 1,000-ohm transformer, T2 *must* be the type specified in the Parts List.

Transistor Q3 is mounted on the underside of the board, with its terminals protruding through the board to the top, or wiring, side. Connection is made directly to Q3's emitter and base leads.

Use spacers to raise the board away from the front panel. To prevent Q3's case, which is the collector, from touching the panel, place several layers of tape on the panel directly under Q3.

Capacitor C13 is not used to reduce RY5's kick-back voltage; don't replace it with a diode. Since the voltage fed to RY5 has a low average value, C13 is used to charge to the full 12 V necessary to close RY5. While capacitor C10 is specified as 0.5 μf, it may be cheaper to use two parallel-connected 0.25 μf capacitors.

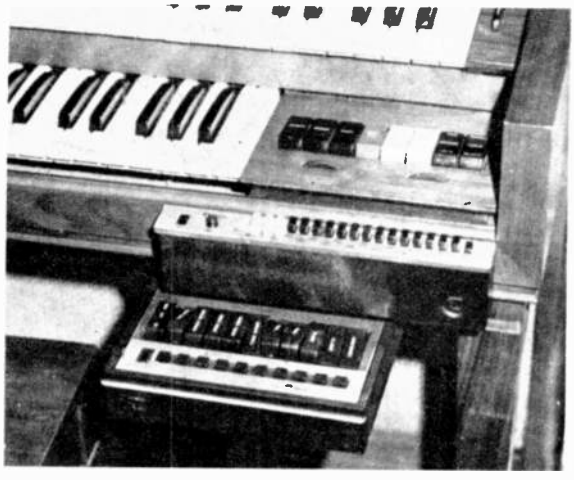
Capacitor C10 resonates T2 and RY4's coil to the operating frequencies. If you substitute a different reed relay, it will be necessary to determine the new value for C10. Connect an AC voltmeter across RY4's coil, feed in a .01-V signal to the amplifier at about the center frequency of the reeds, and

[*Continued on page* 111]

EI Kit Report

Organ Rhythm Section in a Kit

Heathkit { Band Box / Playmate



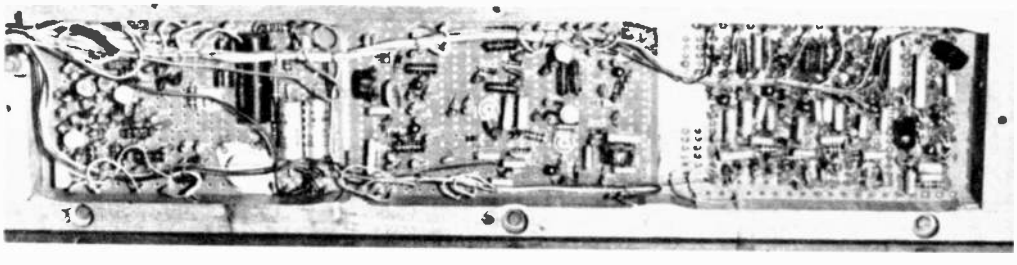
RIGHT up among the top ten on the popularity list of musical instruments is the electronic organ. And for a good reason—it's the electronics, more than the organist, that does all the work of producing the pleasant, exciting, different, startling or whatever you want to call an organ's sound.

To add to the voices which can be produced by its kit versions of Thomas Organs, Heath has two attachments which produce rhythm-instrument sounds as well as rhythms themselves. The $155 Band Box (TOA-67-1) produces very authentic sounds (through the organ speakers) of bass drums, brush and crash cymbals, bongos, clave, block, castanets, snare drum and drum roll. The sounds of any or all of these instruments can be produced when you play on the lower manual, pedals or both. Or, you can touch the buttons on the Band Box to produce the sound.

But if you have absolutely no rhythm in your blood, you add the $189.90 Playmate (TOA-67-5). Tied in with the Band Box, it causes it to beat out 15 rhythms—waltz, Viennese waltz, jazz waltz, fox trot 2/4, boogie 6/8, swing, rock, watusi, samba, beguine, cha-cha, rhumba, tango, bolero, and bossa nova. Combined, the two kits become a rhythm section at your side. Another benefit of the kits is that in acting as what could be called a super metronome, they aid you in learning rhythm when you're just beginning to play the organ.

They can be added to the Heathkit GD-232, GD-235 and GD-983 organs, as well as the latest model, the TO-67. It took us about seven hours to build the Band Box; the Playmate comes assembled. We spent a day installing the units on our GD-983.

What was it like when we turned on power? As our builder is still learning to play the organ, the extra sounds and rhythms were overwhelming at first. He tried again and set up the Band Box and Playmate for a slow waltz. To his delight he played right along without having to slow down the Playmate or rush to keep up with it. Since installing the kits, our builder's playing has improved greatly—or maybe he's using the Band Box's sounds to hide his wrong notes.



Band Box electronics is on three circuit boards (right comes assembled) which are mounted in wood frame that is installed on console under lower manual. In photo at top, Playmate is next to the lower manual.

Notes from El's DX Club

LARRY B. Le Boeuf, VE3GAL (Ontario) reports a doubly rare QSL—for his QSO with VP8JKD, South Orkney Islands, on 14195 kc at 0715 EST. The islands count as a separate country and, while many don't realize it, they also count as the continent of Antarctica under El DX criteria.

Cornelius Van Berkmeer (Mississippi) has received a QSL form letter from the Ministry of Posts, Telegraphs & Telephones, Kuwait. He logged this rare one with a test tape on 19870 kc around 1000 EST.

Lewis H. Masson, K1LJS (Massachusetts), has come up with a newsworthy QSO —XW8CAL in Laos on 21040 kc. Watch for this hot spot around noon EST.

Timothy C. Armstrong has bagged the rare long-wave beacon, AWK (254 kc), on Wake Island. He accomplished this at 2315 PST.

A rare station in Chile has been logged by Gerry L. Dexter (Wisconsin). It is R. El Cerro on 9520 kc. It probably will be best late evenings EST.

Don Jensen (Wisconsin) tells us of a mysterious station in Rhodesia calling itself Harare Radio and beaming programs to Rhodesian security forces. No further information is available yet but there is a chance they're employing transmitters formerly used to jam BBC Botswana.

R. Bucharest (Rumania) has begun to expand its English-language programs. They have a new service for the Pacific Islands at 0130-0200 EST (2230-2300 PST) which has been heard on 17845 kc.

For those who like to hunt rare languages, try the Voice of Germany's Sanskrit transmission aired every other Thursday at 2045-2105 EST (2345-0005 PST) on 15275, 17845 and 21650 kc.

According to the International Radio Club of America the R. Progresso network, with headquarters at Havana, has begun verifying DX reports from the United States on a new QSL card. They operate BCB transmitters on 670, 680, 690 and 700 kc.

Bob Conder (North Carolina) notes that the English-language program of R. Casino (Puerto Limon, Costa Rica) at 2300 EST has good signal strength at times on 5954 kc.

There's no truth to that report that BBC Ascension has begun using offband frequencies. The widely heard transmitters on 15070 kc are just plain old BBC England.

Bob La Rose (New York) reports that R. Damascus has a new English-language transmission at 1030 EST on 15165 kc.

R. Ceylon now has a 15-min. program for SWLs called DX-Panorama produced by the Ceylonese SWL Club. It is aired the last Saturday of each month at 0600 EST on 17830 kc.

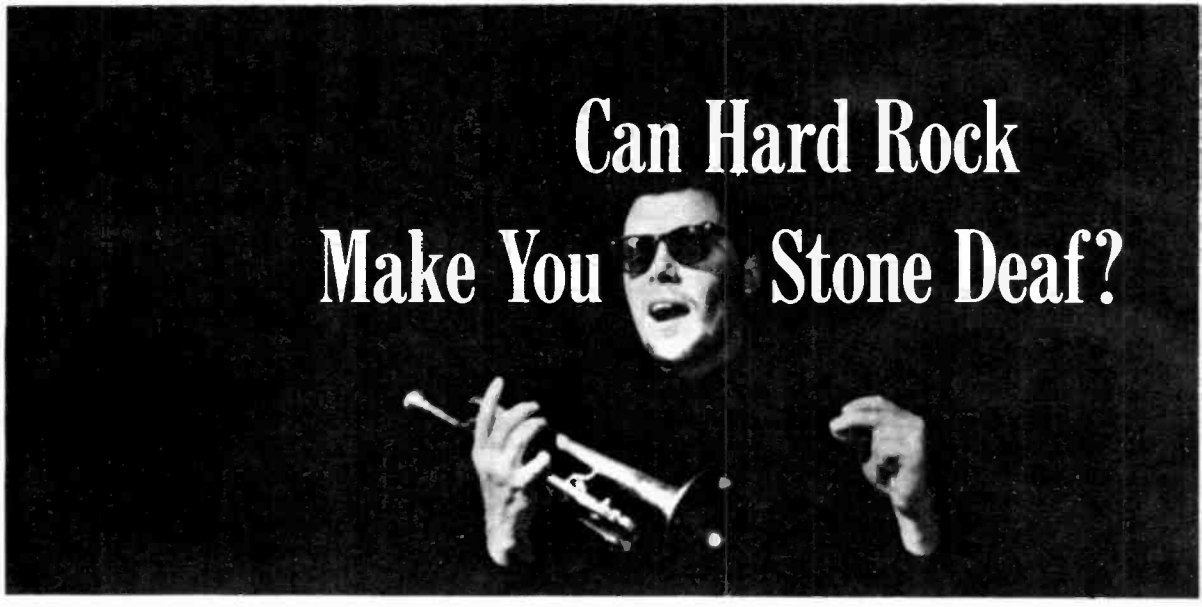
A new frequency for R. Tanzania is 5985 kc. Watch for it around 2230 EST with commercial programming in English.

R. Angola suddenly is being heard in eastern North America down on 4820 kc with powerful signals, possibly indicating a new transmitter, until 2000 EST sign-off.

Propagation: Daytime conditions will remain good to excellent with all bands from 15 to 26 mc useful for short-wave broadcasting. The amateur 10-meter band and Citizens Band (11 meters) also will be open with reception possible from several hundred to about a thousand miles away. At night, the 49-, 31- and 25-meter SW bands will be open. In addition, DX from Latin America will be possible in the 19-meter band until about 8 p.m. local time.

BCB DX will continue good to excellent because of low noise levels this time of the year. There will be little or no transatlantic or transpacific TV DX but a few openings may occur from Central America on the lower channels. The best time to look for them will be mid-afternoon local time.

Can Hard Rock Make You Stone Deaf?



By ERIC LESLIE

SOUND—big, rolling waves of mind-blowing sound—a sea of sound that carries you along like a surfer—there's nothing like it! You need not be a rock fan to have felt it; some people get their kicks from stereo freight trains roaring across the living room, others from the blare of a brass band. Turn up the volume and let its power carry you along.

The question is, on what shore will you be washed up? Can the battering your ears take from these waves damage or destroy your hearing? And, if it can, how great is the danger that it will?

Many cases of temporary hearing loss caused by loud music have been reported and a recent check on a popular discotheque showed noise levels peaking just 10db below the threshold of physical pain. Such sound levels in industry, lasting for long periods, have caused permanent hearing disability. Hidden in that fact must lie some message for rock fans and hi-fi buffs. But what?

Answer is—nobody knows for sure. But the evidence is that high-level sound can and probably will damage your hearing permanently if you get enough of it. There is no doubt about temporary damage. West Coast hearing researchers Drs. Charles Lebo and John A. Garrett measured sound levels in two San Francisco rock spots and found the average level above 100db—the level at which industrial noise becomes dangerous to workers' hearing. Some peaks were as high as 120db and bursts of more than 115db were recorded regularly. Dr. Carol Ehrlich of the University of Denver states "In our Colorado field study we found sound levels in a discotheque to range between 112 and 116db, a level to which one should not be exposed for more than eight continuous minutes per 24-hour period."

This kind of sound definitely causes temporary hearing loss. Dr. Garrett, for instance, reported he couldn't hear his watch tick for three hours afterward. And temporary hearing loss seems to be tied up with permanent loss, though little has been proved on the subject. In fact, before the courts started to award damages to workers whose hearing had been

impaired by noisy working conditions, only a few devoted people had bothered to investigate the effects of noise on hearing—and they often worked in isolation, with special groups or with special aims.

Since recognition of speech is considered so important, frequencies outside the speech range have been studied very little. The common spectrum for hearing studies has been the spot frequencies 500, 1,000, 2,000 and 4,000 cps (all in the lowest 25 per cent of the hearing spectrum of a normal 20-year-old). And almost nothing is known about the effect of loud transients —impulse noises are hard to measure.

Schools make regular hearing tests, but—with one notable exception—few are detailed enough to give much information. The facts we do know (summarized chiefly from the work of Dr. Aram Glorig, Director of the Callier Hearing and Speech Center of Dallas, Tex.) are:

Can Hard Rock Make You Stone Deaf?

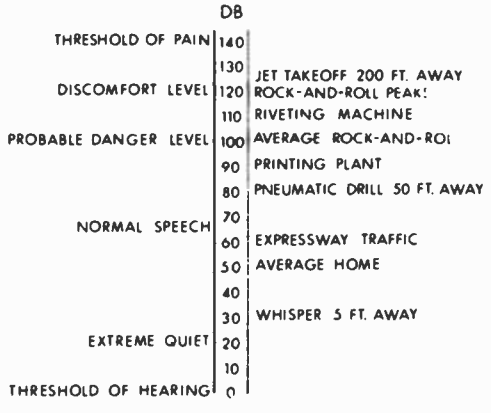


Fig. 1—Typical sound-level readings give some idea how electronically-amplified music compares with other sound sources and threat it poses.

- Noise definitely can lift the threshold of hearing—the volume level below which we can hear no sound—as much as 50db above the hearing threshold of a keen-eared youth.
- Sound levels above 100db affect the hearing of most people.
- Sound levels below 80db probably are harmless.
- Noise-caused impairment shows up first in a hearing drop (threshold rise) around 4 kc. It spreads both ways from that frequency as the hearing grows worse.
- Some individuals may have no hearing loss under conditions that are seriously harmful to the majority while others may suffer severe disability at so-called harmless levels.
- Temporary hearing loss—caused by a single exposure to noise for an hour or more —appears to follow the same pattern as permanent hearing loss caused by exposure to the same noise over long periods.

This last assumption is an important one. It means we should be able to predict long-time impairment from short-time exposures. We know that ordinary discotheque music can cause severe short-time hearing loss. How much of it would you have to hear to make the loss permanent? And what about the hi-fi record player or a single electronic instrument?

The answer depends on whether we are talking about the musicians' or the listeners' hearing. The players—right in the middle of the sound source —are getting stronger signals than those in the audience. And they are exposed night after night. Their hearing *is* in danger. In fact, musicians run risks even without amplification. Dr. Glorig found that nearly half the players in the Marine Band had damaged hearing. The audience doesn't get so much sound (though some discotheques are engineered for constant-level sound at all points in the establishment) while dancers are in the real danger area only a small part of the time.

And the audience's exposure is not constant—an important factor. Dr. Glorig believes that if a temporary threshold shift recovers completely before further exposure, permanent hearing loss is unlikely. So if you spend a few hours in a 110db sound emporium one evening a week you have little to fear.

But how about the quiet types who stay home and listen to a sound system? The fad for hi-fi sound levels at least as loud as the original source being

reproduced has pretty well petered out (except, possibly, among a few die-hard buffs whose hearing probably is already run down by age or past abuse). But many of the younger power-seekers have grown up with the levels of hard rock and aren't happy with anything less. Doctors report cases of high-school students with severe 4,000-cycle loss who have recovered simply by staying away from the hi-fi for a couple of weeks.

The single electronic instrument also can be dangerous. Herbert Rickenberg of the New Eye and Ear Infirmary in Newark, N.J., tells of a youth with serious hearing loss who said he spent most of his time at home and did not attend rock-and-roll gatherings. The 4,000-cycle loss pointed unmistakably to noise-induced threshold shift. It turned out that he had a new electric guitar and spent most of his time at home practicing in his room, with door and windows closed and volume turned well up. Headphones, too, have been responsible for hearing losses—levels can reach 135db.

It is hard to find out how much temporary hearing loss becomes permanent. The guitar-deafened boy never came back. Even industrial tests are are affected by labor turnover to the point where continuous records can't be made. But we do get some indication from school tests. The State of Colorado conducted a study of 1,000 children with hearing loss (the exception we mentioned earlier) under the direction of Harold J. Weber, of the State Department of Public Health. Some of its tables show conduction and 4,000-cycle (noise-induced) losses separately.

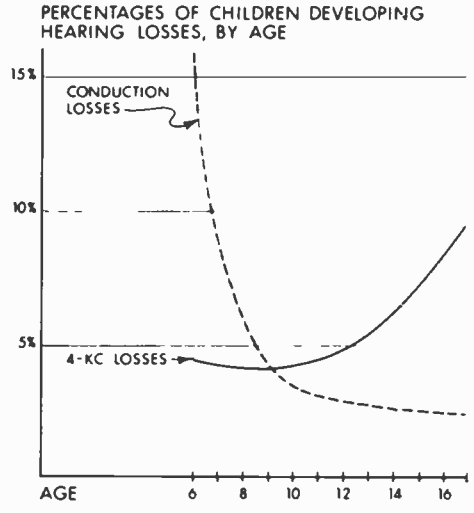


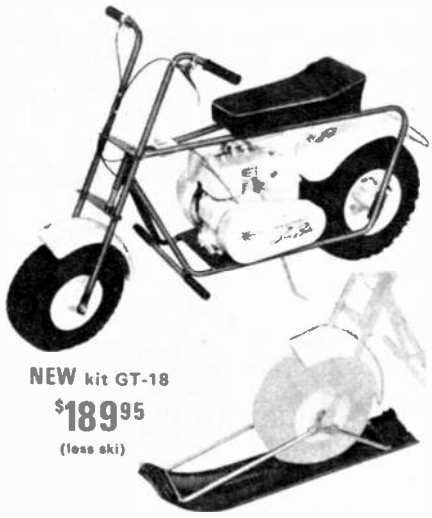
Fig. 2—Conduction (physiological) losses show up less frequently as children age; 4-kc loss cases (symptomatic of noise damage) grow. (See text.)

Fig. 2 shows percentages of Colorado children with hearing loss by the age at which it was first detected. (High percentage of the young end is because large numbers of children were tested for the first time only as they entered school.) The curves show that as the students grow up, noise-induced losses rise and conductive losses drop. The increase in noise-induced impairment with age is startling. Though it is not visible in the graph, researchers note that boys suffer more than girls.

Why should noise-induced hearing losses climb so sharply for boys? The survey suggests that this may be due to big-game hunting and use of farm implements and it points to lower hearing losses in a financially depressed county as evidence. Poor boys, the report says, do not hunt big game and the county is a light-farming area. But few country boys are too poor to own a gun (and a shotgun is louder than a rifle) while most small farmers find tractors cheaper than mules. Even a modest modern dance band, however, has amplification equipment valued in four figures. So it is strongly possible that hard rock is a factor in these curves.

Are there any answers? Well, we are sure, on the basis of rather limited research, that electronic music can produce hearing loss for short periods of time. Experience with industrial noise gives evidence that permanent loss can result from repeated and prolonged exposure to sounds that produce temporary loss. Intermittent and infrequent exposure—even to dangerously loud sound—is not likely to have permanent results unless the sound is loud enough to damage the ear mechanism physically (firecrackers, close artillery, etc.). And the only way you can protect yourself is—be careful! Or—if you play in a hyper-amplified group yourself—wear a good pair of earplugs.

There's A Heathkit® Gift



NEW kit GT-18
$189.95
(less ski)

The HEATHKIT "Boonie-Bike" . . . The All-Season Trail Bike

Introducing the new Heathkit GT-18 Trail Bike . . . it lets you go places other people can't . . . remote backwoods and forest areas . . . rugged mountain regions . . . isolated lakes & streams . . . rough country roads and long forgotten paths . . . even in the snow . . . places inaccessible by usual means. With the GT-18 you no longer have to depend on paved or dirt roads, or even trails. The GT-18 is only 24½" wide — if there's room to walk, you can ride with this one. But don't let the small size give you the wrong impression. The GT-18 is full of surprises. It's larger and huskier than a mini-bike, smaller, lighter and substantially more powerful than a motorcycle-type trail bike . . . and it has the agility, stability, traction and sheer guts of a mountain goat. Here's why: Pre-mounted on the welded ¾" tubular steel frame is the easy-starting Briggs & Stratton 5 horsepower, 4 cycle engine, and it gives the 116 pound GT-18 extraordinary power. Performance? You can't touch it for any price. The tubeless front tire is big by trail bike standards (5.30 x 4.50"), but the tubeless rear tire is nothing short of huge — 18 x 8.50"!! And that's what's behind the amazing all-surface performance . . . that 8½" tread coupled with the two speed shift and 5 horse engine will power you thru mud, sand, snow, gravel, tall weeds and rough underbrush . . . up steep hills & rocky paths that would put other bikes totally out of it. And when the going gets snowy, just snap on the optional ski accessory (GTA-18-1 at $16.95). Heath's unique "grip-lock" mounting eliminates any need for tools too!

And stopping is easy and safe with the big hand-operated Bendix drum type rear brake. Loaded with other features too . . . welded steel skid pan, spring shock front suspension . . . big, comfortable seat . . . safety spring-loaded throttle . . . 400 pound load capacity and much more. The Heathkit All Season Trail Bike is so much fun you'll be looking for reasons to ride it. It's the only way to go when the going gets rough. Order yours today. 125 lbs.

NEW kit GR-58
$47.95

HEATHKIT GR-58 Solid-State AM/FM Clock Radio

The easy way to get up in the morning. Choose the morning news & weather on AM or the bright sound of FM music. AFC makes FM tuning easy. The "Auto" position on the Telechron® clock turns only the radio on, or use the "Alarm" setting for both the radio and the alarm. You can even enjoy fresh coffee when you awake in the morning, thanks to the clock-controlled accessory AC socket on the back of the new GR-58. The handy "snooze" alarm feature lets you wake up gradually for ten minutes to the sound of the radio, then the alarm goes on . . . push the "snooze" button to silence the alarm for ten minutes more of music or news — the alarm sounds automatically every ten minutes and the "snooze" button turns it off, cycling continuously until the selector switch is moved to another position. Fast, easy circuit board construction, smart blue hi-impact plastic cabinet and top reliability make this GR-58 the clock radio for you. 8 lbs.

NEW kit TA-38
$225.00

HEATHKIT TA-38 Solid-State Bass Amplifier

The new Heathkit TA-38 is the hottest performing bass amp on the market, for quite a few reasons. First, there's all solid-state circuitry for reliability. Then there's the tremendous power — the TA-38 puts out 120 watts of EIA music power, 240 watts peak, or 100 watts continuous. Extremely low harmonic & IM distortion too. Many amps suffer from "blow-out" problems, but not the new TA-38 — *YOU CAN'T BLOW IT* . . . it boasts two 12" heavy duty special design speakers with giant 3 pound 6 ounce magnet assemblies mounted in a completely sealed, heavily damped ¾" pressed wood cabinet — those speakers will take every watt the amp will put out, and still not blow. Sound? The TA-38 is tailored to reproduce the full range of bass frequencies delivered by bass guitars and its sound with combo organs and other instruments is remarkable. Easy 15 hour assembly to the wildest bass amp on the market. Order one now and surprise the guys with the high-priced gear. 130 lbs.

kit SB-310
$249.00

HEATHKIT SB-310 Professional SW Receiver

The finest shortwave receiver you can buy. Covers six shortwave broadcast bands (49, 41, 31, 25, 19 & 16 meters), 80, 40 & 20 meter amateur bands and 11 meter CB. And the new optional SBA-310-3 kit converts the 11 meter band to 15 meters for additional amateur coverage. Has many of the same features that have made Heathkit amateur gear the world's best selling . . . pre-built & pre-aligned Linear Master Oscillator . . . crystal-controlled "front end" for same-rate tuning on all bands . . . linear tuning with 1 kHz dial calibrations . . . separate RF and AF gain controls . . . 5 kHz crystal filter included for clear AM, CW & SSB reception . . . switch-selected upper and lower sideband coverage . . . built-in 100 kHz calibrator . . . headphone jack . . . calibrated "S" meter . . . famous Heathkit SB-Series styling and much more. For the finest shortwave listening, order your SB-310 today. 24 lbs. SBA-310-3, 15 Meter Conversion Kit, 1 lb., $9.95.

CIRCLE NUMBER 3 ON PAGE 15

Idea For Every Budget

HEATHKIT AD-27 FM Stereo Compact

The new Heathkit "27" Component Compact was designed to change your mind about stereo compact performance. How? By sounding as if it were made of top quality stereo components . . . which in fact it is. Heath engineers took their highly rated AR-14 solid-state Stereo Receiver, modified it physically to fit the cabinet, and matched it with the precision BSR McDonald 500A Automatic Turntable. Performance? Here's the AD-27 in detail. The amplifier delivers 30 watts music power . . . 15 honest watts per channel . . . enough to drive any reasonably efficient speaker system. Response is virtually flat from 12 Hz to 60 kHz, and Harmonic & IM distortion are both less than 1% at full output. Tandem Volume, Balance, Bass & Treble controls give you full range command of all the sound. Select the FM stereo mode with a flick of the rocker-type switch and tune smoothly across the dial, thanks to inertia flywheel tuning. You'll hear stations you didn't know existed in your area, and the clarity and separation of the sound will amaze you. The adjustable phasing control insures best stereo separation at all times. And the automatic stereo indicator light tells you if the program is in stereo. AFC puts an end to drift too. The BSR Automatic Turntable has features normally found only in very expensive units, like cueing and pause control, variable anti-skating device, stylus pressure adjustment and automatic system power too. Comes complete with a famous Shure diamond stylus magnetic cartridge. The handsome walnut cabinet with sliding tambour door will look sharp in any surroundings, and the AD-27 performs as well as it looks. For the finest stereo compact you can buy, order your "27" Component Compact now. 41 lbs.

NEW kit AD-27 $169.95

HEATHKIT AD-17 Stereo Compact

Using the component approach of the AD-27, Heath engineers took the solid-state stereo amplifier section of the AD-27, matched it with the high quality BSR-400 Automatic Turntable and put both of these fine components in a handsomely styled walnut finish cabinet. The result is the "17" featuring 30 watts music power, 12 Hz to 60 kHz response, auxiliary & tuner inputs, less than 1% Harmonic & IM distortion, adjustable stylus pressure & anti-skate control and much more. Order your "17" now. 27 lbs.

NEW kit AD-17 $109.95

HEATHKIT AS-18 Miniature Speaker System

Miniature in size, but not in performance. This new Heathkit acoustic suspension system features two Electro-Voice® speakers . . . a 6" woofer and a 2" tweeter for 60 Hz to 20 kHz response. Handles 25 watts of program material. Adjustable high frequency balance control lets you adjust the sound to what you like. The 8½" H x 15¾" W x 6½" D walnut cabinet is protected by clear vinyl for lasting good looks. Pick a pair of these performers for stereo compacts. 16 lbs.

NEW kit AS-18 $32.95

HEATHKIT MI-18 Solid-State Tachometer

The new Heathkit MI-18 has advanced performance features like unique inductive pickup for connection to any spark-type engine and any ignition system, 0-6000 & 0-9000 RPM ranges, temperature compensated ±4% accuracy, stainless steel hardware, splashproof black & chrome case. Pick the MI-18-1 for panel mounting, or the MI-18-2 with case and hardware. Send for yours now. 4 lbs.

NEW kit MI-18 $29.95 (panel mount) $32.95 (case mount)

HEATHKIT GR-17 Solid-State AM-FM Portable

Everything you want in an AM-FM portable. The all solid-state circuit delivers clear, stable AM from distances the mini-portables can't match, and the FM section, with it's 34" whip antenna, three IF stages and 5 uV sensitivity performs like a high priced table model receiver. AFC for drift-free listening and easy tuning too. All critical circuits preassembled and prealigned, and the circuit board assembly makes construction even easier. For the greatest sound around, get your GR-17 today. 5 lbs.

NEW kit GR-17 $43.95

HEATHKIT GD-325C Low Cost Solid-State Organ

Put the sound of live music in your home now with this low cost, all solid-state Heathkit Thomas Organ. It features all genuine Thomas factory-fabricated parts and 5-year warranty on the plug-in tone generators. Ten true organ voices . . . variable repeat percussion . . . 13 note heel and toe bass pedals for C1 to C2 range . . . two overhanging 37-note keyboards, range C2 thru C6 each . . . Color-Glo keylights . . . 75 watt peak music power amplifier . . . 12" speaker . . . vibrato . . . manual balance control. Thousands of people have already experienced the thrill and unique personal satisfaction of building this sophisticated, beautiful sounding musical instrument, and you can too. It takes no special skills or knowledge — the famous Heathkit manual with its easy to follow instructions and giant fold-out pictorials make the 80 hour assembly enjoyably simple. Comes with finished walnut cabinet and bench plus 40-lesson self-teacher course. Put the sound of music in your home this Christmas with the GD-325C from Heathkit. 172 lbs.

kit GD-325C $439.95

CIRCLE NUMBER 3 ON PAGE 15

Heathkit® Christmas Gifts

Now There Are 4 Heathkit Color TV's . . . All With 2-Year Picture Tube Warranty

kit GR-681

kit GR-295

kit GR-227

kit GR-180

New Wireless TV Remote Control
For GR-295, GR-227 & GR-180
$69.95

New Wireless TV Remote Control
For GR-681
$59.95

Wish Your Family Merry Christmas This Year With A New Heathkit Color TV . . . A Better Buy Than Ever With New Lower Prices

New GR-681 Deluxe Color TV With Automatic Fine Tuning

kit GR-681 **$499.95** (less cabinet)

The new Heathkit GR-681 is the most advanced color TV on the market. A strong claim, but easy to prove. Compare the "681" against every other TV . . . there isn't one available for any price that has all these features. Automatic Fine Tuning on all 83 channels . . . just push a button and the factory assembled solid-state circuit takes over to automatically tune the best color picture in the industry. Push another front-panel button and the VHF channel selector rotates until you reach the desired station, automatically. Built-in cable-type remote control that allows you to turn the "681" on and off and change VHF channels without moving from your chair. Or add the optional GRA-681-6 Wireless Remote Control described below. A bridge-type low voltage power supply for superior regulation, high & low AC taps are provided to insure that the picture transmitted exactly fits the "681" screen. Automatic degaussing, 2-speed transistor UHF tuner, hi-fi sound output, two VHF antenna inputs . . . plus the built-in self-servicing aids that are standard on all Heathkit color TV's but can't be bought on any other set for any price . . . plus all the features of the famous "295" below. Compare the "681" against the others.

GRA-295-4, Mediterranean cabinet shown **$119.50**
Other cabinets from $62.95

now only

Deluxe "295" Color TV...Model GR-295 $449.95

(less cabinet)

Big, Bold, Beautiful . . . and packed with features. Top quality American brand color tube with 295 sq. in. viewing area . . . new improved phosphors and low voltage supply with boosted B+ for brighter, livelier color . . . automatic degaussing . . . exclusive Heath Magna-Shield . . . Automatic Color Control & Automatic Gain Control for color purity, and flutter-free pictures under all conditions . . . preassembled IF strip with 3 stages instead of the usual two . . . deluxe VHF tuner with "memory" fine tuning . . . three-way installation . . . wall, custom or any of the beautiful Heath factory assembled cabinets. Add to that the unique Heathkit self-servicing features like the built-in dot generator and full color photos in the comprehensive manual that let you set-up, converge and maintain the best color picture at all times, and can save you up to $200 over life of set in service calls.

GRA-295-1, Walnut cabinet shown. **$62.95**
Other cabinets from $99.95

now only

Deluxe "227" Color TV...Model GR-227 $399.95

(less cabinet)

Has same high performance features and built-in servicing facilities as the GR-295, except for 227 sq. inch viewing area. The vertical swing-out chassis makes for fast, easy servicing and installation. The dynamic convergence control board can be placed so that it is easily accessible anytime you wish to "touch-up" the picture.

GRA-227-1, Walnut cabinet shown **$59.95**
Mediterranean style also available at $99.50

now only

Deluxe "180" Color TV...Model GR-180 $349.95

(less cabinet)

Same high performance features and exclusive self-servicing facilities as the GR-295 except for 180 sq. inch viewing area. Feature for feature the Heathkit "180" is your best buy in deluxe color TV viewing . . . tubes alone list for over $245. For extra savings, extra beauty and convenience, add the table model cabinet and mobile cart.

GRS-180-5, table model cabinet and cart **$39.95**
Other cabinets from $24.95

Now, Wireless Remote Control For Heathkit Color TV's

Control your Heathkit Color TV from your easy chair, turn it on and off, change VHF channels, volume, color and tint, all by sonic remote control. No cables cluttering the room . . . the handheld transmitter is all electronic, powered by a small 9 v. battery, housed in a small, smartly styled beige plastic case. The receiver contains an integrated circuit and a meter for adjustment ease. Installation is easy even in older Heathkit color TV's thanks to circuit board-wiring harness construction. For greater TV enjoyment, order yours now.

kit GRA-681-6, 7 lbs., for Heathkit GR-681 Color TV's **$59.95**
kit GRA-295-6, 9 lbs., for Heathkit GR-295 and GR-25 Color TV's **$69.59**
kit GRA-227-6, 9 lbs., for Heathkit GR-227 and GR-180 Color TV's **$69.95**

CIRCLE NUMBER 3 ON PAGE 15

Keep On Giving

HEATHKIT AR-15 Deluxe Solid-State Receiver

The Heathkit AR-15 has been highly praised by every leading audio and electronics magazine, every major testing organization and thousands of owners as THE stereo receiver. Here's why: The powerful solid-state circuit delivers 150 watts of music power, 75 watts per channel, at ±1 dB, 8 Hz to 40 kHz response. Harmonic & IM distortion are both less than 0.5% at full rated output. The world's most sensitive FM tuner includes these advanced design features . . . Cascode 2-stage FET RF amplifier and an FET mixer for high overload capability, excellent cross modulation and image rejection. Sensitivity of 1.8 uV or better . . . Harmonic & IM distortion both less than 0.5%. Crystal filters in the IF section give a selectivity of 70 dB under the most adverse conditions. Adjustable Phase Control for maximum separation. . . elaborate noise operated squelch . . . stereo only switch. . . stereo indicator light. . . two front panel stereo headphone jacks . . . front panel input level controls, and much more. Easy circuit board construction. For the finest stereo receiver you can buy anywhere, order your AR-15 now. 34 lbs. **Optional walnut cabinet, AE-16.** 10 lbs. **$24.95**

kit AR-15 **$339.95** (less cabinet)

Wired ARW-15 **$525.00** (less cabinet)

HEATHKIT AJ-15 Deluxe Stereo FM Tuner

The remarkable solid-state FM stereo tuner section from the famous Heathkit AR-15. If you already own a fine stereo amplifier, the AJ-15 is the stereo FM tuner for you. It has the exclusive design Heathkit FET-FM tuner with two FET RF amplifiers and an FET mixer for 1.8 uV sensitivity and excellent cross modulation. The tuner section is completely factory assembled and aligned for easier construction too. Other features include the exclusive Heathkit Crystal filters in the IF section for perfect bandpass shape, noise-operated squelch, stereo threshold control, "Black Magic" panel lights and more. Put the world's best FM stereo tuner in your system now . . . the AJ-15. 18 lbs. **Optional walnut cabinet ME-18.** 8 lbs. . . **$19.95**

kit AJ-15 **$189.95** (less cabinet)

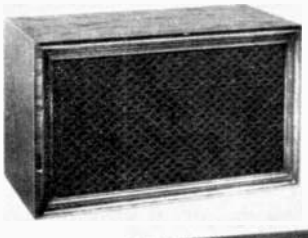
HEATHKIT AA-15 Deluxe Stereo Amplifier

The powerful solid-state amplifier section from the famous Heathkit AR-15. If you already have a fine stereo tuner, the AA-15 is the perfect mate for it. It features 150 watts of music power. . . 75 watts per channel . . . virtually flat response from 8 Hz to 40 kHz . . . less than 0.5% Harmonic & IM distortion at full output . . . individual input level controls . . . two front panel stereo headphone jacks . . . a tone-flat switch that bypasses the wide-range tone controls. . . loudness switch . . . positive circuit protection that makes the power amplifier circuits virtually short-circuit proof and "Black Magic" panel lighting. Put the world's best stereo amplifier in your system now . . . the AA-15. 28 lbs. **Optional walnut cabinet, AE-18.** 8 lbs. . **$19.95**

kit AA-15 **$169.95** (less cabinet)

HEATHKIT AS-48 High Efficiency System

Our finest Heathkit System . . . the new AS-48 with famous JBL* speakers. The specially constructed 12" woofer employs a 4" voice coil, 11½ pounds of magnet assembly and an inert, self-damping material to deliver clear, full-bodied bass down to 40 Hz. Crisp, open highs, up to 20 kHz come from the 2" direct radiator. LC-type crossover. The three position HF level control gives balance as you like it. All components are front mounted in the beautiful one-piece assembled pecan finish cabinet for easy construction. For very high performance stereo, order two of these amazing bookshelf systems today. 43 lbs.



NEW kit AS-48 **$169.95**

HEATHKIT AS-38 Bookshelf System

The New Heathkit AS-38 is a medium priced system featuring JBL* speakers that's small enough to be used in apartments, yet delivers sound that qualifies it for use with the best of components. The 12" woofer and 2" tweeter produce clean, natural response from 45 Hz to 20 kHz and the variable high frequency level control lets you adjust the sound to your liking. For easier assembly and a more solid sound, all components mount from the front of the assembled walnut cabinet. Build in an evening, enjoy rich, complete sound for years. Order two for stereo. 38 lbs.

NEW kit AS-38 **$144.95**

NEW

FREE 1969 CATALOG!

Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, electric guitar & amplifier, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

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CIRCLE NUMBER 3 ON PAGE 15

CB Corner

By Len Buckwalter, KQA5012

Morse Code for CB?

DIT-DAH/dit-dit-dit/dit-dit. Brass pounders will read that bit of code as A-S-I. To the Citizens Bander it could be a signal for change in equipment and operations. ASI translates as Automatic Station Identification, a technical tattler that's now in the trial-balloon stage among government and industry officials.

Let's say a CBer gets on his rig and calls, "CQ. This is the Cottonmouth Kid, running 500 watts into a 100-ft. tower, standing by for any skip-talkin' rag-chewer on the freq." Since he omits his call-sign, who'd be the wiser? Eager ears of an FCC monitor, that's who. While this bit of air pollution transpired, ASI would have snitched the call-sign.

The system already is operating in other radio services. For CB it would simplify the task of FCC sleuths. Since call letters are automatically transmitted, time-consuming detective work of radio direction finding would be eliminated.

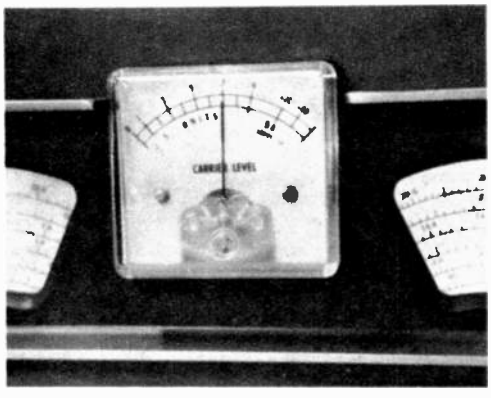
When will ASI devices appear in CB equipment? We asked Curtis B. Plummer, FCC Chief of Field Engineering. It's strictly in the talking stage, he said, with many problems yet to be solved. Today's ASI methods still are too costly for CB but some answers are showing through.

One is the *sequential* system. You'd pick up your mike to talk but, before you draw a breath, the rig automatically would fire off your call at the rate of 300 wpm. It would be decoded by equipment at the official listening end. The other possible system is *simultaneous*. It would transmit the call in Morse Code at the easily-copied rate of 25 wpm. The coding tones, though, would lie below 300 cps. Anyone picking you up on a regular CB receiver would hear only your voice since his receiver would contain a filter to cut off all frequencies below 300 cycles. (Many CB receivers have little response down there anyway since bass tones don't contribute to intelligibility.) The monitoring station would have the filter for snaring the tone code.

Swinging S Units. . . About the only agreement on S-meters is that S means signal other matter. Some say the meter would indicate a 50-μv signal when the needle stands at S-9. Trouble is that such absolute accuracy in S readings could double the cost of a CB transceiver.

Neverthless, S-meters, as strictly *relative* indicators, can be put to good use. It's a built-in alignment indicator, for example. If you're troubleshooting and don't have a signal generator and output meter handy, an S-meter often is a good substitute. Receive a signal off the air and tune IF and RF stages for highest number of S-units. You can compare or tune antennas, too, by measuring S-units while receiving a steady signal, then changing the antenna.

Be careful, though, about interpreting S-units. The needle travels *less* as it moves *higher* on the scale. For example, we fed a test signal to a CB rig from a lab generator and noted that it took an increase of 6μv to raise the needle from S-5 to S-6, or one S-unit. But it took more than double that (13 μv) to increase it another S-unit, from S-6 to S-7. This perfectly normal action compresses needle excursion in the meter's upper range. So keep signal levels fairly low and you'll find it much easier to observe small differences in signal strength when you're aligning a set or reworking an antenna.



How big is an S-unit? Meters on CB and ham gear (this is from a ham rig) measure relative, rather than absolute values, as the text explains.

An Introduction to Hi-Fi and Stereo

DOES it make sense to you that recordings are offered today in either stereo *or* hi-fi versions? Does it mean that stereo is *not* high fidelity? Any simple answers would be no more than half true. If that seems confusing don't let it worry you. It's typical of the needless complications that can make hi-fi and stereo seem hopeless to the uninitiated, even if he has a pretty fair grasp of other areas of hobby electronics.

The phrase *high fidelity* originally was coined to express the idea that quality equipment could reproduce recorded sound more faithfully than the phonographs then on the market. By the mid '50s, matters had improved considerably due, in part, to the acceptance of LPs and 45s. At the same time, all records and almost all record players—good, bad and indifferent—had come to be called hi-fi by their manufacturers, making the term just about meaningless. Then came stereo. The added realism and spaciousness of discs and tapes made with two separately but simultaneously recorded channels replaced simple (mono) high fidelity as a big selling point. Hence, today, stereo recordings are labelled *stereo* and mono recordings are called *hi-fi*. Nonetheless, good stereo still is, by definition, high fidelity.

How high must fidelity be to be hi-fi? In the eyes (or ears) of many mass-producers of phonographs, apparently, not very. Figures for distortion and fre-

quency response (the two basic specifications of hi-fi) tell the story most vividly. The Institute of High Fidelity (IHF) specification systems—followed by most makers of quality equipment—generally assume 1 per cent total harmonic distortion (THD) as a maximum for respectable sound. This means that if you feed a particular waveform through the equipment the total *change* in that waveform should not exceed 1 per cent of the original waveform amplitude. To this must be added intermodulation (IM) distortion—the interaction of two waveforms to produce a spurious element in the output. If THD and IM each is kept below 1 per cent for all conditions within the ratings of the equipment they usually will add to less than 1 per cent *combined* for any *practical* use of that equipment.

But remember that distortion is cumulative. If phono cartridge, amplifier and speaker each runs 3 per cent THD and 3 per cent IM when driven to maximum levels (as they might in a moderate-quality phonograph) that's a total of 12 per cent distortion—pretty bad by hi-fi standards. On the other hand, playing a badly worn record with a badly worn stylus in an improperly-adjusted arm easily can result in 100 per cent distortion—that is, equal quantities of the sound originally placed in the record groove and spurious signal injected by your equipment and habits. If that's the way you do things, the fine points of hi-fi are not for you.

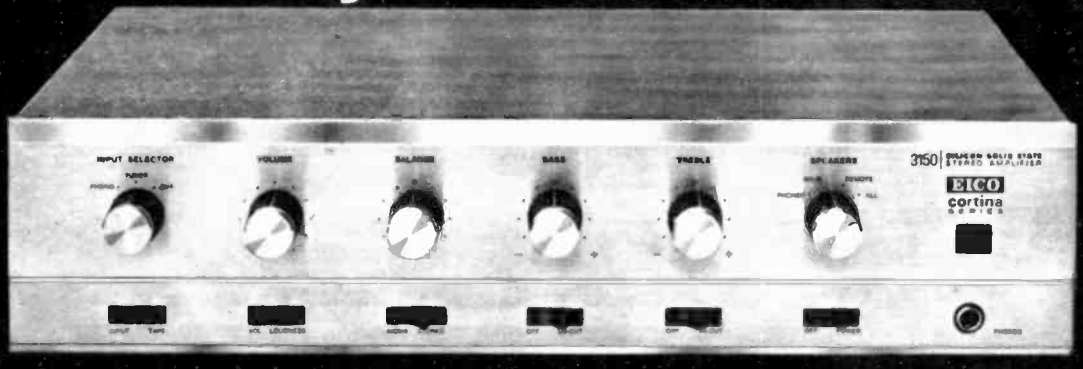
Frequency response, we said, is another basic specification. Response of most electronics, even if they're inexpensive, is quite good these days—about 30-15,000 cps. Some quality electronics can claim 5-50,000 cps and more. It can be argued that such wideband response is wasted in audio equipment since the ear can hear

A pair of cabinets houses a complete home-entertainment center. The system includes Fisher receiver, Ampex recorder plus video.

System at left features Garrard turntable plus Sherwood tuner and amplifier. Doors hide equipment. Behind grille at top are speakers.

This is more amplifier than you may think you need.

But after you see the price, why settle for less.



The EICO "Cortina 3150" all-silicon solid-state 150 watt stereo amplifier is truly a lot of amplifier. It combines wide-range preamplifiers, controls, and power amplifiers, all on one uniquely compact chassis. It delivers clean power to *two* sets of speaker systems, stereo headphones (for which there is a jack on the front panel) and a tape recorder. The Cortina "3150" gives you *complete* control facilities.

Most people think that, while all this would be very nice to have they don't want to pay a lot of extra money for it.

We agree. That's why we designed the "3150." Fully wired it costs $225.00. If you want to buy it as a kit — and it is a particularly easy kit to assemble because of our advanced modular circuitry techniques — it's a mere $149.95. The beautiful Danish walnut vinyl clad cabinet is included at no additional cost. At these prices, the "3150" is no longer a luxury. It's virtually a necessity. The power delivered by the "3150" is enough to give faithful reproduction of the highest peaks in music even when it is used with inefficient speaker systems.

The "3150" gives you more than just power. With *both* channels driven the harmonic distortion is *less* than 0.1%, IM distortion is less than 0.6%, frequency response is ±1.5db, 5Hz to 30 KHz, all at full output, hum and noise 75db below rated output; channel separation is more than 50db; input sensitivity is 4.7MV at magnetic phono input, 280MV at all other inputs.

Phase shift distortion is negligible due to the differential amplifier input circuit and the transformerless driver and output circuits. Al electronic protection (no fuses) of output transistors and speakers makes overloads and shorts impossible.

The "3150" also provides ten versatile control facilities: volume, balance, full range bass and treble controls. Input Selector (phono, tuner, aux), tape monitor, loudness contour, low and high cut filters, and speakers system selector switches.

See and hear this most advanced of all silicon solid-state amplifiers at your EICO dealer. We are confident it will quickly change your mind as to how much amplifier you really need.

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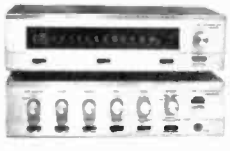
See the complete Cortina® Line at your EICO Dealer.



"The EICO Cortina Series are low-cost audio components that look and sound like high cost components."
Popular Science Magazine.

Cortina 3070 a full capability 70-Watt All Silicon Solid-State Stereo Amplifier for $99.95 kit, $139.95 wired, including cabinet.

Cortina 3200 Solid-State Automatic FM Stereo Tuner for $99.95 kit, $139.95 wired, including cabinet.

Sound n' Color is an exciting innovation in the home entertainment field. It adds a new dimension to your musical enjoyment. See the music you hear spring to life as a vibrant, ever shifting interplay of colors.
See every tone, every note, every combination of instruments create its own vivid pattern. EICO Model 3440—Kit $49.95, Wired $79.95.

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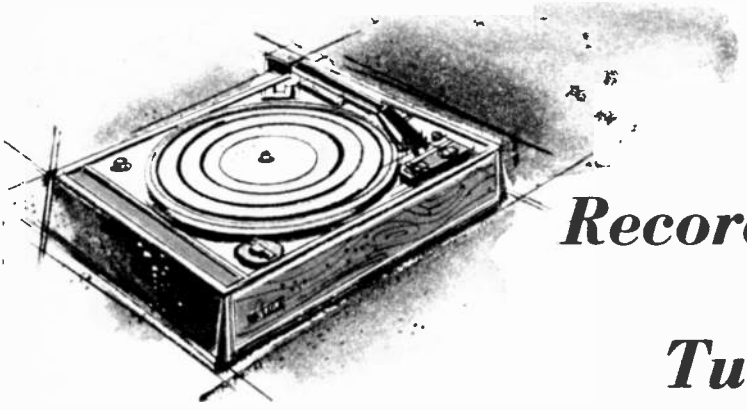
CIRCLE NUMBER 6 ON PAGE 15

no more than 16-20,000 cps at best. On the other hand, it also can be argued that extreme wideband response contributes to the exact preservation of waveforms and adds something to realism and clarity.

Frequency response in loudspeakers is something else, again. We'll have more to say on this subject in the section on loudspeakers. But two differences between the response of a speaker and that of, say, an amplifier should be kept in mind. First, it's virtually impossible to keep output level (compared to input level) constant within a couple of db over the whole frequency range of a speaker (it's expected in an amplifier). And the extremes of the audible spectrum are difficult to reproduce on a speaker without increased distortion or reduced level.

One specification peculiar to stereo is channel separation. Theoretically, the two channels of stereo equipment should not interact—a signal in one should not leak into the other. In practice, however, it doesn't work that way. If the unwanted signal in one channel is 35db down from the level of the signal in the other channel producing it, the separation is said to be 35db—a respectable figure.

With the foregoing in mind, let's look at the various classes of hi-fi equipment.



Record Changers and Turntables

AT one time the only means of achieving quality record reproduction was considered to be through the use of separate turntable and pickup arm—no record changers allowed! The term *automatic turntable* has been adopted by changer manufacturers to dramatize how their finest products now do what earlier models couldn't. Today there are few separate turntables and arms still available on the hi-fi market.

There are, however, a few manual turntable-and-arm combinations on the market. Automatic turntables can be made to operate manually. In addition, they can be set to accept a stack of records and feed them one at a time to the turntable like a changer.

Hallmarks of a good turntable are precision machining of the platter itself, a properly designed and installed motor, a well-engineered drive system and conveniently placed controls. Inability of a turntable to run at a rock-steady rate is measured as wow and flutter. Wow is a slow variation in speed while flutter is faster. Together, they are expressed as a percentage of variation in turntable speed. A good 4-pole motor should hold the figure to 1 per cent or less. Some hysteresis-synchronous motors can do better.

The way the tonearm is balanced determines the degree to which it can take advantage of modern cartridges. Dynamic balancing using an accurately adjusted counterweight with a knife balance or ball bearings at the pivot is the most common. Generally speak-

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January, 1969

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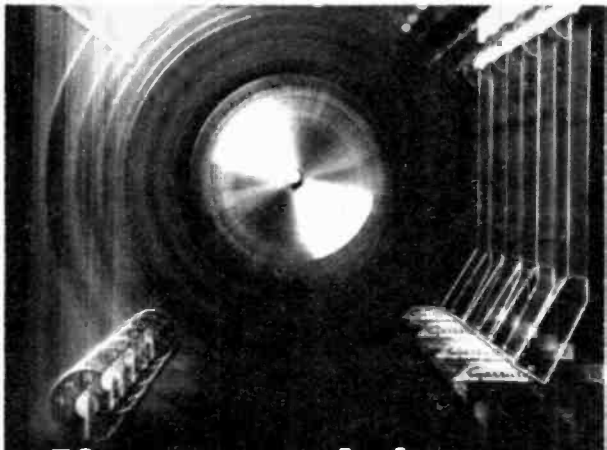

If your record player today still has a heavy turntable, it must have yesterday's motor

Why did Garrard switch from heavy turntables (which Garrard pioneered on automatics) to the scientifically correct low mass turntable on the SL 95? Simply because the synchronous Synchro-Lab™ Motor has eliminated the need for heavy turntables, developed to compensate (by imparting flywheel action) for the speed fluctuations inherent in induction motors. The light, full 11½" aluminum turntable on the SL 95 relieves weight on the center bearing, reduces wear and rumble and gives records proper edge support.

The Synchro-Lab Motor has also made variable speed controls as obsolete as they are burdensome to use. The synchronous section of the motor locks into the rigidly controlled 60 cycle current (rather than voltage) to guarantee constant speed regardless of voltage, warm up, record load and other variables. This means unwavering musical pitch. And the induction section provides instant starting, high driving torque and freedom from rumble.

At $129.50, the SL 95 is the most advanced record playing unit available today. For Comparator Guide describing all Garrard models, write Garrard, Dept. AS908, Westbury, N.Y. 11590.

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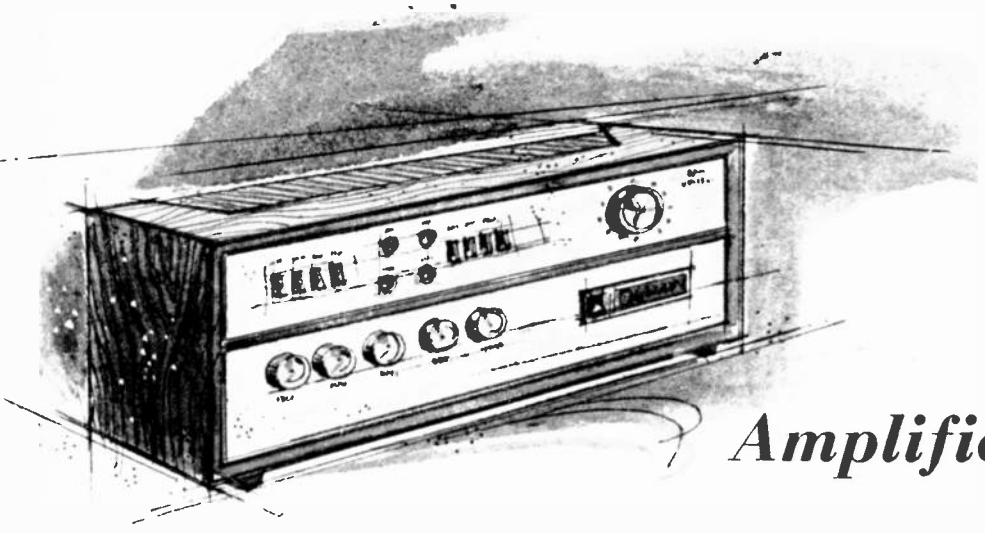
ing, spring loading does not achieve equal results. In the best arms the counterweight usually can be set so that it exactly balances the arm, the cartridge shell and the cartridge itself. Then a tracking force adjustment moves the center of mass just far enough toward the stylus to match the tracking force needed for the cartridge in use. Some arms have an anti-skating device to counteract the innate tendency of an otherwise perfectly balanced arm to press toward the center of the record.

Of the various specifications for pickup cartridges, tracking force is the first to look at. While, generally speaking, tracking force should be as low as possible, use of either cartridge or arm at forces lower than those recommended can result in serious loss of quality and damage to the record (see HOW LONG DO STEREO RECORDS LAST?, Sept. '68 EI). For the best cartridge and arms, tracking force should run around 1 gram. But some fine cartridges are designed for 2 grams or more for use in changers and with less precisely-made tonearms. Stylus compliance (flexibility) is intimately related to tracking against the groove wall to follow it precisely. Compliance around 20 x 10^{-6} cm/dyne is considered pretty good.

Other common cartridge specifications include frequency response, channel separation, moving mass and square-wave response. Look for evenness of the horizontal portions of square-wave response curves and oscillograms. All cartridges have some tendency to peakiness about 10 kc and if a severe peak matches the frequency of a similar peak in your speakers' response it can produce a shrill, harsh sound.

Most styli are shaped like a cone with the tip rounded off. Tip radii run from 0.5-mil (for stereo) or 0.7-mil (for mono LPs) to 3-mil (for 78s). Elliptical (or biradial) styli (which generally track best) are wider across the groove than they are in the other dimension. A typical elliptical might be expressed as having a 0.3 x 0.6-mil tip.



Amplifiers

TERMINOLOGY in high-fidelity amplifiers is derived from the concepts of professional audio equipment, where all signals levels must be raised to a standard line voltage before they can be mixed, equalized, switched and generally manipulated. Then they are amplified for monitoring, recording, transmitting or any other end use. Technically, any amplification necessary to raise the signal to line level is preamplification. What the professional would term a monitor amplifier is called a power amplifier in hi-fi.

Line level in hi-fi generally runs around 2 V (peak voltages). Tuners, tape recorders with built-in preamps and similar so-called high-level sources are designed to feed signals to the amplifier at about this level, while stereo pickup cartridges and tape heads have

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outputs measured in millivolts. There, extra gain of perhaps 50db or more is needed for these low-level sources. In addition, special equalization may be needed—to compensate for the RIAA preemphasis curve in records or the NAB curve for tapes. Both of these functions are supplied by the preamplifier. Then control functions take over.

Standard controls today are selector (tuner, tape, phono, etc.), mode (stereo, mono, etc.), bass, treble. A loudness control adds extra gain at the frequencies normally difficult to hear at low volume levels. A tape monitor switch can be used only if your recorder has separate record and playback heads. If you do, the switch will allow you to hear the output of the playback head while you are recording from one of the other inputs.

Now we're ready for the power amplifier section. In most equipment, however, preamplifier, control functions and power amplifiers are housed in a single unit. If it contains just these elements it is called an integrated amplifier (or preamp-amplifier). But most hi-fi products go one step further and include a tuner as well—making the unit a receiver. We'll have more to say about receivers in the section on tuners.

How much power do you need in a hi-fi power amp? Twenty watts (IHF) per channel per speaker system may be adequate in many cases even with inefficient speakers. For example, if you want stereo in two rooms you would need two speakers on each of the two channels—or a total of about 80 watts. (In a stereo amplifier 80 watts is the same thing as 40 watts per channel.) You might need more if your room is very large, if it has lots of heavy draperies or other sound-absorbing materials or if you like to play music extremely loud. Conversely, for background music in small, acoustically live rooms with efficient speakers you can get by with much less. So don't be awed by high power ratings. (See HOW TO COPE WITH THE POWER HOAX, Mar. '68 EI.)

If the amplifier you choose turns out to be underpowered for your installation, overall performance may be downgraded. Reason for this is that you might have to operate the amplifier with the volume control wide open to produce moderate to high volume levels. And at this point amplifier distortion may increase beyond its rated level.

Tuners and Receivers

ANY TUNER with pretentions to hi-fi quality today handles both mono FM and multiplex stereo FM. Many also tune the AM band. Outside of a few European products, little attention has been paid to the inclusion of the international short-wave bands. The most common arrangement includes an integrated amplifier on the same chassis with the tuner to make a receiver. By definition, a hi-fi receiver includes these

elements but no speakers (unlike most radio receivers in the more general sense). Receivers, like separate tuners, can be AM/FM or FM only.

When you buy a complete receiver you generally save about 25 per cent of the cost of separate components. Once upon a time, true audiophiles looked down on the stereo receiver as an undesirable compromise (tube construction forced manufacturers to modify an otherwise good design to eliminate heat or make room for the oversized circuitry). However, the transistor has made possible the construction of receivers which are in no way inferior to separate tuners and amplifiers.

Some FM tuner specifications will need no explanation for the ham or short-wave fan—sensitivity and image rejection, for instance. Typical sensitivity for a high-quality tuner might be expressed as, say, 2μv for 30db quieting. This means that 2μv of RF at the antenna terminals will deliver audio (at full modulation) 30db louder than RF-generated background noise. Stronger signals will produce greater quieting. Capture ratio is the ability of a tuner to receive one of two stations operating on the same frequency and to reject the other. The lower the figure—usually only a few db—the better.

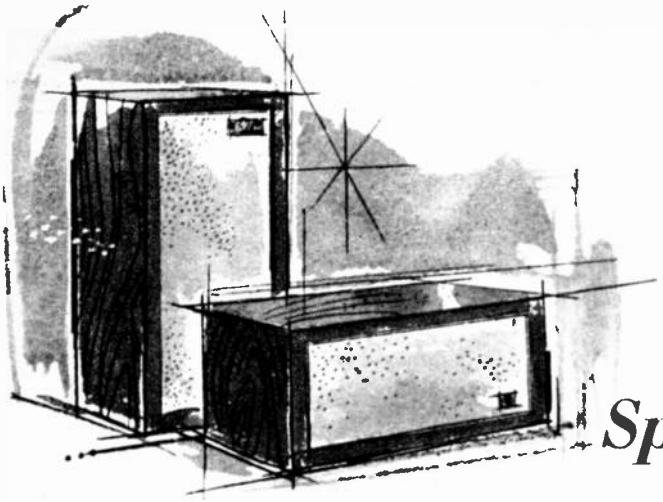
A good antenna gives a tuner a far better chance of pulling in FM stations clearly and reliably. The farther you are from the station you are trying to receive, the better the antenna must be. If the stations you plan to listen to are not all in the same direction from you, but instead surround you, you will need an antenna rotator. Such a device, which is often found on TV antennas, turns the antenna to aim it in the direction of the station which you want to listen to. And a rotator will greatly aid you in making adjustments in the positioning of an antenna to minimize multipath reception problems (analogous to ghosts on a TV screen).

And besides, a good antenna improves the performance of any tuner, regardless of its sensitivity. If you live in the city where all the stations are close by, an indoor antenna will suffice. If you live in the suburbs, a roof antenna will be necessary.

If you are in a fringe or low-lying area, you may need an antenna with 10 or more pairs of elements. However, it may not be necessary to go out and buy another large antenna—if you already have a good one for TV. Simply add a distribution amplifier with two or more outputs. Such a device may be cheaper than a new antenna and will provide a boost to the level of the signal from the antenna to both your FM tuner and TV. It also provides isolation between the receiver and the TV set.

Channel separation of 30db or more is usual in a stereo tuner though, as in the case of cartridges, this usually means mid frequencies where separation is better than it is at higher frequencies. Don't confuse quieting with muting. Muting (like squelch) cuts off output for all RF signals below a particular level, removing all interstation noise as you tune across the dial. If you want to receive weak stations as well as those that come in loud and clear you will want to be sure that muting (if your tuner is so provided) can be defeated.

Another control that is relatively uncommon is AFC. Transistors, with their lower operating temperatures, have made heat-produced drift an almost non-existent problem. A glance at a center-tuning meter (most tuners have one today) from time to time will give you more accurate, distortion-free tuning than the older AFC tube circuits. Some of the more elaborate FM tuners have additional meter functions to indicate things like signal strength and multipath signal reception. Some even have two meters or a miniature oscilloscope to provide extra tuning information—particularly valuable if you use an antenna rotator. Another feature you may encounter is a far/near switch. It inserts attenuation in the front-end to keep it from being overloaded by strong signals. You switch out the attenuation for full sensitivity on weak signals. A more common solution to the problem of front-end overload today is the use of FETs (field-effect transistors) in the tuner's front-end. FETs are used because they're far less susceptible to overload than are conventional transistors.



Speakers

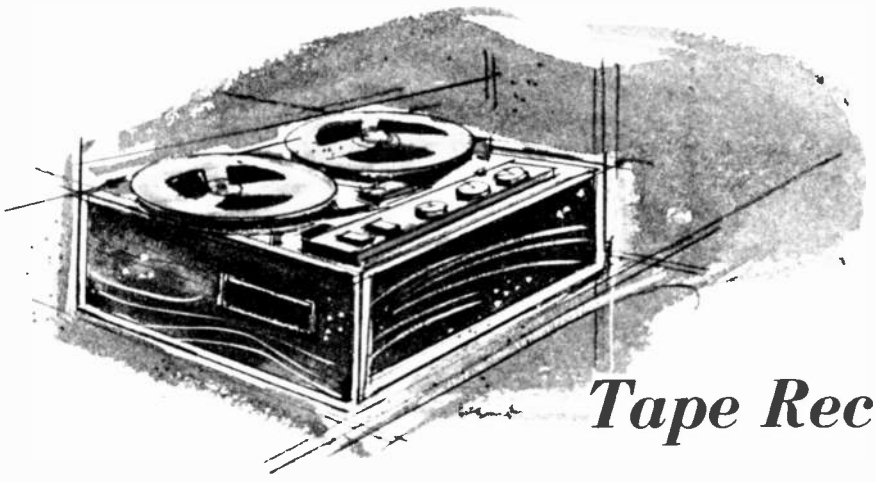
NOTHING in a hi-fi system is more difficult to select than a speaker system. Transducers—devices that convert mechanical energy to electricity or vice versa—are axiomatically the least linear of audio devices. And speakers pose the most knotty problems of all to design engineers, particularly if the selling price is to be kept low. Where an amplifier may be flat within 1 or 2db, a speaker system is doing well to stay within 5db over its entire range—and that range can be considerably less than that of an amplifier.

A conventional loudspeaker system consists of at least two elements, the so-called raw speaker itself and the enclosure that houses it. Matching of the speaker to its enclosure is all-important if good results are to be achieved. But that still is not enough. Although the last few years have seen dramatic improvements in small, inexpensive speaker systems, a single speaker in the best of enclosures can't be expected to reproduce the whole of the audible spectrum in true hi-fi style. A minimum is the inclusion of two speakers in the system—a woofer (low-frequency driver) and a tweeter (for the high frequencies). A crossover network is required, of course, to feed to each speaker only the frequency range it is designed to handle. Larger, more refined systems may add a mid-range speaker and, perhaps, a super-tweeter (for the extreme high end) with suitable crossovers. The next step is to reinforce bass further by adding extra woofers or a folded horn.

There are unconventional systems, too. The most widely accepted are electrostatics. Instead of a coil moving in a magnetic field to drive a cone diaphragm, electrostatics feed audio to one flat membrane, an electrostatic bias to another, so the two attract and repel in response to the changing polarity of the audio. Ionic speakers (including the new experimental flame speaker) are similar in principle except that they use charged gas ions in place of a charged membrane.

But the overwhelming bulk of speakers sold are conventional in design. Particularly popular are air-suspension designs—usually bookshelf-size systems using long-throw speakers in sealed enclosures. A perennial of many years' standing is the bass-reflex enclosure which has an opening or port of critical size and placement to extend and smooth out the speaker's bass response. Bass-reflex systems generally require larger enclosures but are more efficient than air-suspension systems. Large exponential horns require still more space.

Unfortunately, there is no standard specification that will tell you how efficient a particular system is. Power-handling capacity is a clue—but no more than that. Nor are size, price or the number of speakers inside the enclosure necessarily an adequate clue to the quality of a system. Speakers—and tastes in speakers—vary more than any other audio component. The only way to choose is by listening.



Tape Recorders

THERE is a more bewildering variety of types and features available on the tape-recorder market than there is in any other class of audio equipment. While cassettes and the various types of continuous-loop cartridges offer many advantages, superb sound is not among them. That leaves open-reel. A true open-reel recorder is a complete package consisting of the transport mechanism that moves the tape, record preamp and bias oscillator for recording, playback preamp, power amp and speakers. A tape *deck*, on the other hand, has preamps but no power amp or speakers. It is designed to feed a high-fi system, although it often is supplied with a carrying case and looks like a full recorder. Sometimes the word deck is applied to a transport without any electronics.

You can get by without a playback preamp if you have a separate preamp, integrated amp or receiver with a *tape-head* position on the selector switch. (Providing outboard record electronics is more difficult.) You probably are better off using the playback electronics in the recorder since it automatically changes record and playback equalization when you switch tape speed—something separate electronics can't do. With the proper equalization—and tape designed for the purpose—today's recorders can produce at 3¾ ips sound that is virtually indistinguishable from that at 7½ ips, the hi-fi norm.

We haven't mentioned stereo recorders and most of what we've said can be applied to mono. But virtually every high-fi recorder today uses 4-track heads and electronics in pairs. They can be used for mono, of course, but they're designed for stereo. In some machines this results in a bonus for the mono user—sound-on-sound and sound-with-sound techniques make possible mono overdubbing on a single recorder.

There are some special features on some recorders that can be of considerable value. A bias control will help to match recorder characteristics to tape specifications for optimum performance. Since bias requirements from tape to tape (even of the same manufacturer) are different it's best to standardize on one tape and leave the bias set accordingly. Even with a front-panel bias control, frequent resetting becomes a chore.

If you want to do editing, be sure the recorder has a pause or cueing capability. Automatic reversing is considered a great convenience by some users, an expensive and performance-jeopardizing gadget by others. If you want it check two things: whether the recorder will record as well as play back in reverse and what tripping system is used. Subsonic signals are on many prerecorded tapes, metal foil on some raw tapes.

The newest feature added to the almost endless list in the recorder field is automatic noise suppression, based on the Dolby unit (see HI-FI TODAY, Sept. '67 EI). Until specially-processed prerecorded tapes are available, its advantages will apply only to tapes you make yourself.

Good Reading

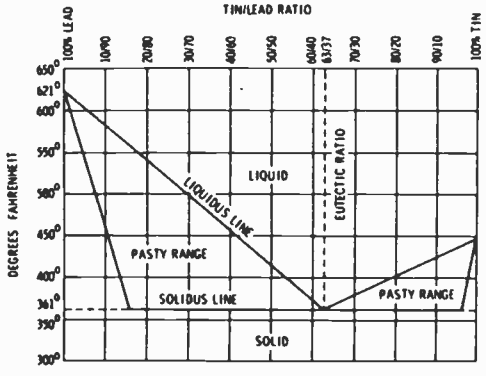
By Tim Cartwright

RADIO AND TELEVISION: PRINCIPLES AND APPLICATIONS. By J. P. Hawker. Hart Publishing Co., New York. 399 pages. $12.50

A title like this one usually is not a good omen. Neither is a thick format that weighs 2 or 3 lbs. These usually are portents of a dull text for a captive college or tech-school audience. But the book is a well-written, first-rate explanation of most of what really matters about radio and TV broadcasting. Anyone who is reasonably literate should get the point. Although nothing is said about him on the dust jacket, the author obviously is British (even in this American edition a whole chapter is on valves, rather than good old tubes). There is nothing unusual in treatment or presentation. But the simple and potent virtues of really clear expository writing do the job on their own. The result is a book that definitely is going on my permanent reference shelf.

ABCs OF ELECTRICAL SOLDERING. By Louis M. Dezettl. Howard Sams & Bobbs-Merrill, New York and Indianapalois. 128 pages. $2.95

A book about soldering? Come off it! Sorry, but you'd better wipe the smile off your face and take a look at this one the next time you're at the parts store. Even if you know most of the techniques and tools it describes you may discover you've never really understood what goes on in a solder joint.



Graph from ABCs of Electrical Soldering shows how changes in the tin/lead proportion of solder affects the way it responds to the iron's heat.

RADIO PROGRAM IDEABOOK. By Hal Fisher. Tab Books, Blue Ridge Summit, Pa. 256 pages. $12.95

RADIO PROMOTION HANDBOOK. By William A. Peck. Tab Books. 191 pages. $9.95

RADIO SALES PROMOTIONS: 300 Creative Selling Ideas. By Jack MacDonald. Tab Books. 72 pages. $10.00

With these three books I have to step out of the way; the supercharged local radio operations they describe are the kind I can't stand. Still, if you're interested in local radio and would like to know some tested recipes for programming and promotion these are books for you. They're full of detail. The promotion handbook is particularly professional in style and coverage but all do a thorough job.

DICTIONARY OF ELECTRONIC TERMS. Edited by Robert E. Beam. Allied Radio Corp., Chicago. 111 pages. $1

This isn't the most elegant set of electronic definitions I've ever seen. But it's complete in coverage and the price is as low as I think this sort of thing should be. Allied has built up a helpful little reference library. This is a worthwhile addition.

ARITHMETIC REVIEW FOR ELECTRONICS. By Nelson M. Cooke & Herbert F. R. Adams. McGraw-Hill, New York. 176 pages. $3.50

You don't need this, do you? No, I thought not. But, just in case—I mean, say a resistor is coded 220 ohms and measures 206. What's the error percentage? Aha! I thought you didn't need this.

And Make Note of. . .

VOLTAGE AND POWER AMPLIFIERS. By Robert E. Sentz. Holt, Reinhart & Winston, New York. 282 pages. $3.95

TRANSISTOR SUBSTITUTION HANDBOOK. Howard Sams. 128 pages. $1.95

SEMICONDUCTOR HANDBOOK, Second Edition. By Robert B. Tomer. Howard Sams. 287 pages. $5.75

NEW DX AWARDS

OUTPOSTS

TO celebrate our Eighth Award Period, opening with the publication of this issue, EI announces the Outposts Award—one for SWLs and one for hams. Why outposts? Well, partly because they represent some pretty far-away, romantic DX countries and partly be-

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Cay Sal Is. (Bahamas) *(U.K.)*
Dominica Is. *(U.K.)*
Fr. St. Martin & St. Barthelemy *(Fr.)*
Guadeloupe Is. *(Fr.)*
Guantanamo Bay *(U.S.)*
Martinique *(Fr.)*
Navassa Is. *(U.S.)*
Netherlands Antilles (Aruba, Bonaire, Curacao) *(Neth.)*
Puerto Rico *(U.S.)*
Rancador Cay & Serrana Bank *(U.S./Colombia)*
St. Kitts & Nevis Is. *(U.K.)*
St. Lucia Is. *(U.K.)*
St. Vincent Is. (incl. Br. Grenadines) *(U.K.)*
San Andres & Providencia Is. *(Colombia)*
Sint Maarten (Dutch St. Martin), Saba and St. Eustatius Is. *(Neth.)*
Swan Is. *(U.S.)*
Turks & Caicos Is. *(U.K.)*
Virgin Is. *(U.S.)*

PACIFIC & AUSTRALASIA
American Phoenix Is. (incl. Canton, Enderbury Is.) *(U.S.)*
American Samoa *(U.S.)*
Antipodes & Bounty Is. *(N.Z.)*
Baker & Howlands Is. *(U.S.)*
Bonin & Volcano Is. *(U.S.)*
Bouvet Is. *(Norway)*
Br. Gilbert & Ellice Is. *(U.K.)*
Br. Phoenix Is. *(U.K.)*
Br. Solomon Is. *(U.K.)*
Caroline Is. *(U.S.)*
Celebes & Molucca Is. *(Indonesia)*
Chatham Is. *(N.Z.)*
Christmas, Fanning, Washington Is. *(U.K.)*
Clipperton Is. *(Fr.)*
Coco Is. *(Costa Rica)*
Cook Is. *(N.Z.)*
Easter & Sala y Gomez Is. *(Chile)*
Fiji Is. *(U.K.)*
French Polynesia *(Fr.)*
Galapagos Is. *(Ecuador)*
Gilbert, Ellice, Ocean Is. *(U.K.)*
Guadelupe Is. *(Mex.)*
Guam *(U.S.)*
Hawaii *(U.S.)*
Heard Is. *(Aust.)*
Hong Kong *(U.K.)*
Jarvis Is. *(U.S.)*
Johnston Is. *(U.S.)*
Juan Fernandez Is. *(Chile)*
Kermadec Is. *(N.Z.)*
Line Is. (except Christmas, Fanning, Washington Is.) *(U.K.)*
Lord Howe Is. *(U.K.)*
Macao *(Port.)*
Macquarie Is. *(Aust.)*
Malpelo Is. *(Colombia)*
Manihiki & Danger Is. *(N.Z.)*
Marcus Is. *(U.S.)*
Mariana Is. (Rota, Saipan, etc.) *(U.S.)*
Marquesas Is. *(Fr.)*
Marshall Is. *(U.S.)*
Midway *(U.S.)*
Nauru *(U.K./Aust./N.Z.)*
New Caledonia *(Fr.)*
New Guinea Terr. *(Aust.)*
New Hebrides Is. *(Fr./U.K.)*
Niue Is. *(N.Z.)*
Norfolk Is. *(Aust.)*
Papua Terr. *(Aust.)*
Paracel Is. *(S. Vietnam)*
Pitcairn Is. *(U.K.)*
Port. Timor Is. *(Port.)*
Revillagigedo Is. *(Mex.)*
Ryukyu Is. (Okinawa) *(U.S.)*
Tokelau (Union) *(N.Z.)*
Tonga (Friendly) *(U.K.)*
Wake *(U.S.)*
Wallis & Futuna Is. *(Fr.)*
Western Samoa *(U.S.)*
Willis & Coringa Is. *(Aust.)*

INDIAN OCEAN & AFRICA
Amsterdam & St. Paul Is. *(Fr.)*
Andaman & Nicobar Is. *(India)*
Angola *(Port.)*
Cargados Carajos Is. *(Mauritius)*
Ceuta & Melilla *(Sp.)*
Chagos Is. *(U.K.)*
Christmas Is. *(Aust.)*
Cocos (Keeling) Is. *(Aust.)*
Comoro Is. *(Fr.)*
Crozet Is. *(Fr.)*
Fr. Somaliland *(Fr.)*
Ifni *(Sp.)*
Juan do Nova & Europe Is. *(Fr.)*
Kamaran Is. *(S. Yemen)*
Kerguelen Is. *(Fr.)*
Laccadive & Aminidivi Is. *(India)*
Marion & Prince Edward Is. *(S. Africa)*
Mozambique *(Port.)*
Port. Guinea *(Port.)*
Reunion Is. *(Fr.)*
Rodriguez Is. *(Mauritius)*
Seychelles Is. *(U.K.)*
Socotra Is. *(Aden)*
Sp. Sahara (Rio de Oro) *(Sp.)*
Sp. Guinea (Rio Muni) *(Sp.)*

NEW DX AWARDS OUTPOSTS

cause they are a dwindling breed, slated for near-extinction. They are, for the most part, colonies, dependencies, territories—DX countries that don't claim home rule.

A glance at the Outpost List (below) will prove that there's a lot of difficult DX represented. So we're asking applicants to log only six outposts—two-way communications in the case of hams, reception in the case of SWLs. In addition, all of EI's past awards are offered once again. A complete list appears at the end of this article.

Following this article you will find a copy of the Official DX log. Use this form *only* to apply for any of the awards on the list. The only way we can keep within reason the time it takes to process the awards is to insist on this point. If you need additional copies of the form, you can copy it carefully by hand (same size, same layout), make duplicates on an office copying machine or, of course, you can buy extra copies of the magazine.

In filling out this year's form, you'll notice that we have changed dates and times from local time to GMT. Reason is that most award applicants appear to fill out the application from their QSLs rather than from their own log. Since most QSLs are made out in GMT we think the new application form will be simpler for most DXers than the old one.

You must, of course, substantiate each entry on your log with a valid QSL. Pay particular attention to transmitter location—which is what counts for all awards except Major Cities-25, for which it is the studio location that counts.

Don't send your QSLs to us with the form. (If we need to check them for any reason, we'll request them later on.) Mail just the form, *carefully checked* to see that all blanks are filled in and correct, to:

EI's DX Club
67 West 44th St.
New York, N.Y. 10036

All entries must be postmarked no later than April 30, 1969—the end of this Award Period, Any mailed later will be returned to the sender.

If you want a complete list of all countries and cities that qualify for the awards we have offered in the past, ask for the Official World DX list. Send your request, with a self-addressed, stamped envelope to EI's DX Club at the above adress.

HANDY GUIDE TO EI'S DX AWARDS

CLASS OF AWARD	TYPE OF AWARD		FREQ. LIMITS	REQUIREMENTS
	SWL	HAM		
General 100 (DX Century)	X	X	None	Reception of or two-way communications with stations in at least 100 different countries.
General 50	X	X	None	Reception of or two-way communications with stations in at least 50 different countries.
Special	X	X	None	Reception of or two-way communications with stations in at least 10 different countries.
BCB Stateside Special	X		535-1605 kc	Reception of stations in at least 25 different states or provinces.
Broadcast Band	X		535-1605 kc	Reception of stations in at least 15 different countries.
All-Continents	X	X	None	Reception of or two-way communications with stations on all six continents.
United Nations-25	X	X	None	Reception of or two-way communications with stations in at least 25 different UN member countries.
Major Cities-25	X	X	None	Reception of or two-way communications with at least 25 of the most populated world cities. (Populations based upon 1967 Information Please Almanac published by Simon & Schuster, New York, N.Y.)
Outposts-6	X	X	None	Reception of or two-way communications with at least 6 different outposts (complete list on previous page).

ELECTRONICS ILLUSTRATED DX CLUB

OFFICIAL DX LOG

INSTRUCTIONS: PRINT neatly or use typewriter—DO NOT WRITE! Check SWL or HAM to designate type of Award and enter class of Award you are applying for (see chart on opposite page). In listing below, complete all blanks for each entry. Under *Date*, use figures (such as 10-1-64); all log entries must be dated January 1, 1950 or later. Under *Time*, use Greenwich Mean Time and 24-hour clock (0000 to 2359 hours). Make up identical copy of this log if you need more space. Eighth Award Period ends April 30, 1969.

NAME ..... (last name) ..... (first name and initial) ..... HAM CALL .....

ADDRESS .....

CITY ..... STATE AND ZIP (or country) .....

TYPE OF AWARD ☐ SWL ☐ HAM

CLASS OF AWARD ..... DATE .....

	DATE (GMT)	TIME (GMT)	FREQ. (kc)	STATION CALL	LOCATION (city & country)	QSL
1						card ☐ letter ☐
2						card ☐ letter ☐
3						card ☐ letter ☐
4						card ☐ letter ☐
5						card ☐ letter ☐
6						card ☐ letter ☐
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20						card ☐ letter ☐
21						card ☐ letter ☐

	DATE (GMT)	TIME (GMT)	FREQ. (kc)	STATION CALL	LOCATION (city & country)	QSL
22						card ☐ letter ☐
23						card ☐ letter ☐
24						card ☐ letter ☐
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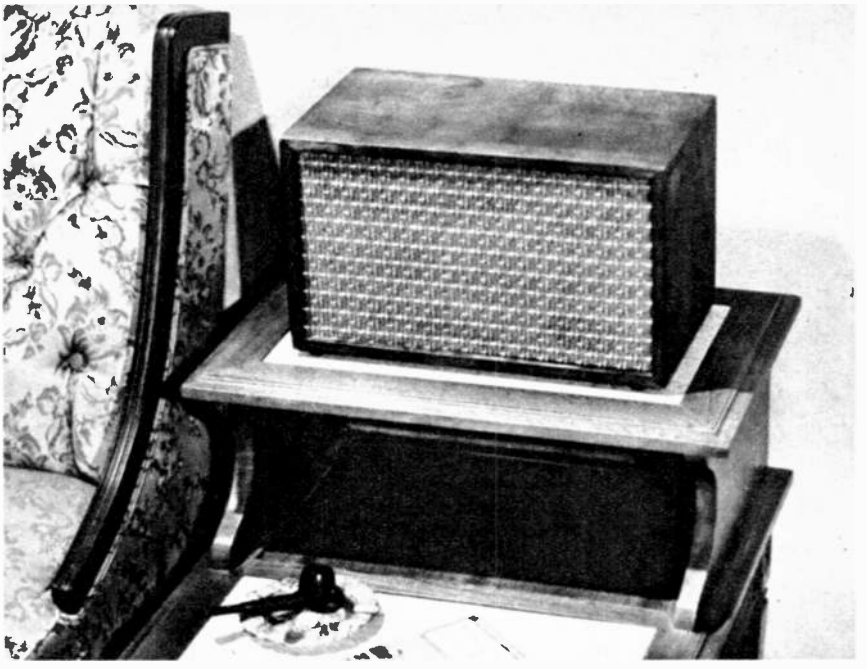


Super-Mini Speaker

By HARRY KOLBE

ASK the old-time hi-fi reactionaries and they'll tell you there's nothing like a big speaker system for really good sound. Fortunately, they have had their day. Speakers, like the value of the dollar, have been shrinking in size for the last decade. But this doesn't necessarily mean that the quality of sound from a small speaker system has had to diminish at a proportionate rate.

True, you do have to sacrifice some of the oomph of a 6-cubic-ft. enclosure if you have only limited space, such as that on a bookshelf, for a speaker. We're not saying, however, that a little speaker system capable of putting out respectable sound can't be built. The Super-Mini Speaker succeeds in doing it.

Although the Super-Mini has a volume of about ½ cu. ft., it shows a flat frequency response that starts way down at 70 cps and extends beyond 15,000 cps. Power-handling capacity is more than adequate for the average-size living room.

If you already have a pair of speakers in your living room, the Super-Mini is an ideal extension speaker for the den, workshop, kitchen or bedroom. It is efficient and light enough to be hung on a wall.

The Super-Mini incorporates two 4½-in. woofers and one 2¾-in. cone-type wide-dispersion tweeter. Why two woofers, you say, when a slightly larger one might be able to do the job? Cost, for one thing. But there are other reasons. Let's see what they are.

The speakers we used are the high-compliance, heavy-magnet, long-

Super-Mini Speaker

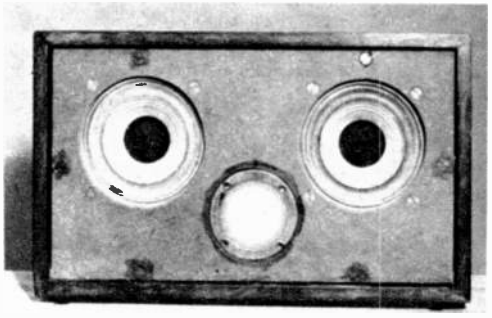


Fig. 1—View of front of Super-Mini with grille cloth removed. Note that tweeter (center) is mounted with front surface flush with front of panel.

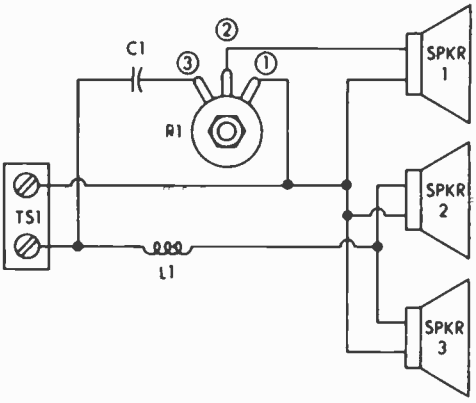


Fig. 2—Crossover network. Be sure to connect woofers (SPKR2,SPKR3) so they're in phase. Check with battery: cones should move in same direction.

excursion type. Such characteristics are necessary because in order to make the low-frequency response of a small speaker useful, the small-diameter cone must be able to move a fairly long distance. (Long in comparison to the cone travel of an ordinary replacement speaker.) Hence, the high-compliance cone.

The heavy magnet is necessary to control and maintain linear voice-coil travel over the long distance (excursion) the voice coil must travel.

However, despite the heavy magnet and high compliance, the effective piston area of a 4½-in. speaker is so small that the low-frequency power-handling capacity is limited. By adding a second woofer to the system, we double the effective piston area but quadruple the acoustic output power.

The tweeter used in the Super-Mini is a 2¾-in. cone type which has low distortion and smooth response to about 20,000 cps. We have included a level control for the tweeter so you can adjust overall system balance to suit your listening preference.

Building the Cabinet

You don't have to be a carpenter or experienced cabinet maker to build the Super-Mini's cabinet. The top, bottom and sides of the cabinet can be built of ½-in. plywood or flakeboard (Novoply). Or you can jazz up the appearance of the cabinet by using veneered plywood. You have a choice of mitering the corners of the cabinet or using butt-joint corners. Use whichever method

PARTS LIST

C1—6 μf, non-polarized capacitor (or, two 12 μf, 50 V electrolytic capacitors. See text)
L1—Inductor wound of No. 18 enameled wire (see text)
R1—8-ohm L-pad (Lafayette 99 T 6134)
SPKR1—2¾-in. tweeter (Lafayette 99 T 0117)
SPKR2, SPKR3—4½-in. woofer speaker Lafayette 99 H 0144, not listed in catalog. $3.95 plus postage.)
TR1—Two-screw terminal strip
Misc.—
¼-in. tempered Masonite
¾ x ½-in. pine cleats
½-in. plywood, flake board, or walnut-veneer plywood
Grille cloth
Rubber mounting feet
Walnut wood tape
8-32 x 1¼-in. flat-head screws and washers
No. 6 x ⅝-in. round-head wood screws
Foam-rubber strips

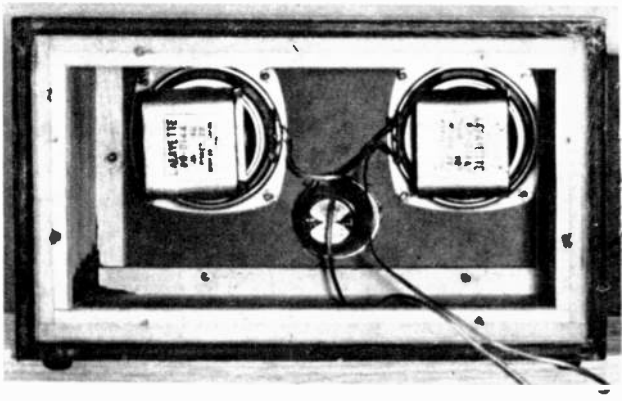


Fig. 3—Inside of cabinet. Be sure there's an airtight seal between sides, top, bottom, front panel and cleats. Note the foam-rubber strips on cabinet's rear cleats.

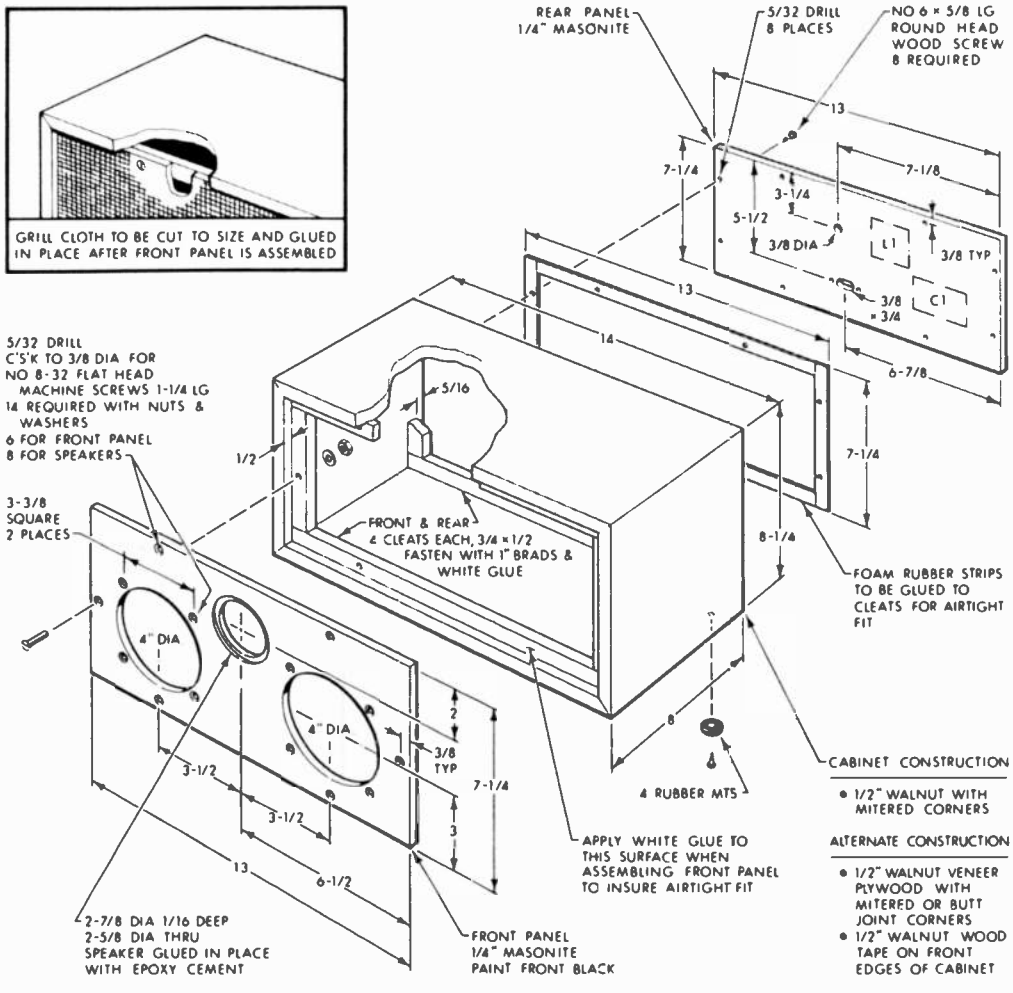


Fig. 4—All construction details are on this diagram. Corners are shown mitered, but they can be butted.

you feel you can handle. But be sure all joints are fastened securely and airtight.

To finish off the front of the cabinet, glue wood tape on the edges. And put rubber feet on the bottom so the cabinet won't scratch the shelf. Detailed construction information is covered in Fig. 4.

If you're going to use light-color grille cloth, paint the front panel with flat black paint. After mounting the three speakers on the front panel, coat the front of the panel with glue and lay the grille cloth in place. Make sure that the pattern is straight.

The front panel should be screwed and glued to the front cleats. Next, cement a layer of thin plastic-foam weatherstripping on the rear cleats so the enclosure will be airtight when the back panel is screwed on.

The Crossover Network

The inductor (L1) for the crossover network is wound on the form shown in Fig. 5. To the ends of a 1⅝-in.-long piece of 1-in.-dia. dowel attach 1⅞-in.-square pieces of ¼-in.-thick Masonite. Attach the pieces of Masonite to the dowel with brass or aluminum nails. Then random-wind (a pound should do it) No. 18 enameled wire on the form until the wire is out to the edges of the end pieces. A finished coil is shown in Fig. 6.

The capacitor used in the crossover network is a 6-μf 50-V (minimum) nonpolar-

[*Continued on page* 109]

Stereo Separates

DYNACO PAT-4 Preamp / Stereo 120 Power Amp

FLEXIBILITY is only one of the outstanding features of the $89.95 Dynaco PAT-4 preamp ($129.95, assembled) and the $159.95 Stereo 120 power amplifier ($199.95, assembled). Unlike some integrated amplifiers, the Dynaco combination can handle just about any job demanded by a hi-fi enthusiast. In addition, construction options permit the *special* input jack to be used for such low-level sources as microphones and musical-instrument pickups.

Although the Stereo 120 and PAT-4 are separate units, we tested them as an integrated system as though there were no interconnecting cables.

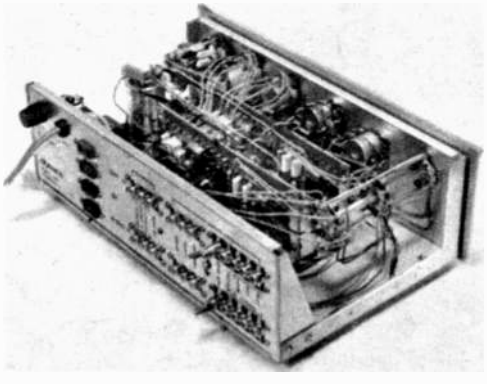
The PAT-4 has six switch-selected inputs: *tape head, phono, tape* (from tape-deck preamp), *tuner, spare* and *special.* Three pairs of phono jacks on the rear apron are equalized for a low-level magnetic cartridge, a ceramic cartridge and a high-level magnetic cartridge. The low- and high-level magnetic inputs are RIAA equalized. The *spare* input is just another high-level input and can be used as tuner or tape input. The *special* input normally is wired as a mike preamp and instructions are provided for its conversion to an additional phono or other low-level equalized input (tape head from a second tape deck).

Four pairs of outputs (three on the rear apron and one on the front panel) are provided on the PAT-4. The first, the usual tape output, comes before the volume and tone controls (which still function as part of the monitoring circuit, leaving your recording unaltered). The other three follow the controls and are in parallel. The first of these can be used when you want to equalize, filter or otherwise alter the signal being fed to the tape recorder.

The second feeds the headphone jack on the front panel. When a plug is inserted in the headphone jack, it automatically disconnects the final pair of outputs, silencing the speakers. To use the speakers and headphones simultaneously, you would feed the power amp from the first pair of output connectors.

Dyna doesn't save pennies, as do some manufacturers, by omitting a tape position on the input-selector switch, requiring the use of a tape-monitor switch for all tape playback. Having a tape position on the selector switch makes things easier. In addition, Dyna put a spring on the *monitor* rocker switch so it can't be left on inadvertently, disabling the other inputs. If you regularly monitor the output, Dyna will supply you with an unsprung switch. The PAT-4 doesn't have phase-reverse or channel-reverse switches.

Front-panel controls, in addition to the input selector, are *volume, balance* and dual-concentric *bass* and *treble.* Switches are *hi-filter, monitor (tape), loudness, lo filter, power* and *mono-stereo.*



Location of wires in preamp to controls, switches, rear-panel connectors is critical. However, manual doesn't say this until after you have wired.

Stereo 120 Power Amp

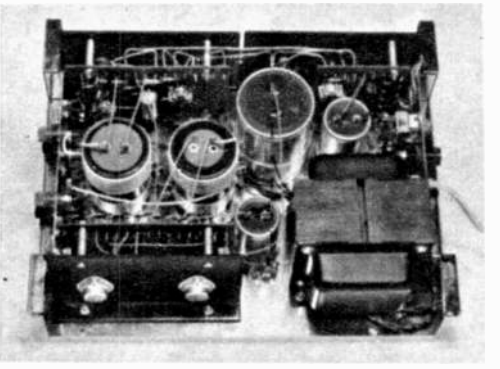
The *hi-filter* switch provides sharp high-frequency cutoff at 15, 10 and 7 kc. For example, when set to 7 kc to attenuate record scratch, the response is down 1.5db at 6 kc, 4.5db at 7 kc and 15db at 10 kc.

The *lo-filter* (for rumble) switch is similarly effective and the cut is 3.5db at 70 cps and 20db at 10 cps. The *loudness* control provides only bass boost—approximately 11db at 70 cps at 1-watt output.

Building the Kits. The PAT-4 uses printed-circuit boards. The usual care taken when soldering to circuit boards must be observed. There's plenty of space in the preamp.

One note of caution if you're used to manuals with built-in double-check procedures ("Before proceeding, recheck all steps from 3-12 onward."). Dyna doesn't coddle its builders that way. So work methodically and take the time to double-check anything that will be out of reach before you install a subassembly or circuit board.

Also, Dyna consistently tells you what to do and then how to do it. You'll avoid most problems if you read each step through before performing any of the operations called for. Be particularly careful about dressing wires (which affects stereo separation, for one thing). The manual only pins down the point after most of your connections have been made. Frequent looks at photograps of completed wiring should keep you out of trouble. Our construction time was about 20 hours.



Power amp (left, above). Output transistors for one channel are at lower left. Other channel's transistors are opposite at top. 3,300 μf electrolytics in between couple outputs to speakers.

Performance. With an 8-ohm load, the system delivered its rated 60 (rms) watts per channel (both channels driven) from 20 to 20,000 cps at no greater than 0.34 per cent THD (total harmonic distortion). With a 4-ohm load the maximum output power per channel at the verge of clipping (0.3 per cent THD) was 48 watts. It was 38 watts with a 16-ohm load.

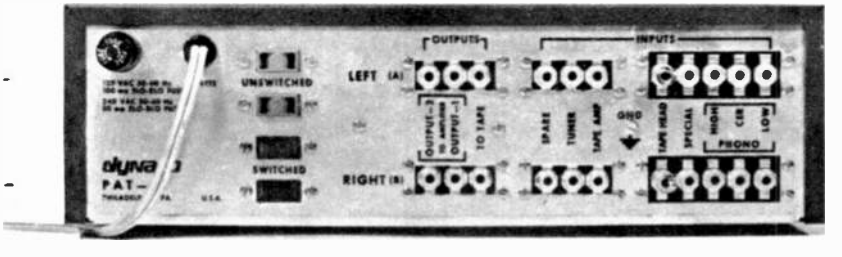
The input sensitivities for 60 watts into 8 ohms were as follows:

Tuner, tape, spare	*158 mv*
Magnetic cartridge	*4.2 mv*
Magnetic cartridge (high level)	*280 mv*
Ceramic cartridge	*150 mv*
Tape head	*2.5 mv*
Special	*3.2 mv*

Frequency response (at 1 watt) of the system—with the tone controls set to flat—was within +1.5db, −0.5db from 5 to 50,000 cps. The system is extraordinarily quiet—the magnetic-input noise level was better than 70db down.

The PAT-4's *output-1*, *output-2* and tape-output levels are 2 V (rms). The tone con-

[*Continued on page* 113]



Eleven pairs of input and output connectors take care of every requirement. Note two switched and two unswitched AC outlets. Circuit includes eight silicon transistors and two diodes.

6 good reasons to get into electronics:

1

2

3

4

5

6

Want more reasons? Read on...

A future? Electronics *is* the future. Build your career in a field that's growing this fast, and you should grow fast.

Security? When you're an electronics technician, you have the kind of security a man really wants: the knowledge that there now are more good jobs in your field than men to fill them.

Travel? Excitement? Advancement? Yes. Electronics has the good things you're looking for . . . and maybe even a few more that will surprise you.

Don't forget money. There's money in electronics. You can make a good living. And when it comes right down to it, that's what a career is all about.

What's the catch?

Just this: nobody can do it for you. You have to want to get into electronics. You can't become a highly-paid electronics technician by just saying a magic word.

It takes some work. But we can teach you what you need to know —in one of our schools—or at home, by mail. It's probably a lot easier and a lot faster than you think. Why not find out? Make the first move. Send in the post card . . . and make things start happening!

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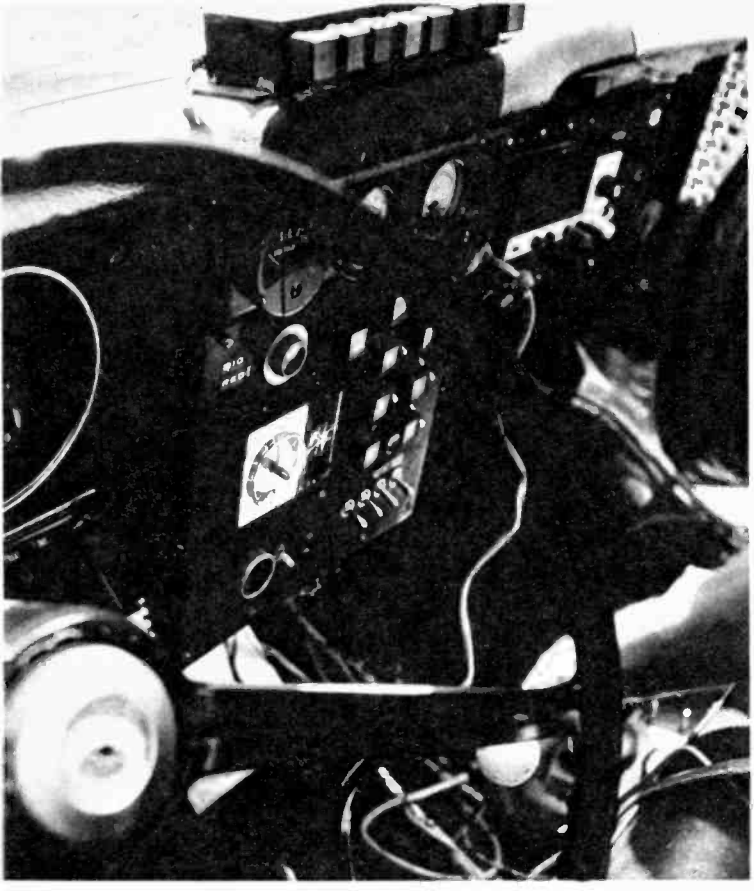
DE VRY INSTITUTE OF TECHNOLOGY
4141 BELMONT AVE., CHICAGO, ILL. 60641 DEPT. EI-1-Z

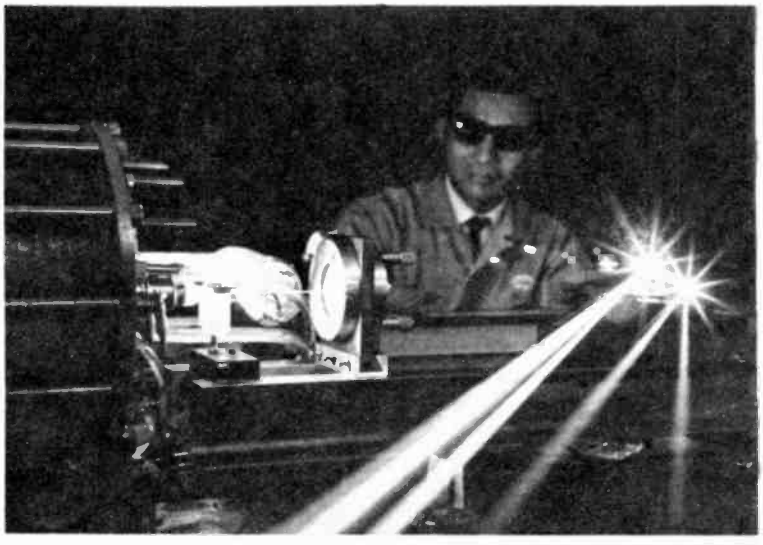
BELL & HOWELL SCHOOLS



ON YOUR MARKS . . . It all had a flavor of Jules Verne. There were two batches of college students—one from MIT in Cambridge, Mass. and one from Cal Tech in Pasadena —and each had designed an electric automobile for a transcontinental race to the other's campus. The control panel (dash is hardly the word) of the MIT entry is at left, mounted in a 1968 Chevrolet Corvair body equipped with a DC motor powered by Gulton nicad batteries. Cal Tech's design (dubbed a Voltwagen by one writer) used a Volkswagen bus body with cobalt-lead batteries and a similar motor. It won on a corrected time of 210 hr. 3 min. MIT's motor burned out 130 mi. short of Pasadena and they had to be towed the rest of the way, giving them a corrected time with penalties of 210 hr. 30 min., although they arrived first on elapsed time.

Electronics in the News

3-D Color TV? . . . Ever since the invention of the hologram daydreamers have been trying to figure out a laser scanning technique that would make possible some sort of 3-D TV whose moving image could be looked into and examined from various angles like a holographic image. Now Toshiba raises another possibility. Their argon and krypton lasers like the one shown here can emit a variety of frequencies, with particularly high outputs at four points in the spectrum—one each in blue, green, red and yellow—making color separation and color reproduction theoretically possible. Color holograms? Of course, says Toshiba. And color 3-D TV? Well, why not?



Highboy . . . "You're kidding," we said to the Estey publicity man when we saw this photograph. But the voice on the other end of the phone wasn't kidding. "We sell the Magnatone with the controls on the top, just like it is in the picture," he said. Then he went on with something about the whole concept being big—1,000 watts of power, two 15-in. woofers, two 15-in. passive radiators, 12 other speaker elements—but we weren't listening. We were trying to imagine what sort of customer looks down on a control panel 8 ft. above the floor. Perhaps if Roy Rogers stood on Trigger's back . . . "When we took the picture the kids were using the small control unit at the right," the publicity man offered, as though that explained it all.

New Bid . . . Chips can be made out of cards, says Westinghouse—not poker chips but semiconductor chips. To dramatize its point Westinghouse printed 100 transistors on this playing card. In production, many types of paper, plastic or metal foil stock might be used. Why do it that way? Well, would you believe disposable microcircuits, for example?

Hi-Fi Today

By John Milder

* Success Story

IF YOU haven't noticed it on your own yet, it's time to acknowledge that the Japanese have managed to penetrate as far in the audio-components business as they have in cameras.

Figures that mean something always are hard to come by. (Who was it that classified all falsehoods as lies, damn lies and statistics?) The ones you see most often may be weighted pretty heavily on the lo-fi side. But I'd be willing to bet that the total component and stereo tape-recorder business done by Japanese equipment in this country is close to the total for American manufacturers. That's not counting all the subassemblies sold to American manufacturers for use in domestic brands of audio gear. Here, particularly, it takes thorough research to determine the extent of Japanese involvement in the American market. If a big U.S. company like GE or RCA has a radio carrying its brand-name made in Japan, the radio should say just that somewhere on its case. But what American component-maker is going to announce: IF strip by Tokyo Rose & Co.?

Well, I'm not inclined to rake up any sweeping guff about that cheap Japanese stuff. In terms of quality, in fact, the Japanese have done well—coming close to equalling their own standards in photographic equipment. For a landmark product —one that had the same kind of impact as, say, Yashica in the moderate-price camera area—I'd have to single out the Sony 250 tape deck, which broke the market wide open. Not only is the 250 a pertinent product—a good-quality deck that sold (generally) for less than $150—but the level of uniformity was excellent.

A big help, undoubtedly, was the American importer of Sony recorders, Superscope. It instituted a thorough inspection and repacking program on incoming recorders. (Superscope also may have had a hand in deciding on the accessory and instruction materials—which still show a big lead in Sony equipment over the Japanese average.)

Then, of course, came the spate of ambitious and high-price Sony components. And, at the same time, Kenwood began establishing an excellent reputation with moderate-price and well-thought-out stereo receivers. Ironically for some American manufacturers who currently are decrying the Japanese invasion, the Kenwood receivers achieved an excellent following with dealers simply by working and working well at a time when many American transistor products were going up in smoke.

Finally, over the past few months, we've seen incredible growth, including the real arrival in audio of Panasonic (Sony's far bigger rival in Japan), Pioneer, Sansui, Japanese Victor (Nivico) and others.

Some interesting things are happening. One is that several of the Japanese brands are competing in the highest-price category, à la Nikon in the camera business. But an interesting difference is that new hi-fi entries (unlike cameras that have evolved through years of marketing experience in this country) seem to display a tendency to add extra features for their own sake—just to make the component different from those that preceded it into the marketplace. Electronic crossovers (which I discussed in detail in the Sept. '68 column) are a case in point. If the proliferation of gadgetry takes over from quality, reliability and simplicity of operation I don't think these manufacturers will be doing themselves or the rest of the hi-fi industry any good.

In the meantime, some American manufacturers seem to feel that they are doomed to die in a flood of Japanese equipment. Some even have pressured hi-fi magazines not to accept advertising from Japanese manufacturers. Now there's a real piece of positive thinking for you!

I can't help wondering, though, how the situation would be altered if that huge (and well-paid) reservoir of talent presently devoting itself to military and aero-space electronics in this country were to turn its energies to the hi-fi field. Japan, lacking those industries, can attract a much larger proportion of its engineers to consumer electronics. Maybe that's the key to Japanese success.

Build Your Own Ultrasonic Burglar Alarm

By HERB COHEN

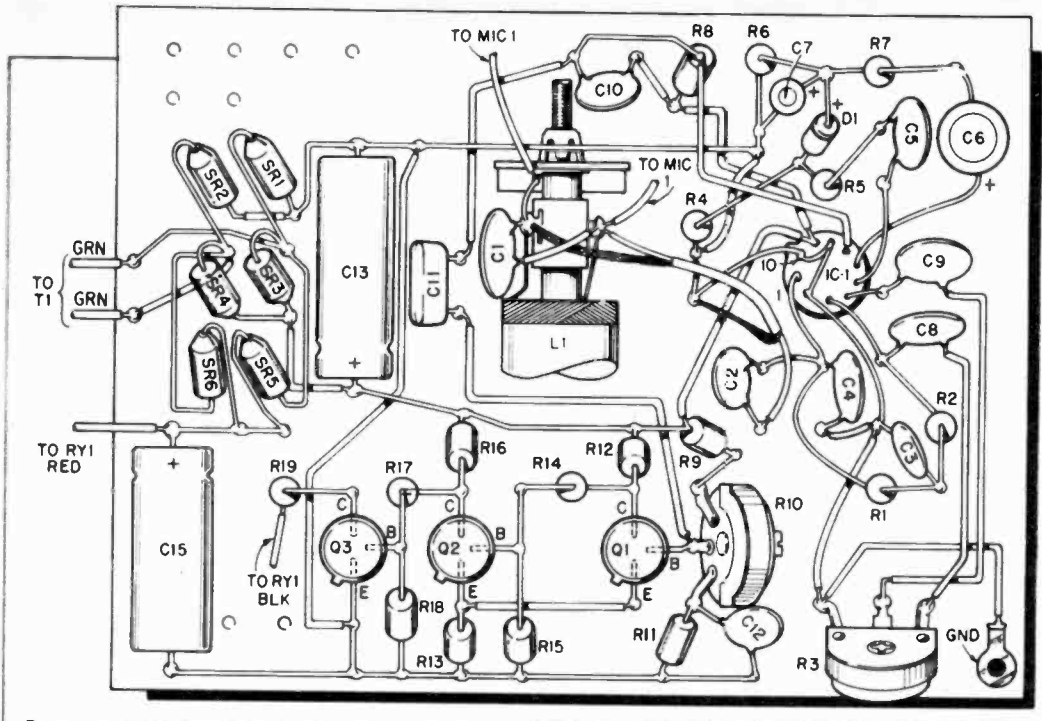
IT'S after midnight. The house is quiet. But trouble is lurking in the shadows. A burglar hiding in the shrubbery approaches a window and starts to open it. He looks carefully for switches, wire strung across the window sill and light beams. Not finding them, he starts to enter. The instant he sticks his hand inside an alarm goes off to alert you of the danger.

Inside a store a shoplifter hides during the day. After the store has closed he leaves his lair and starts for the jewelry counter. As soon as he moves an alarm goes off outside to summon the police.

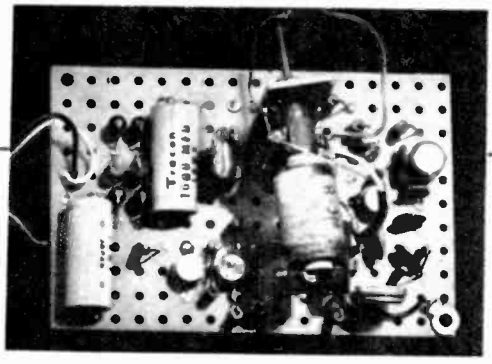
In your office a prowler intent on cracking the wall safe looks for the usual light beams, switches on the door jamb and wire strung across the room. Not seeing them he heads toward the safe. As he moves towards it an alarm goes off.

What is it that detects the person in each of these situations? It's an invisible spider web of silent sound coming from our ultrasonic burglar alarm system and it fills the room. Our alarm also can be used as a proximity detector or even a fire alarm.

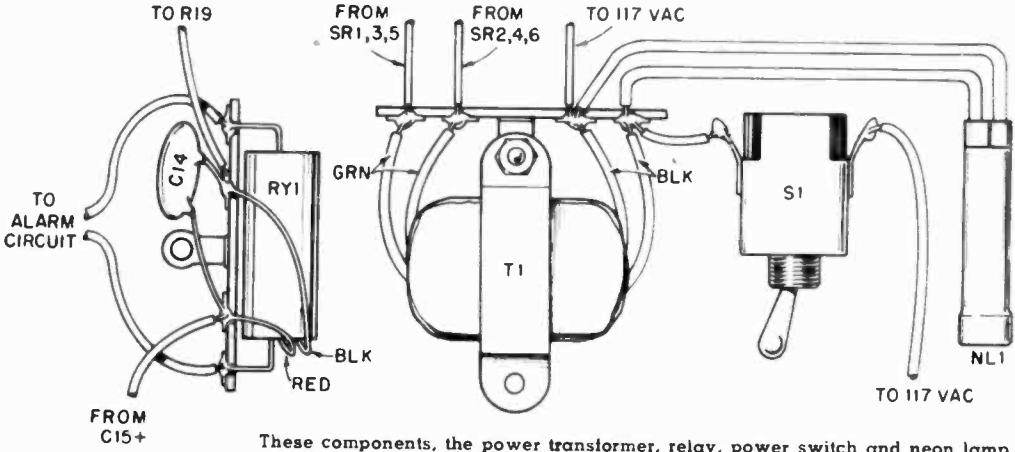
The system consists of a transmitter and a receiver. The transmitter sends out an ultrasonic sound which fills the room. Waves reflected by the walls, ceiling, floor and ob-



Receiver circuit board is 4 x 5 in. To conserve space, we mounted resistors on end rather than flat. In pictorial we show wiring on top of board; however, as you can see in photo below, wiring in our model is on rear of board.



Build Your Own Ultrasonic Burglar Alarm



These components, the power transformer, relay, power switch and neon lamp are mounted at the top of the main section of the Minibox as in photo at right.

jects are picked up by the receiver. Any phase or amplitude change in the reflection of the wave appears to the receiver as an amplitude modulation of the signal.

The receiver amplifies the signal and then demodulates it. A Schmitt trigger shapes the demodulated signal and feeds it to a relay driver amplifier, which actuates a small reed relay.

The alarm is sensitive enough to detect the air turbulence that is caused by fire. Connect an oscilloscope to the third-amplifier output (pin 7) of the IC, and you'll be able to see the effect of normal air currents in a perfectly quiet room. The receiver can cover a 120° arc and is sensitive enough to pick up an intruder at a 20-ft. distance.

How the System Works

The transmitter sends out a 17-kc ultrasonic signal which will saturate a small room. The receiver picks up not only the direct signal from the transmitter, but the waves that are reflected by walls, ceiling and other objects in the room. The many waves which have traveled different distances, have different phase relationships at the receiver. The receiver's microphone algebraically adds the amplitude and phase relationships of all the waves and produces a signal which the receiver sees as a single reflected wave.

If an object in the room moves, its reflected wave, as seen by the receiver, will change in amplitude and phase. The amplitude change depends on the position of the object in relation to the receiver and transmitter. The phase change depends on the speed of the object and the wavelength of the transmitted signal.

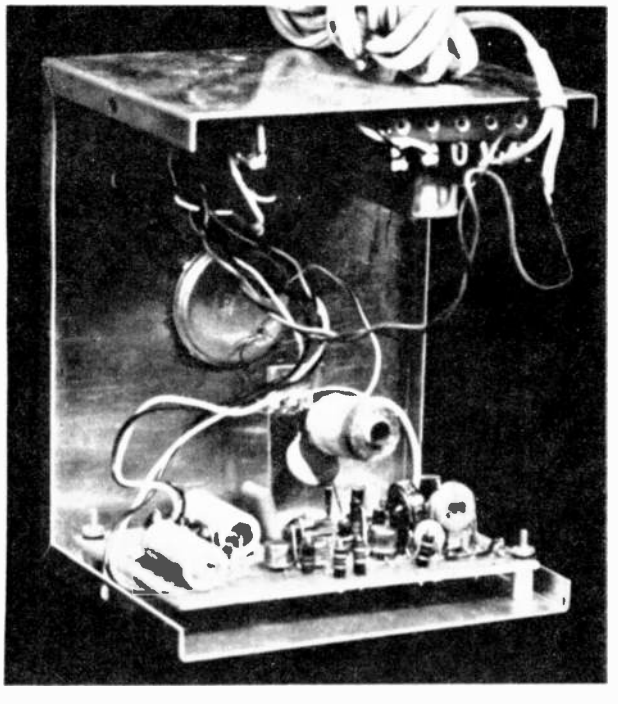
Since the wavelength of a 17-kc signal is about 0.8 in. an object moving at several feet-per-second toward the receiver, will cause phase reversals in its reflected wave at a rate of 30 to 50 cps. These phase reversals will alternately add to and subtract from the total received signal and appear to modulate the signal at a low audio rate.

Crystal mike MIC1 is tuned to 17 kc by L1 and C1. Capacitor C2 feeds the input signal to the first amplifier of IC1. The signal is amplified and the output at pin 3 goes to *sensitivity* pot R3. This pot determines the level of the signal which is sent to the second amplifier input at pin 4.

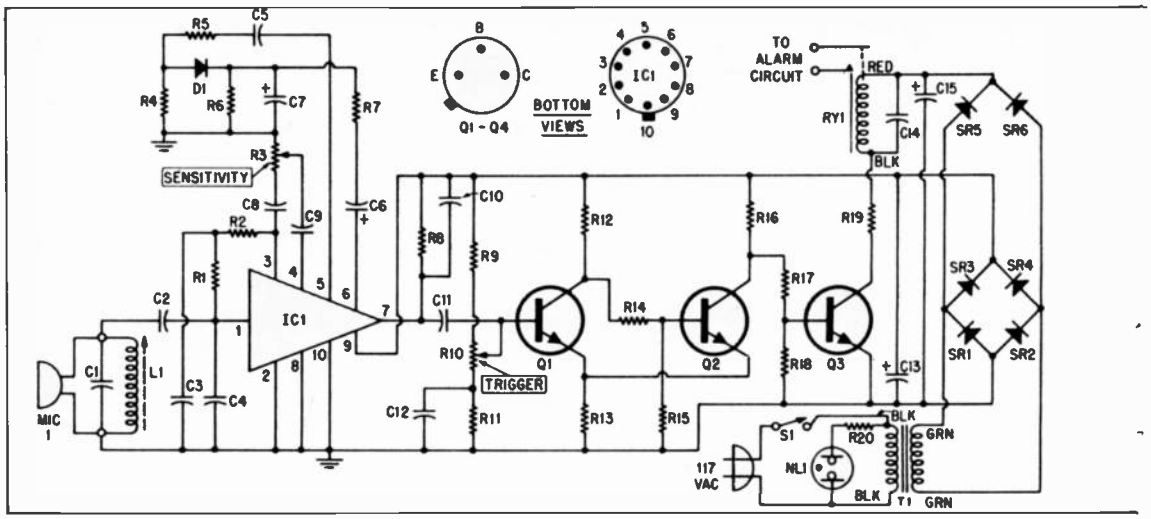
The output of the second amplifier is demodulated by D1. It is then filtered by C3, which also attenuates the high frequencies and noise in the modulation envelope. The third amplifier in the integrated circuit is used as a straight amplifier for the demodulated signal. The signal is then fed to the Schmitt trigger (Q1, Q2). Capacitors C4 and C10 are RF bypass capacitors. Potentiometer R10 is a trigger-level pot for the Schmitt trigger.

The Schmitt trigger, which is a regenerative switch, converts the demodulated signal into square waves which feed relay-driver Q3 and relay RY1. Relay RY1 is a reed relay which is used to control an external relay. It has a contact rating of 500 ma. An ordinary relay mounted in the same cabinet as MIC1 will, on closing, cause acoustic feedback and send the system into oscillation. The reed relay's contact closing is almost inaudible.

The transmitter is a standard emitter-coupled oscillator which is powered by a 9-V transistor-radio battery. Crystal microphone MIC2 is connected across the tank circuit. The efficiency of the oscillator and the transducer are so high that the battery drain is only 1.5 ma. This enables the battery to operate the transmitter continuously for one week without replacement



Rear view of receiver. Note how circuit board is mounted with ¼-in. spacers. Transformer and relay are installed in top of cabinet away from coil L1.



Output of IC1 is fed to Schmitt trigger (Q1,Q2) which converts demodulated signal into square waves that feed relay-driver transistor Q3. Q3 energizes reed relay RY1 which is used to control an external relay.

Build Your Own Ultrasonic Burglar Alarm

The transmitter can also be powered from the receiver power supply. Connect two wires across C15 and run them to the transmitter. At the transmitter install a decoupling network consisting of a 200-ohm resistor and a 200-μf capacitor.

Construction

The receiver was constructed on perforated circuit board and eyelets were used for mounting parts. This method proved much cheaper and quicker than using a home-brew printed-circuit board.

The CA3035 integrated circuit should be mounted in a 10-pin socket so you don't have to solder directly to the IC's leads. Transistor leads can be pushed through the eyelets and soldered. However, do not push the transistors flush to the board or the eyelets will short to the transistor case. Let the transistors sit about ⅛ in. above the board.

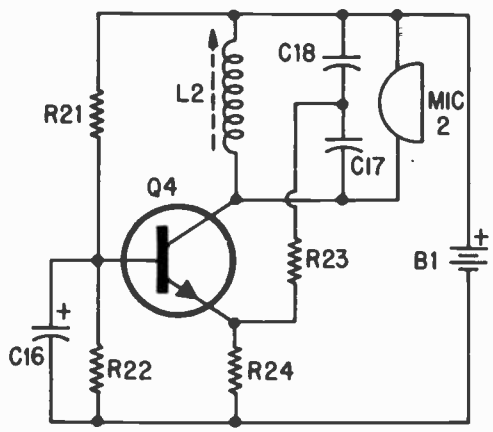
The circuitry layout is not critical, but try to duplicate ours. However, the position of L1 may be a bit touchy. Inductor L1 should be placed well away from the power transformer or it will pick up hum. Mount the microphones in the cabinets in 1⅜-in. dia. punched holes. Epoxy cement can be used to hold the mikes in place. The power-transformer secondary has a center-tap lead which is not used. It should be cut short and taped so it will not touch the cabinet.

Five-lug terminal strips, with center lug mounting, were used for the AC terminals and the relay connections. The relay itself is mounted by its contact leads. This means they should not be slack or the relay will have a tendency to vibrate when the contacts close and cause acoustic feedback.

Adjustments

To start with, turn on the receiver but disconnect the 9-V battery from the transmitter. Turn R3 counterclockwise for minimum sensitivity. Now turn R10 so that the relay closes. Back off on R10 so that the relay

Transmitter is emitter-coupled oscillator whose ultrasonic frequency is determined by L2. MIC2 is crystal mike. It works well as ultrasonic speaker.



PARTS LIST

B1—9 V battery
Capacitors: 50 V or higher unless otherwise indicated
C1,C17—.01 μf, ceramic disc
C2,C3,C5,C8,C9,C10,C14—.04 μf ceramic disc
C4—.005 μf ceramic disc
C6—100 μf, 6-V electrolytic
C7,C16—5 μf, 6-V electrolytic
C11—.25 μf ceramic disc
C12—.002 μf, ceramic disc
C13,C15—1,000 μf, 10-V electrolytic
C18—.1 μf ceramic disc
D1—1N34A diode
IC1—CA3035 integrated circuit (RCA)
L1,L2—1.5-10 mh adjustable width coil (J. W. Miller 6322, Lafayette 34 T 8852)
MIC1, MIC2—Crystal-microphone cartridge (Lafayette 99 T 4509)
NL1—NE-2 neon lamp and holder
Q1,Q2,Q3—2N696 transistor
Q4—2N2270 transistor
Resistors: ½ watt, 10% unless otherwise indicated
R1,R2,R20—100,000 ohms
R3—2,000 ohm linear-taper potentiometer (Mallory Minitrol MTC-23L1, Lafayette 33 T 1645 or equiv.)
R4,R5—5,600 ohms, 5%
R6,R14,R21—10,000 ohms, 5% R7—680 ohms
R8,R16—3,000 ohms, 5% R9—62,000 ohms, 5%
R10—5,000 ohm, linear-taper potentiometer (Mallory Minitrol MTC-53L1, Lafayette 33 T 1647 or equiv.)
R11—6,800 ohms R12—5,000 ohms, 5%
R13—330 ohms R15—2,700 ohms
R17—2,200 ohms, 5%
R18,R22—1,000 ohms, 5%
R19,R24—100 ohms R23—510 ohms, 5%
RY1—SPST (normally-open contacts) miniature (1 in. long x 7/16 in. dia.) reed relay. Coil: 250 ohms, 40 ma. Avaliable for $4.95 (postage included) from Round Hill Associates, Inc., 325 Hudson St., New York, N.Y.
S1—SPST switch
SR1-SR6—Silicon rectifier; minimum ratings: 750 ma, 50 PIV
T1—Filament transformer, secondary 6.3 V @ 0.6A
Misc.—Perforated circuit board, flea clips, 5 x 2¼ x 2¼-in. Minibox, 6 x 5 x 4-in. Minibox, integrated-circuit socket (Cinch-Jones 10-ICS)

opens again. The Schmitt trigger is now set just below its threshold. If RY1 closes unpredictably, back off on R10 a bit until the relay is just into its stable *off* position.

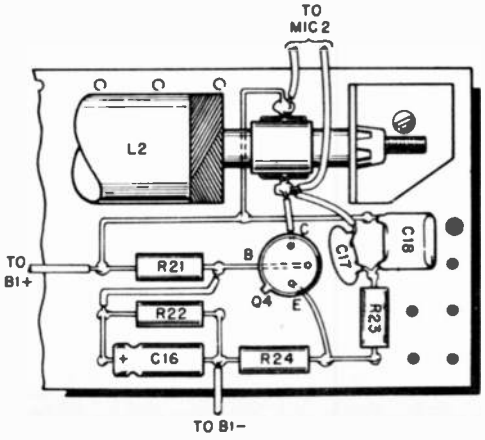
Next, connect a scope from pin 5 of IC1 to ground and slowly turn R3 clockwise toward maximum. If oscillation breaks out connect a 200-ohm resistor across R3. If the 200-ohm resistor does not stop the oscillation, back off on R3 until the oscillation stops. Now connect the scope to the junction of R5/C5 and ground. The transmitter should be about 10 ft. from the receiver. Fire up the transmitter and observe the pattern on the scope. Next, adjust the core of L2 on the transmitter until the pitch of the sound is beyond the range of your hearing. To our ears the frequency was about 17 kc. If the waveform is saturated (flattened at the top and bottom) back off on R3 until the waveform is clean. Now adjust L1 for maximum signal and back off on R3 if the signal saturates.

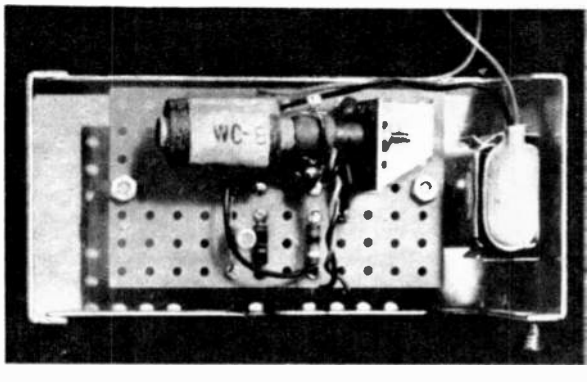
A final adjustment should be made with the transmitter in its more-or-less permanent location. If used to detect the opening of a door, the transmitter should face the door and be about 4 ft. from the receiver.

The receiver should also face the door, and all final adjustments should be made from the rear of the receiver, so as not to block the mike. Adjust R3 so that the waveform is saturated. Now back off on R3 until the peak-to-peak signal voltage is half the saturated voltage.

[*Continued on page* 113]

Layout of transmitter's parts on 2 x 3-in. piece of perforated board is not critical. Bracket holding L2 is made from a piece of scrap aluminum.





Transmitter. Parts placement differs a bit from that in pictorial, but it isn't important. Mount board in main section of Minibox with ¼-in. spacers.

The Private War of Color TV

By VERNON SIMMS

IN Galveston, Texas, a TV viewer sees the peacock spread a tinted tail. In Osaka, a Japanese watches Kabuki in color. Up in Saskatchewan, a Canadian sees multihued hockey. Though the three viewers live at the corners of a global triangle they could swap television sets and still receive pictures. Their receivers might be Motorola, Marconi or Matsushita, thanks to a common set of standards for color TV. That's hardly true for the rest of the world.

In an international brouhaha now dragging on, some 70 nations are forsaking the U.S. lead in search of a color-TV system that, they hope, will be better. Failure of the world to adopt a single system wrecks the dream of a common (and therefore simple) method for live colorcasting via satellite. And it might close markets to U.S. equipment.

The color controversy boils down to three basic systems: American (NTSC), French (SECAM) and German (PAL). As our chart below shows, the U.S. has won over five other nations, the French system about 30 and the German about 15. Those allegiances are far from final because commercial colorcasting overseas is in its infancy and must be regarded as largely experimental.

NTSC. The letters identifying the American system represent National Television Systems Committee, the industry group that ended this country's battle over color just after the Korean War. The NTSC color receiver, say economists, is the single most successful electronic product ever to enter the American home.

European engineers also pay tribute. Although their systems seem like a horse of another color, NTSC is universally credited with solving most of color's technical problems. So a look at French and German color systems really begins with their similarities to NTSC. (A detailed NTSC explanation appears in our series The ABCs of Color TV—EI, Jan.-Sept. '67.)

The NTSC system, like the others, exploits the principle of breaking down a scene into component amounts of red, blue, and green light. Separate tubes in the camera derive separate red, blue and green voltages. In the receiver's color picture tube the process is reversed. Color voltages are converted into glowing hues. (Each system can operate on the shadowmask tube used in American sets.)

All systems use the same method to supply a compatible signal to B&W receivers. Before

INTERNATIONAL ALIGNMENTS IN THE COLOR-TV WAR

NTSC (American)	SECAM (French)			PAL (German)
Canada	Algeria	Gabon	Niger	Austria
China (Formosa)	Bulgaria	Greece	Poland	Brazil
Ecuador	Cameroon	Hungary	Portugal	Denmark
Japan	Central African Rep.	Ivory Coast	Romania	Finland
U.S.A.	Colombia	Lebanon	Senegal	Germany (West)
Saudi Arabia	Congo (Brazzav.)	Malagasy Rep.	Togolese Rep.	Iceland
	Cuba	Mali	Tunisia	Ireland
	Czechoslovakia	Mauritania	Upper Volta	Lichenstein
	Dahomey	Monaco	USSR	Netherlands
	France	Mongolia	Yugoslavia	New Zealand
				Norway
				South Africa
				Sweden
				Switzerland
				United Kingdom

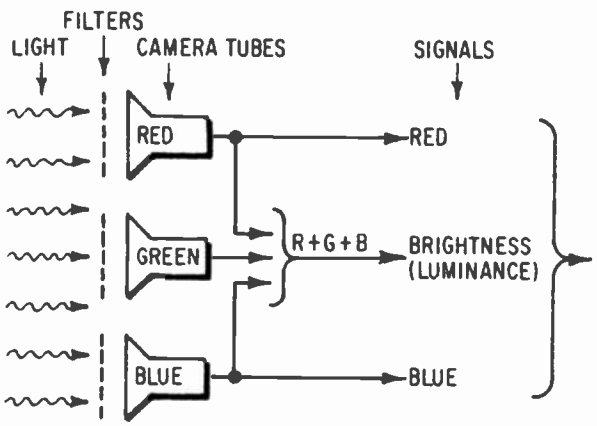
(Only a few countries (U.S., Canada, Japan, U.K., Germany, France, for example) are on the air with regular color broadcasts. Russian NIR, standing for initials of a technical group, is a system derived from SECAM but differing in some ways from French system.

transmission, part of the red, blue and green voltages are combined and transmitted as an overall brightness signal. This mixture is received by a B&W set as a conventional monochrome telecast.

Next, all systems eliminate the color green as a separate signal. Since it's already hidden in the brightness signal (red + blue + *green*), the color receiver can trap green by performing simple electronic math; red and blue are subtracted from the brightness signal, leaving green.

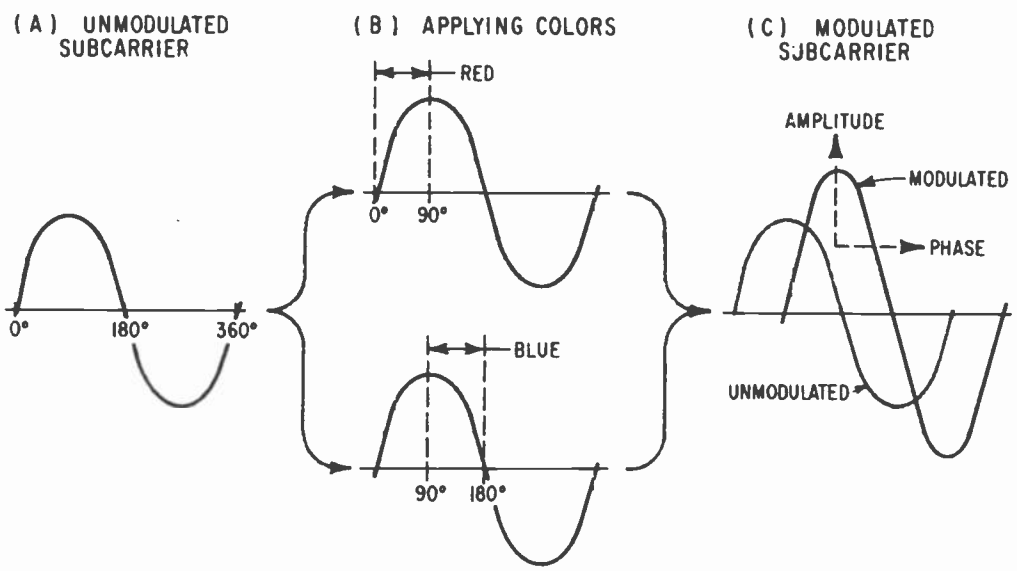
Finally, there's the task of transmitting red and blue as separate entities. To keep color pure, these hues must neither mix in transmission nor interfere with the brightness signal. Everyone agrees it must be done with a color subcarrier. This is an additional frequency (3.58 mc in the U.S.) that can mesh with the brightness signal and leave it undisturbed. Riding the subcarrier, color interleaves with the brightness signal as neatly as upper and lower teeth on a jack-o'-lantern.

The great debate centers around how colors should be modulated onto the subcarrier. The NTSC subcarrier begins as a steady signal on 3.58 mc. How it is modulated by red and blue is shown in the diagram below. The first quarter of the subcarrier cycle—or 90°—is reserved for the red signal. The second quarter-cycle is occupied by blue. When the two modulated carriers are combined, the result is a 3.58-mc wave that twists in two directions simultaneously (phase and amplitude). The modulating process produces a complex waveform but it can be reduced to



All color-TV systems begin with the NTSC concepts at left. Separate camera tubes generate the three color signals. Brightness signal combines all three and also provides the B&W picture signal. Red and blue signals are used to modulate a subcarrier (using different methods in the three systems). Green rides the brightness signal and is separated and recreated electronically in the receiver.

NTSC applies color information (below) to a 3.58-mc subcarrier (A). Red modulates first quarter-cycle, blue the second (B). The result is a combination of phase modulation (representing hue) and amplitude modulation (representing saturation) of subcarrier (C



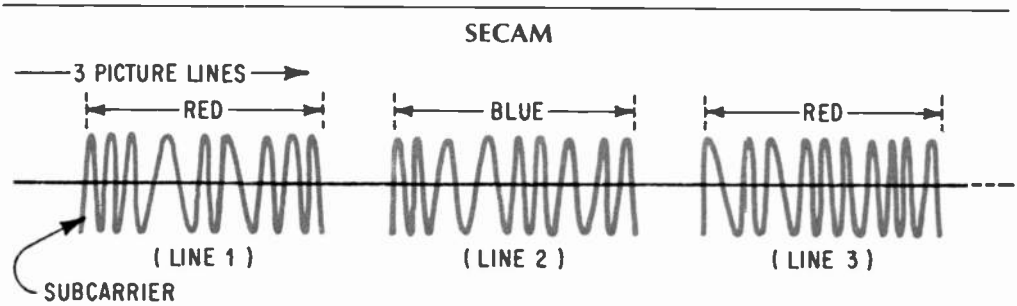
The Private War of Color TV

the concept that, for any given instant, the shape of the subcarrier is determined by the two color signals.

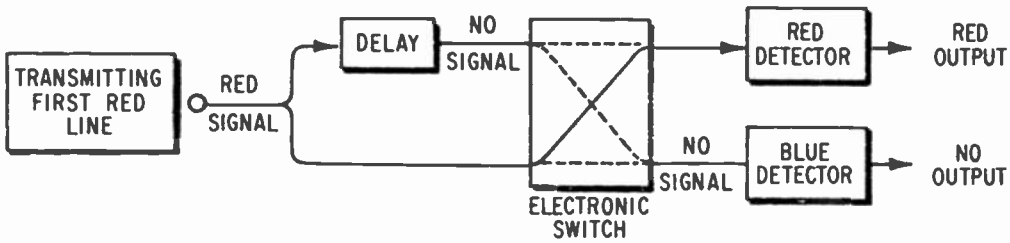
The receiver removes color signals from the carrier by reversing the process. A local oscillator in the receiver provides an accurate carrier-phase reference. As changing color shifts the subcarrier, the receiver senses and compares these changes in phase and converts them into color voltages similar to those originally generated in the TV camera.

Red and blue are so intimately woven into —and balanced on—the subcarrier, that small phase disturbances cause serious color error on the screen. That's the reason for color control knobs on NTSC sets. For example, if a red is jostled forward in phase it becomes purplish. As this happens it also disturbs blue's position on the wave.

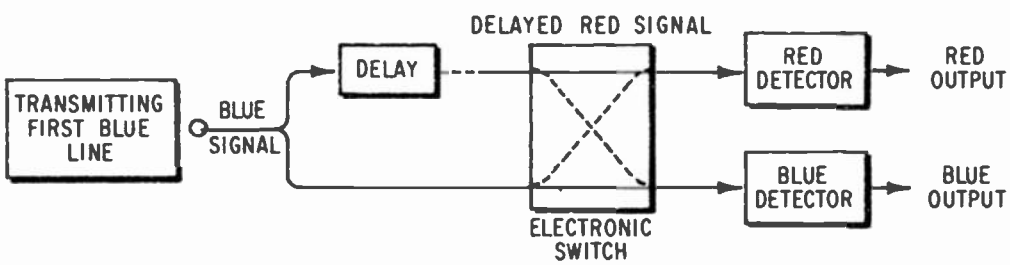
Phase can be shifted by multipath or through a poorly matched lead-in wire as waves bounce in the wrong direction. But, for European use, one of the severest threats to an NTSC signal is network operations. As in this country, Europe's TV signals are dis-



In SECAM system, the color subcarrier is frequency modulated (to resist phase distortion) with red and blue taking turns modulating alternate picture lines. This separation reduces mixing of the two color signals.



Since only one color is present in each line of a sequential-system picture the other color must be supplied to that line by a delay. Incoming color is fed to both detector and delay which stalls it for the precise time it takes to transmit that line, releases it as the other color comes in on the subsequent line.



A synchronized switching unit distributes the color signals to their appropriate detectors. In the bottom drawing, the blue signal is fed directly to the blue detector while red goes from delay to red detector. On the following line the switch will reverse, feeding blue from the delay, red from the incoming signal.

tributed through miles of coaxial cable and microwave links to local stations before telecasting to home receivers. The European system simply isn't good enough to handle the tight phase requirements of NTSC.

It's estimated that signal errors of 5°—more than results from thousands of miles of U.S. network links—cause a noticeable change in color on the screen. But Europeans estimate that, in their network, equipment error can mount to nearly 30°. That's the problem that is attacked by European color-TV techniques.

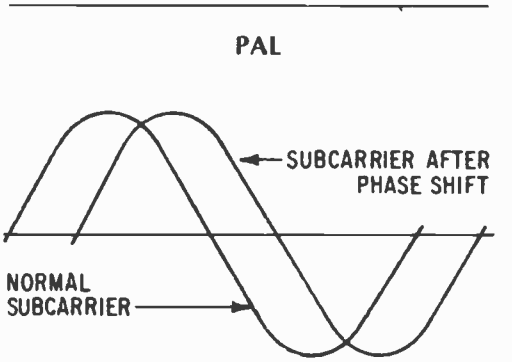
SECAM. Meaning Sequence and Memory, this is the French answer to NTSC. SECAM abandons the idea of transmitting both red and blue simultaneously. Red is transmitted during one line of picture information, followed by a line of blue, then red and so on —a so-called line-sequential system, as opposed to the simultaneous NTSC arrangement. To apply red and blue to its subcarrier, SECAM uses frequency (not phase) modulation. FM is resistant to phase changes.

Since SECAM transmits each color half the time (every other line) is must convert red and blue to full-time (simultaneous) operation to decode green from the brightness signal. This is done by the memory aspect of SECAM. A delay line electronically holds, then releases each color to fill in every alternate line. The overall effect is to double red and blue signals in the receiver.

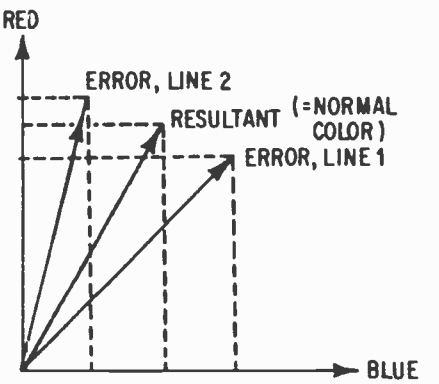
It also reduces SECAM's color fidelity. In sending red and blue alternately the number of lines bearing color information is cut in half and so is color definition in the vertical direction. It's claimed that the image suffers little despite repeating color lines because the human eye doesn't discern small color differences as easily as small brightness differences.

Aside from the ruggedness of SECAM's color signals it has the advantage of dispensing with color controls knobs found on NTSC receivers.

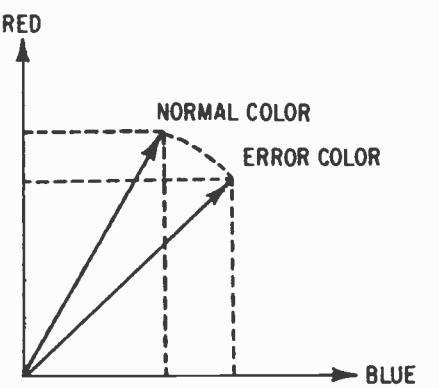
PAL. The German system's name means Phase Alternation Line. Like SECAM, it attempts to eliminate NTSC's susceptibility to phase shifts by a special approach to color modulation. PAL is very close to NTSC—green is hidden in the B&W signal during transmission, blues and reds are applied to a subcarrier in basic NTSC fashion. The difference, however, is an extra twist PAL gives to the red signal. Red causes the most visible trouble if there is phase error. So, as we'll



PAL is similar to NTSC in applying red and blue to the subcarrier. The drawings suppose there is a phase distortion to show how PAL will handle it.



The phase error shown above would drive red toward blue, changing the color on the screen. Note how red and blue color components are altered.



By reversing phase of red signal in alternate lines, PAL system alternates the phase direction of the error. Average between the two corrects the color.

The Private War of Color TV

see, when a phase disturbance strikes red the error is reversed to cancel itself out. It's reminiscent of negative feedback in hi-fi amplifiers.

We know that during one picture line of an NTSC signal, red and blue occupy a certain portion of each cycle on the subcarrier. In a PAL transmission, the red signal is completely flipped around by 180° on the subcarrier for every other picture line. The receiver similarly switches its detector circuits 180° for alternate lines. The net effect is that red continuously reverses during transmission but ends up as a conventional NTSC signal after detection in the receiver.

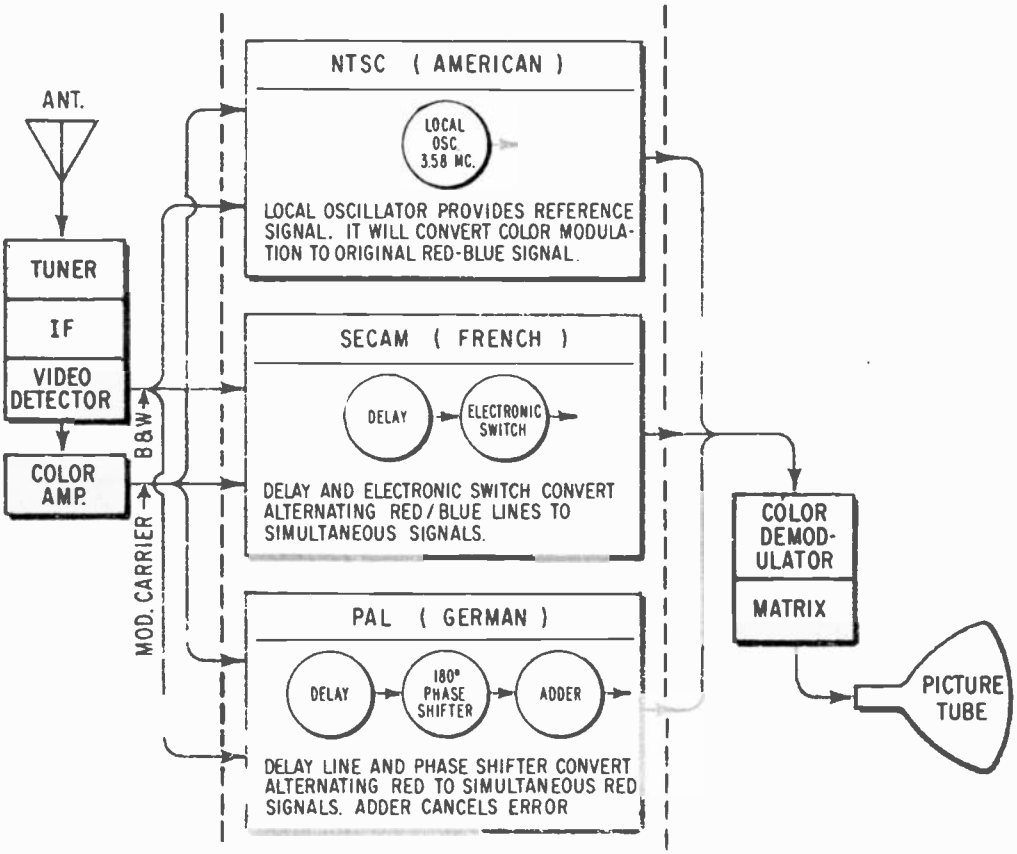
Let's say the PAL signal is jostled by a phase disturbance that pushes red several degrees farther along the subcarrier. The red will appear on the screen incorrectly as a purplish hue. When the next line down appears on the screen the phase disturbance will push red in the opposite direction—toward orange. That's because red now is being sent in reverse. The same disturbance drives the red signal backwards in phase by the same number of degrees. So the error produces lines that alternate between purplish-red and orange-red. To the human eye, though, the lines merge and give the illusion of red—the true signal.

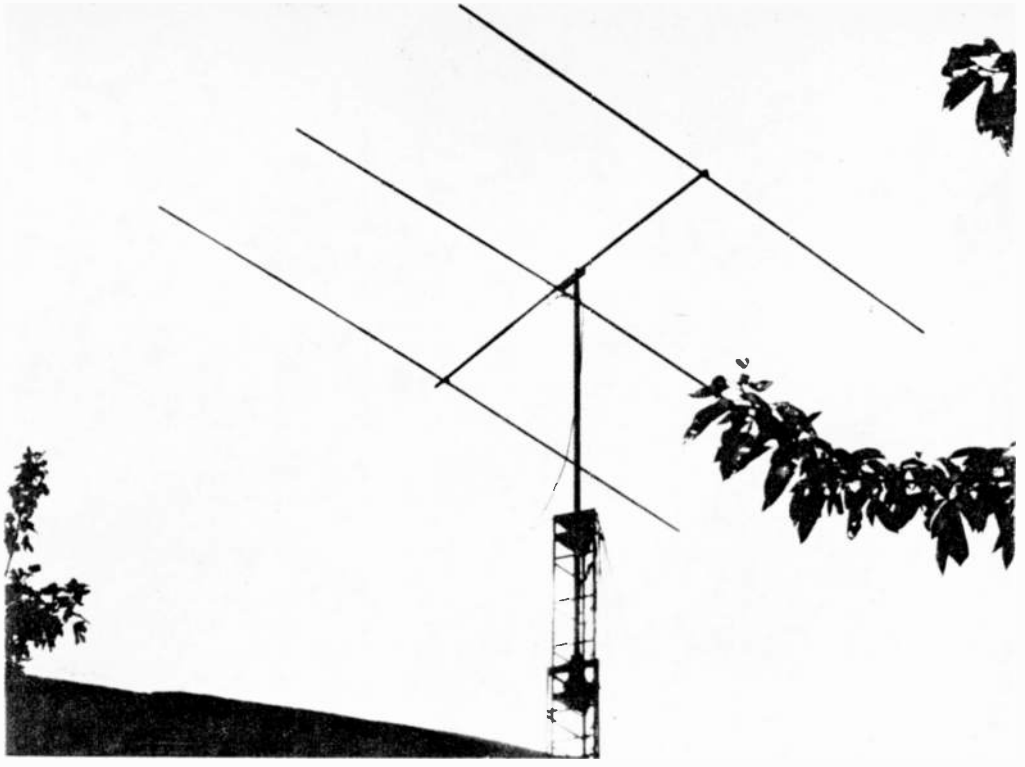
Early PAL, in fact, used the eye as the mixing device to average the color error. In today's sets, signal mixing is done electronically before color reaches the screen. It re-

[*Continued on page* 111]

HOW THE THREE COLOR RECEIVERS DIFFER

The major differences between NTSC, SECAM and PAL occur in the color decoding circuits. Shaded areas are similar in all of the three systems. (Audio is similar but some countries use AM rather than FM signal.)





$10 Beam Antenna for 10 Meters

By RONALD LUMACHI WB2CQM

AFTER several years in the doldrums, 10 meters now is buzzing with activity. One sure way to get in on the action is to use a skyhook which is tuned to the center of things and has some gain to boot.

A dipole, the mainstay of antennas because of its simplicity and low cost, might be the first antenna you'd think of stringing up. However, it has only a moderate amount of directivity and has no gain (it is the reference on which the gain of other antennas is based). A two- or three-element array excited by a dipole and rotated is a better choice.

Such an antenna is our three-element 10-meter beam (Yagi). Costing about $10, its gain is 5 to 6db and spurious-signal rejection at sides and rear is about 30db and 35db, respectively.

The Driven Dipole. Our beam consists of driven-dipole, reflector and director elements. The key to success of any antenna system is the means by which RF is transferred from the transmitter (and transmission line) to the antenna (and free space) with a minimum of loss. The matching technique used in our array results in the transfer of almost all of the power.

Construction. Prepare an 8-ft. 5½-in. length of RG8/U coax (if your input power is less than 400 watts, you can use RG58/U coax) in the following manner: At the center (4 ft 2¾ in.) carefully cut through the outer jacket with a sharp knife. Make additional cuts in the jacket 3½ in. each side of the center. Be careful making these cuts because the braided shield must not be cut. Peel away the jacket to expose the shield.

At the center of the coax, carefully cut through the shield with a scissors. Be sure you don't cut the dielectric. Unbraid the shield from the center toward the sides, twist the shield and tin it. Cut off about 1 in. of each length of shield and install solder lugs on each end as shown in Fig. 2.

At each end of the coax, remove ½ in. of the jacket, peel back the shield and cut off about ¼ in. of the dielectric. Do not cut the inner conductor short.

Twist the shield around the center con-

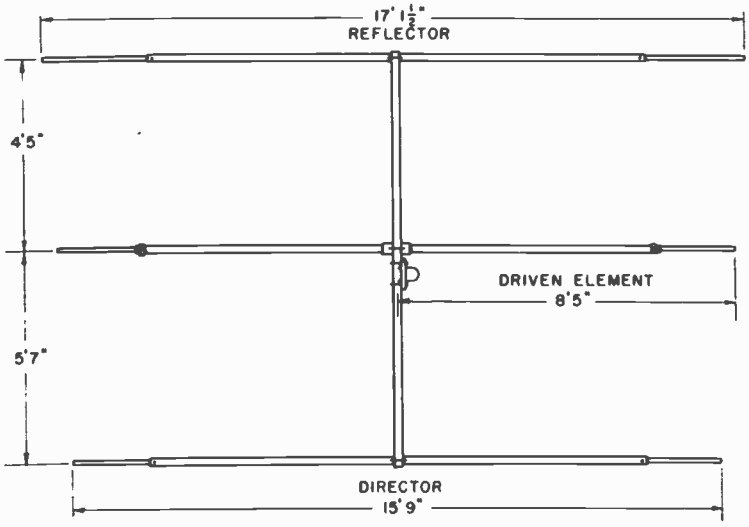


Fig. 1—Dimensions of 10-meter beam. Main section of reflector, driven element and director are 12-ft. lengths of 1¼-in. o.d. aluminum tubing. Lengths of ⅞-in. o.d. tubing are fitted in ends to extend elements to lengths indicated. Reflector and director are one piece. Driven element is two pieces joined with wood support as shown in Fig. 3.

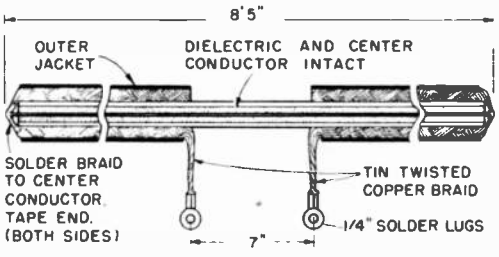
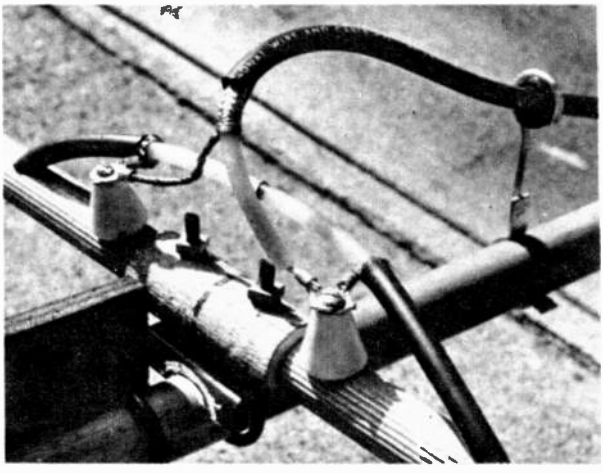


Fig. 2—Remove 7-in. of outer jacket from center of 8-ft. 5½-in. length of coax. Cut braid at center, twist, tin and attach solder lugs. Don't cut into dielectric. At each end solder braid to center conductor then cover ends with tape. Take prepared wire and slip it into elliptical holes in driven element as shown at right. Signal is inductively coupled from the coax to the tubing.



$10 Beam Antenna

ductor and apply a generous amount of solder to insure a good electrical connection. Tape the ends carefully so no wire is exposed. Set the coax aside; it will be installed later.

The three antenna elements are each made from 12-ft. lengths of 1-in.-dia. aluminum tubing which are extended to the dimensions in Fig. 1 with short telescoped lengths of ⅞-in.-dia. tubing. Make the measurements between the elements from the center of the tubing to insure both electrical and mechanical balance. The dimensions will resonate the

MATERIALS

1—10-ft. TV mast; 1¼-in. o.d., 18-gauge steel
*3—12-ft. lengths 1-in. o.d. aluminum tubing, 0.058-in. wall thickness
*1½—12-ft. lengths ⅞-in. o.d. aluminum tubing, 0.058-in. wall thickness
9-ft. length RG8/U or RG58/U coax (see text)
7—mast clamps (Lafayette 18 T 0195)
2—solder lugs
4½ x 9 x ½-in. thick exterior-grade plywood
12—No. 6 x ⅜-in. self-tapping screws
12-in. length 1¼-in. wood dowel
2—1-in.-high cone insulators (Lafayette 33 T 3213 or equiv.)
2—No. 6 x 1¼-in. screws, nuts, lockwashers
2—1¼-in.-dia. stainless-steel hose clamps
*Available for $2 per 12-ft. length (freight charges collect) from Gotham Antenna, 1805 Purdy Ave., Miami Beach, Fla. 33139

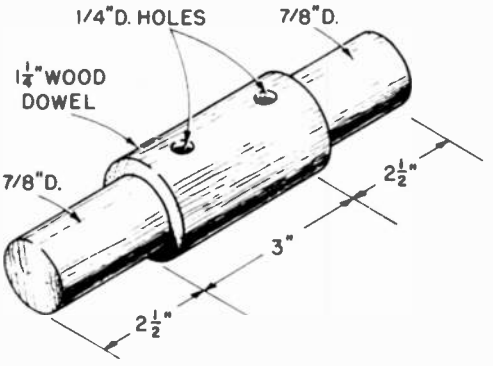


Fig. 3—Driven-element insulator is made from an 8-in. length of 1¼-in.-dia. wood dowel. Machine screws hold each element on ⅞-in. dia. ends.

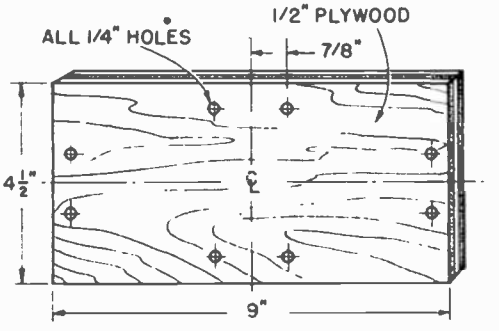


Fig. 4—The boom/mast mount is made from a 4½ x 9 x ½-in. thick piece of exterior-grade plywood. Boom is attached on one side, mast on the other.

antenna around 28.6 mc. depending on your installation.

When installing the end pieces, insert about 4 to 5 in. of ⅞-in. tubing in the 1-in. tubing for added strength. On the director and reflector elements drill a small hole through both sections and secure the extensions with stainless-steel self-tapping screws.

At each end of the 12-ft. driven element, cut several 1½-in. lengthwise slits. Place hose clamps over the ends (Fig. 5, center), adjust to the dimensions in Fig. 2 and tighten the clamps. Seven-eighths of an in. each side of the center of the driven element, reflector and director elements, drill a ¼-in. hole for the U-shaped mast clamp. The reflector and director elements are attached to the boom using the clamp arrangement shown in Fig. 5 (right).

Cut the driven element exactly in half. To insulate the two halves of the driven element from the mast, it is necessary to make a combination insulator and support. If a lathe is available, turn down the ends of an 8-in.-long x 1¼-in. dia. wood dowel to the dimensions in Fig. 4. Drill ¼-in. holes in the wood support for the mast clamp.

Six in. from the inside ends of the driven elements, drill a ⅜-in. hole through *one* wall of the tubing. Elongate the opening along the tubing length by manipulating the drill to accept the coax as shown in the photo in Fig. 2. File smooth the edges of the holes. Drill No. 6 holes through the tubing and dowel and mount the two porcelain insulators as shown in Fig. 2.

A standard 10-ft. steel TV mast is ideal for the boom and is readily available. The mast/boom support is made from a 4½ x 9 x ½-in. thick piece of exterior-grade plywood as shown in Fig. 4. Spray the wood with a paint or preservative to prevent weathering.

Assemble the beam on the ground being careful that all elements are parallel. Tighten

[*Continued on page* 119]

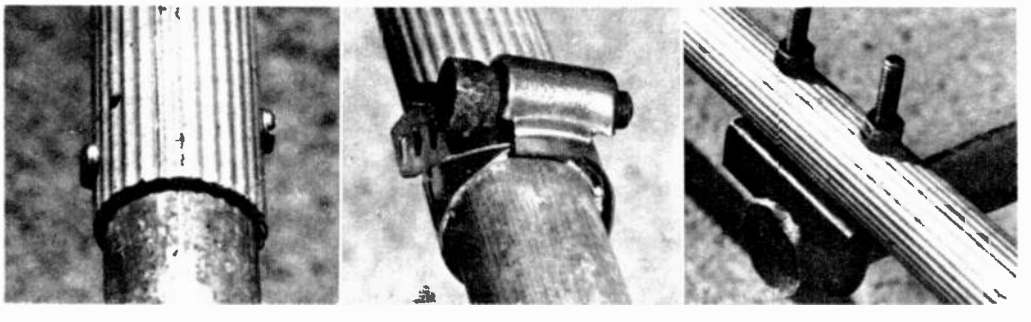


Fig. 5—Use self-tapping screws (left) to attach extensions to director and reflector elements. Hose clamps (center) permit driven element's ends to be adjusted easily. Reflector's and director's boom clamp (right).

DXing the Top of the World

By ALEX BOWER

PROVIDING adequate radio coverage in the Arctic presents broadcasting with one of its toughest technical challenges. Proximity to the earth's magnetic pole means BCB signals don't travel far because of increased absorption, while short-wave transmissions are unreliable. And these problems are considerably more acute during periods of high sunspot activity, such as we now have.

Except for a few of the larger centers, such as Aklavik (CHAK, 860 kc), Whitehorse (CFYK, 1340 kc) and the U.S. Air Force base at Thule, Greenland (AFRTS, 1425 kc, which has been logged by U.S. DXers) the North American Arctic is served only by CBC transmissions from Sackville, New Brunswick. But even this service may be curtailed by the Canadian government.

Efforts by local citizens to obtain licenses for broadcast stations have not been successful up to now. A group at Baker Lake began negotiations with Ottawa in June '66 and still is without a station. The result is that several unlicensed stations sprang up, the best known being Inuit Neepingit (Voice of the Eskimo) at Pond Inlet, Baffin Island. It operated in the 75-meter amateur band nightly at 1900-2300 EST on 3750 kc with 100 watts.

Until recently these operations had been tolerated by the government as long as they didn't cause interference to regular communications. But then Arctic broadcasting became a national issue in Canada and Inuit Neepingit was ordered off the air. It took intervention of a member of Parliament (Robert Orange of the Northwest Territories) before the CBC loaned IN a 20-watt BCB transmitter and it was granted a pilot-project license, a ticket issued by the Dept. of Transport for experimental work.

For its size and nature, IN boasts a pretty fair compliment of equipment, including a communications receiver, two tape recorders (for rebroadcast of the CBC's Northern Service when conditions permit), a library consisting of 4,000 records and tapes and even a standby transmitter (now banned). Although using 100 watts, the station served an area bounded by Thule and Alert on the North and well into the Northwest Territories to the Southwest.

Similar irregular stations reportedly had sprung up at Cape Dorset, Clyde and Pangnirtung, which are more or less within the area formerly covered by Inuit Neepingit.

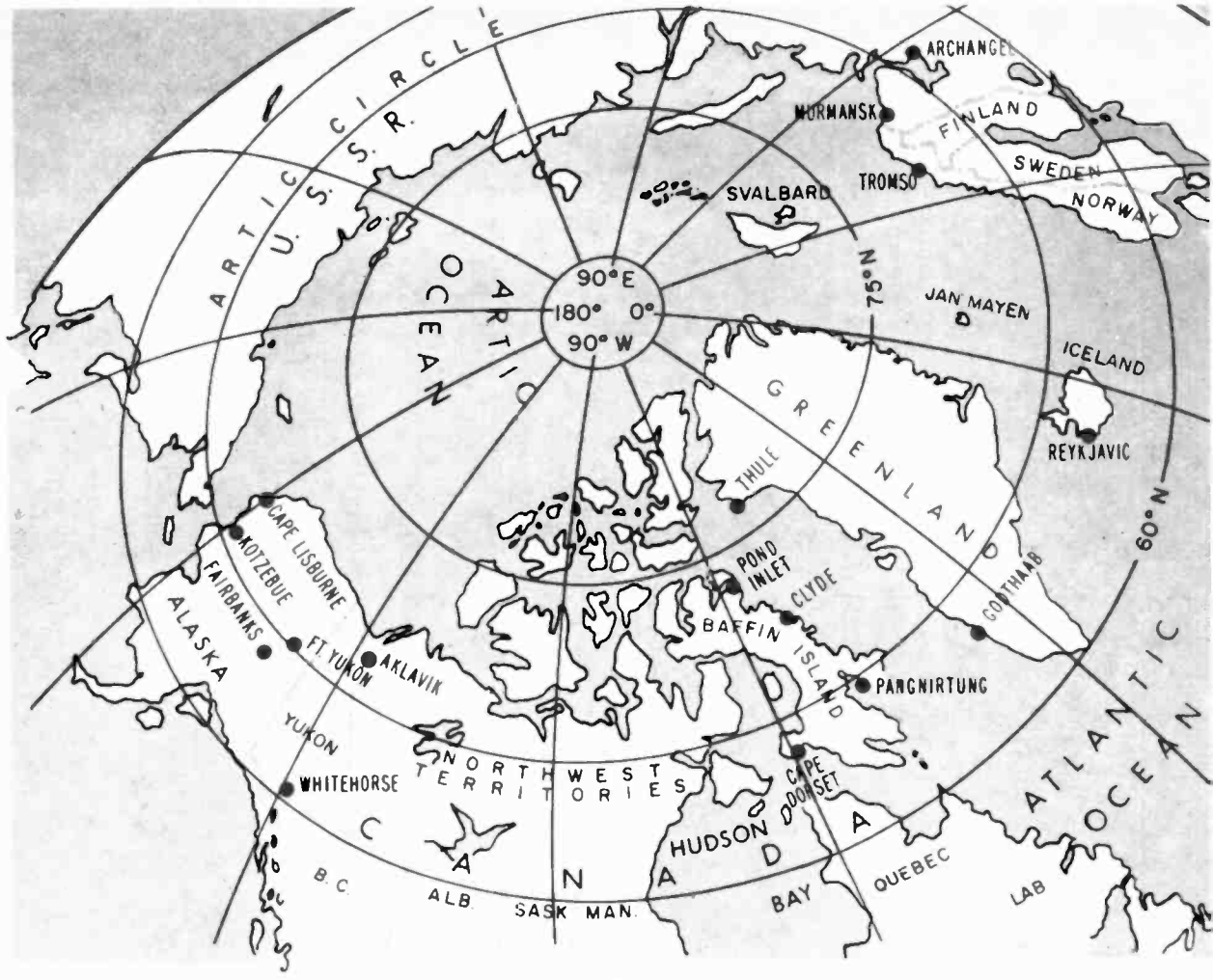
EI's GUIDE TO ARCTIC BROADCASTING

FREQUENCY (kc)	STATION
155	Tromso, Norway
209	R. Iceland
380	Archangel, U.S.S.R
656	Murmansk, U.S.S.R
660	KFAR, Fairbanks, Alaska
790	KFRB, Fairbanks, Alaska
860	CHAK, Aklavik, Northwest Territories (Canada)
1425	AFRTS, Thule, Greenland
5980	Godthaab, Greenland
11735	Tromso, Norway

These still might make an occasional appearance on 75 meters.

In Alaska, the one bright spot is Fairbanks. Here, just below the Arctic Circle, several BCB stations operate, including KFAR (660 kc) and KFRB (790 kc). The only Alaskan BCB stations within the Arctic Circle are flee-power AFRTS transmitters at Cape Lisborne, Kotzebue and Fort Yukon that provide only local coverage of the bases themselves. Programs are supplied both by tape and, ionospheric conditions permitting, from off-the-air pickups of AFRTS SW transmissions over VOA facilities in California. Southern Alaska, of course, is well supplied with BCB stations—none, however, broadcasting in either Eskimo or Indian.

European countries boast good Arctic broadcast services, largely because their population centers are somewhat farther North (Moscow and Kodiak, Alaska, for example, are at approximately the same latitude). One of the most interesting is the



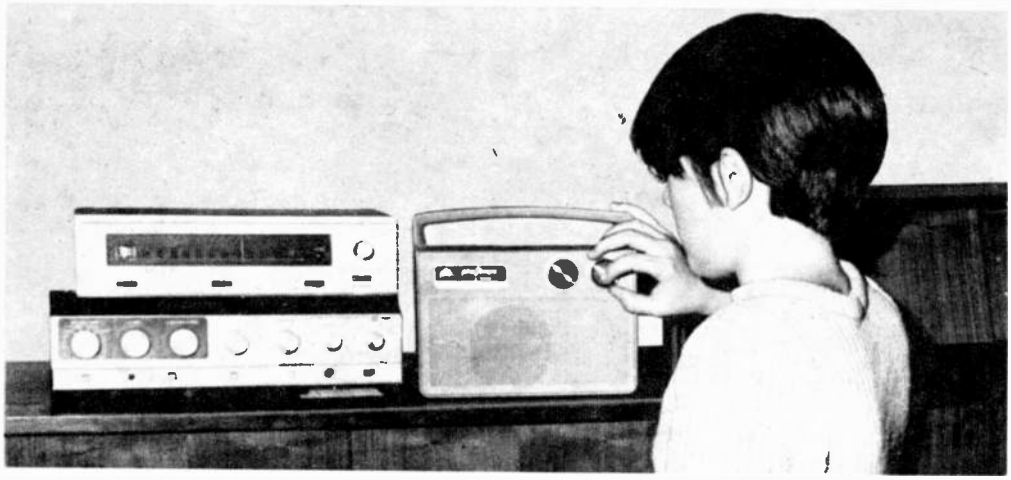
Russian station at Archangel with 50 kw on 380 kc. That's right—long-wave territory. Frequencies below about 400 kc are not impaired by ionospheric disturbances; in fact, these disturbances sometimes increase the station's coverage. During the current period of high sunspot activity it will be interesting to see whether this low-frequency Arctic station can be logged by DXers farther south in North America. But you'll have to fight your way through heavy beacon interference.

The Soviets also operate a 150-kw transmitter at Murmansk on 656 kc. This is the most powerful broadcast outlet within the Arctic Circle.

R. Norway's station at Tromso runs a 10-kw transmitter on 155 kc (DXers will have to fight off QRM from an LW station at Brasov, Rumania) plus an SW relay on 11735 kc. When Tromso is not on the frequency, however, R. Norway operates one of its Oslo transmitters there, presenting another rough DX challenge.

Just below the Arctic Circle, we find Iceland's two LW broadcast outlets on 209 kc. R. Iceland gave up the SW battle a couple of years back but Greenland Radio hangs onto two SW outlets. One occasionally is logged in the U.S. on 5980 kc, early evenings EST. Also operating in Greenland and Iceland are government-owned BCB networks.

In the Asian Arctic the Soviets have a network of strategically placed LW broadcast stations stretching across north-central Siberia (see The Forgotten World of LW Broadcasting, Nov. '67 E). The CBC has attempted a similar approach, but using 50-kw BCB outlets much farther south. It's doubtful how often (if ever) they reach the Arctic Circle. Aeronautical weather beacons running 50 kw or less (usually much less) regularly achieve ranges up to 400 mi., on the other hand. So if real Arctic communications are to be achieved the Soviet system presently looks likes the best yet.



How to Hi-Fi a PlayTape

By VICTOR KELL

FIRST it was the transistor radio that teeny-boppers used to assault our ears. They drove us absolutely mad in buses, at the beach and even in the flicks. Now they have an even worse weapon, a battery-operated tape player—the PlayTape—which plays the same tune over and over and over and over. Since you won't be able to fight it, you may as well join it because some of the tape cartridges contain music suitable even for squares.

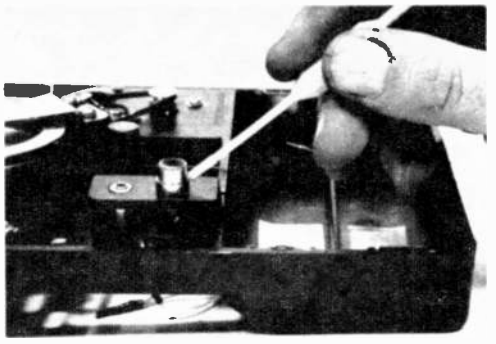
Fact is, PlayTape cartridges and players do have a small amount of inherent fidelity. Just a slight modification to the player will let you play cartridges through your hi-fi system. You aren't going to hear wide-range sound but you'll be able to enjoy some of the teen set's better cartridges more than you would from the player alone.

Since most PlayTape models (ours is a 1320) use the same basic amplifier, the modifications are more or less universal and consist of replacing the existing earphone (external-speaker) jack with a phono jack. All players except one have the built-in earphone jack. If you have the model without the jack, you simply install a phono jack on the back cover, then follow our wiring procedure.

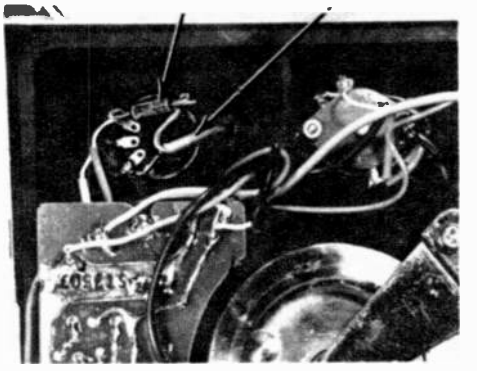
Remove all the battery-compartment cover screws, the cover and the batteries. Then remove the front-panel knobs and the screws which hold the tape transport to the front panel. The entire transport, to which the amplifier is attached, comes out in one piece.

You'll find the earphone jack installed in one of two ways: it will be part of the amplifier assembly with both the front and the back of the jack on the back of the tape transport or it will pass through the transport with the terminal side of the jack on the front of the transport. If the jack passes through the transport the wire you add, which goes from the amplifier to the jack, will have to pass through the plastic transport frame. If this is the case, drill a ⅛- or 3/16-in.-dia. hole through the transport near the volume control.

Note that the earphone jack is the normal-through type (when the earphone plug is inserted the speaker is disconnected). Carefully trace the wires to the jack. You'll see there are two leads connected to the jack's frame terminal; one lead comes from the amplifier (ground) and the other goes to the speaker. Unsolder the leads, connect them together and cover them with tape.



The output signal to your hi-fi system is taken from a phono jack which you install in place of original miniature phono/external-speaker jack.



Phone jack is connected by shielded cable to volume control. There's a signal-dropping resistor between control's hot lug and the cable's hot lead.

How to Hi-Fi a PlayTape

The other lead goes from the speaker to the tip lug. Another lead to the normal-through lug comes from the amplifier. Unsolder these two leads, connect them together and cover them with tape. Remove the headphone jack and install a phono jack.

(If your PlayTape didn't have an earphone jack and you installed a phono jack pick up the wiring from this point.)

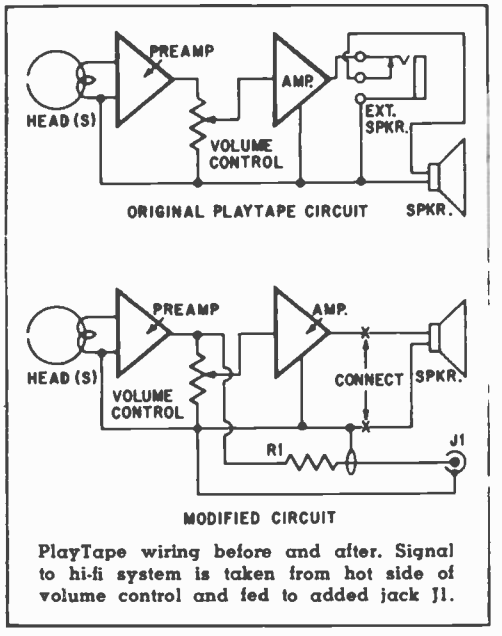
If the phono jack's terminals are on the same side of the transport as the volume-control terminals connect a thin shielded wire between the jack and volume control.

Connect the shielded wire to the jack first, then quickly solder the shield to the volume control's ground lug. Solder R1 to the volume control's hot lug and connect the shielded wire's hot lead to the resistor's free end.

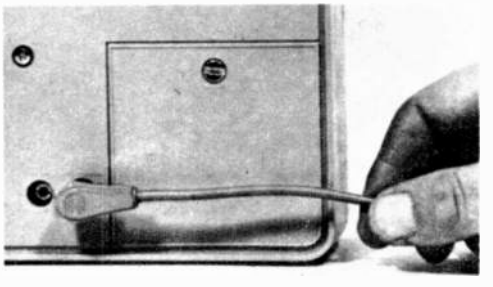
The value of R1 will depend on the tape-head input load resistor in your amplifier. If the resistor is less than 50,000 ohms, R1 should be 250,000 ohms. If the resistor is 50,000 to 250,000 ohms, R1 should be 500,000 ohms. If the resistor is greater than 250,000 ohms, R1 should be 1 megohm. If you are not certain of the amplifier's tape-input load resistor try a 500,000 ohm resistor for R1. If the amplifier overloads when using the PlayTape, change R1 to 1 megohm.

If your amplifier is not equipped with a tape-head input the PlayTape may be connected to the magnetic phono input, in which case R1 should be 250,000 ohms.

After the shielded wire is installed reassemble the PlayTape.



PlayTape wiring before and after. Signal to hi-fi system is taken from hot side of volume control and fed to added jack J1.



PlayTape tape player should be connected to your hi-fi system's amplifier with a standard phono-plug patch cord. Plate covers battery compartment.

EI's 1968 Index

C—Construction Project
F—Feature Article
TP—Theory & Practice
Name following title is author.
Page number follows the date.

AMATEUR RADIO

AUDIO, STEREO & HI-FI

CITIZENS BAND

KIT REPORTS

SERVICING

SHORT-WAVE LISTENING

SPECIAL CONSTRUCTION PROJECTS

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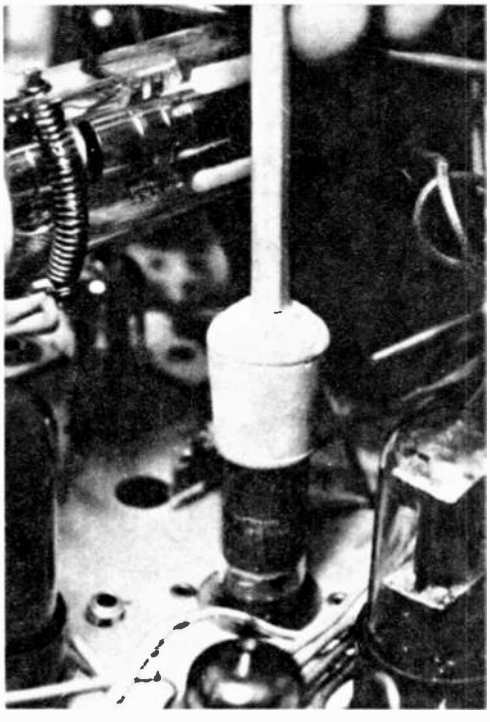
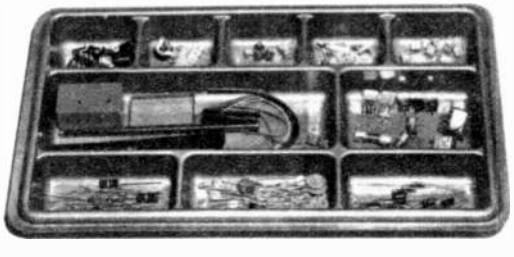
SPECIAL FEATURE ARTICLES

THEORY & PRACTICE

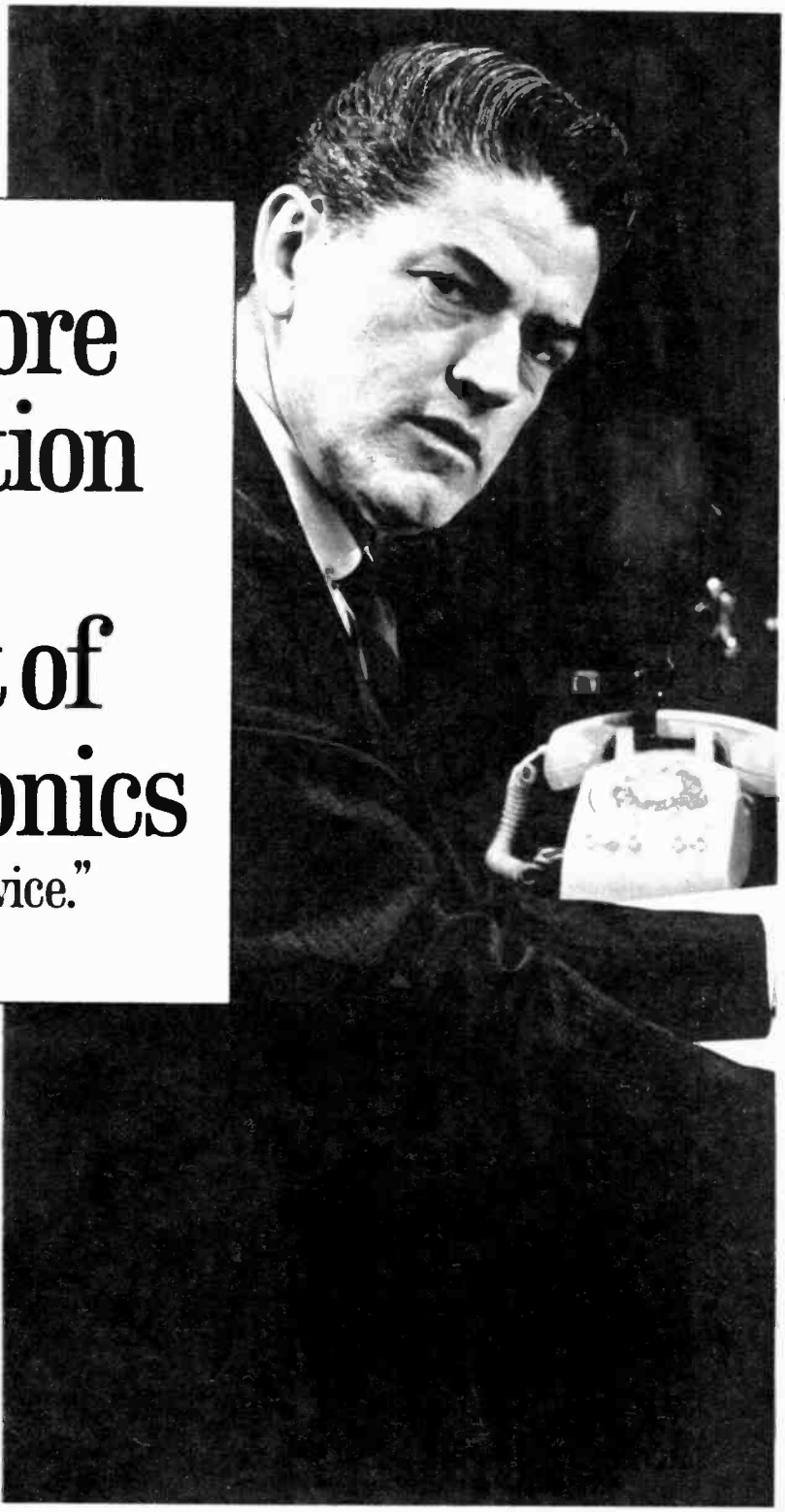
TIPS



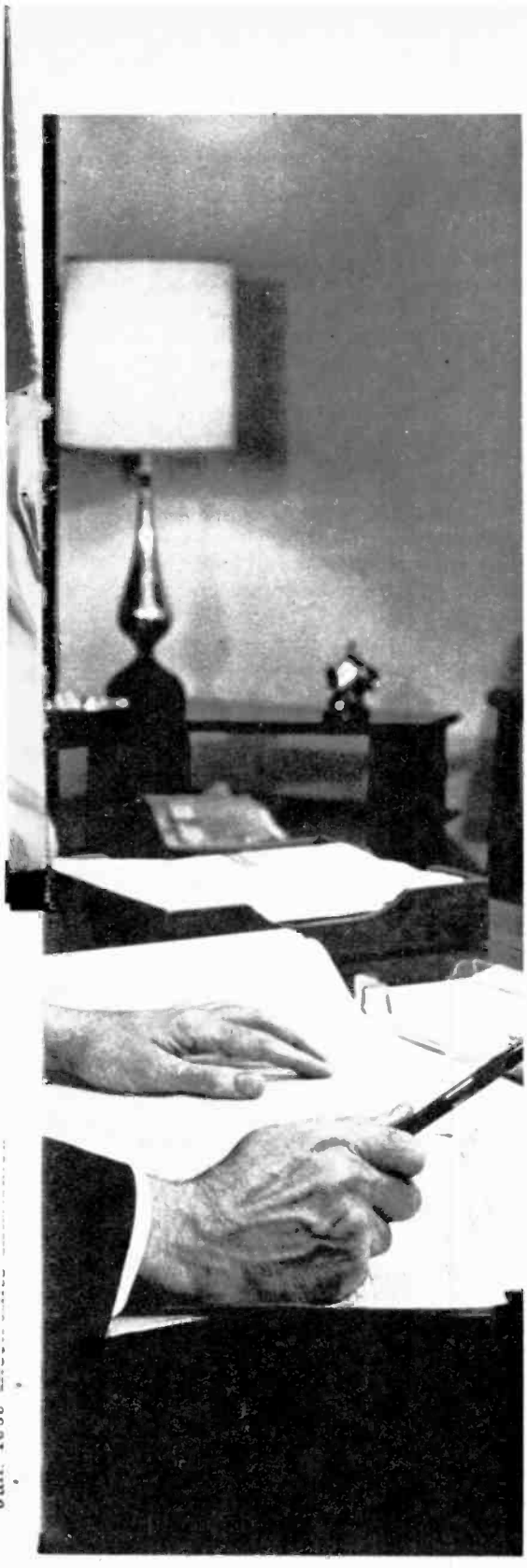
Off in a corner of a TV set is a tube which has to be pulled for checking. You reach in, grab it and let out a howl because it is as hot as lava. Instead of searing your fingers again, make a tube puller by attacking a rubber furniture tip to a dowel. A ⅝-in. tip fits miniature tubes.



Storing and locating small parts when building a kit wastes valuable time. The problem can be solved by using a drawer-size cosmetics tray. Such trays have small compartments, which are ideal for hardware, small parts, resistors and capacitors as well as chassis sections and subassemblies.



"Get more education or get out of electronics ...that's my advice."



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☐ Space Electronics ☐ Nuclear Engineering Technology
Industrial Electronics for Automation
Computer Systems Technology

APPROVED FOR TRAINING UNDER NEW G.I. BILL

The Listener

By C. M. Stanbury II

Czechmate

NEVER has any Communist SWBC station enjoyed such a large and sympathetic audience as did R. Prague during the two months preceding Russia's invasion of Czechoslovakia. And all the while RP kept making it clear that its government still was a full-fledged Marxist state.

SWLs who listened carefully to RP's North American service got a pretty good clue to Moscow's invasion motives. It repeatedly stressed that Czechoslovakia was being supported by Yugoslavia and Rumania. As those who listen to R. Bucharest know, Rumania has given some indications of leaning toward Peking (though certainly not as much as Albania) while Yugoslavia's R. Belgrade is at the liberal end of the red spectrum. The only thing Czechoslovakia's two major allies had in common, besides Marxism, was a nagging desire to cut Russia down to size.

During those first few days after the takeover, several anti-Soviet Czech underground radio and TV stations were reported on the air. It seems likely that some may continue on clandestine radio from outside Czechoslovakia.

On July 31, R. Prague made a statement that also may affect the clandestine radio picture. On that transmission R. Prague claimed the support of both the Spanish and Portuguese Communist parties. Each of these groups supposedly operates a clandestine SWBC outlet—R. Espana Independiente and R. Portugal Livre, respectively. While REI has been credited with a Prague mailing address (from which, as far we we know, no one ever has received a QSL) it appears that at least one and probably all of their transmitters are in the USSR. Assuming that R. Prague's claim was true, will REI be looking for new transmitters? Or will there be two competing REIs? Similar considerations also may apply to RPL.

As this is being written, it remains to be seen how R. Prague will reflect the Moscow settlement—and whether it will manage, once again, to establish an independent identity. It also remains to be seen how R. Bucharest will respond to increasing pressure from the Soviets. So keep an ear on the stations in our Guide. All transmissions listed are in English except those of REI and RPL.

EI'S SHORT-WAVE GUIDE TO THE NEW MARXISM

FREQ. (kc)	STATION	TIME (EST)
7345	R. Prague	2000-2055, 2230-2325
8330*	R. Portugal Livre	1700
9540	R. Prague	2000-2055, 2230-2325
9570	R. Bucharest	2030-2130, 2200-2230, 2330-2400
9620	R. Belgrade	1700-1715
11810	R. Bucharest	2030-2130, 2200-2230, 2330-2400
11990	R. Prague	2000-2055, 2230-2325
15240	R. Belgrade	1030-1100
15380	R. Bucharest	2030-2130, 2200-2230, 2330-2400
15448	R. Prague	0900-0955 (Sun. only)
17700	R. Espana Independiente	0800
17840	R. Prague	0800-0955 (Sun. only)

* FREQUENCY VARIES

Name the Station . . . At 0100, Wolfman Jack—self-proclaimed king of underground music in Southern California—signs off. Jack really doesn't play underground music, just good down-to-earth rhythm & blues. But the Wolfman himself certainly is pretty far out.

Next comes an evangelist (who, we assume, is not one of the Wolfman's disciples) proclaiming that our United States is *the* chosen nation, that Anglo-Saxons are especially blessed and that Russia will attack the United States (because his Bible tells him so).

What station are we listening to? One of those powerful Mexican border outlets that dominate the MW scene from time to time, right? Wrong! This is international SW's newest voice—HISD, R. Quisqueya International, 6090 and 9505 kc, Santo Domingo, Dominican Republic.

For many years, similar formats have kept roughly half a dozen XE BCB multi-kilowatters rich and famous. But will such material really attract listeners on 31 and 49 meters? The answer to that one may be a surprise.

[*Continued on page* 113]

Super-Mini Speaker

Continued from page 75

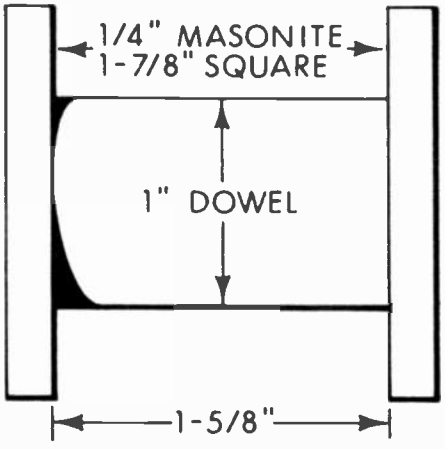


Fig. 5—Make this form for L1. Attach end pieces with glue or brass nails. Wind No. 18 enameled wire until wire reaches edges of the end pieces

ized type. Do not use an electrolytic. If you cannot obtain a 6-μf non-polarized capacitor, use two 12-μf, 50-V electrolytics connected in series *back to back*. That is, plus to plus or minus to minus.

The crossover-network parts (C1, L1), the L-pad and the terminal strip are all mounted on the back panel. The inductor and capacitor(s) can be cemented to the back panel.

Fill the inside of the cabinet with 400 cu. in. of fiberglass wool and attach the back panel with eight wood screws.

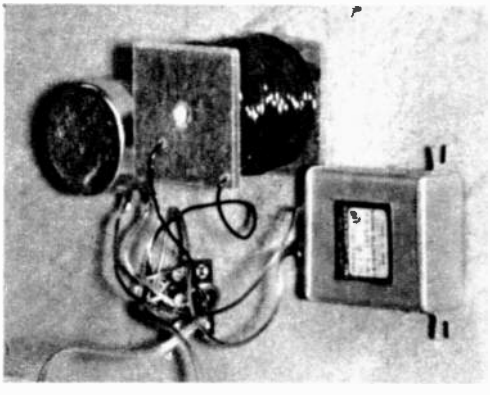
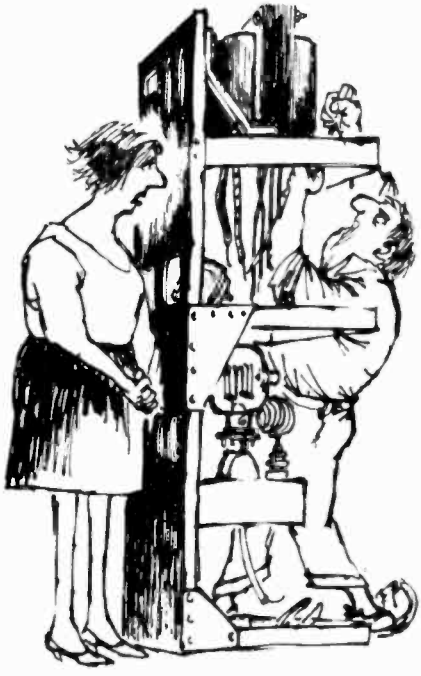


Fig. 6—Crossover network. Our capacitor was a 6-μf non-polarized type, but two 12-μf electrolytics can be used connected series back-to-back.

Over and Out

rodrigues

"We're selling home entertainment, Harris, not static!"



"So, Mr. Favorite Grandson! What shall we buy with our 135 QSL cards?"

"But Albert, are you allowed to talk back to Radio Moscow?"

The Private War of Color TV

Continued from page 94

quires the addition of a delay line to store signals, then release them to the screen after they've been cleaned up. The PAL receiver needs no tint (phase) control but does require one knob to allow the user to compensate for variation in the amount (or saturation) of color in the image.

More Color Confetti? Although it's early to pick a winner among the three rival systems, comparisons tend to level their differences. PAL and SECAM are reported to have increased immunity to phase-distorted color signals. And their sets are easier than NTSC's for the general public to operate. On the other hand, they still must prove themselves in daily operation in large numbers of homes. These systems are just commencing commercial telecasting. NTSC has been operating more than a dozen years (presently to one of five American homes) and boasts the simplest receiver. PAL and SECAM need additional circuitry, notably a costly glass delay line. Picture quality among the three systems is estimated to be about the same under ideal conditions, but there are conflicting reports on how the European systems function when noise interference, as well as phase distortion, becomes especially severe.

One sure conclusion is that the world's controversy over color TV is as political as it is technical. Most European countries have opted for PAL, while France and the Soviet Union have elected SECAM. More recently, the Soviets split with France and are talking of a variation of SECAM that they call NIR. South America hangs in the balance, with Brazil making gestures in the direction of PAL.

Some European critics have wagged that NTSC really means Not The Same Color. But the peacock still has plenty to preen about.

Tele Remote Control

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determine which capacitor value gives the highest voltage across C10.

Note that C13, RY5 and S01 are connected to a single reed-relay terminal. Additional control circuits, identical to C13, RY5 and S01 may be connected to the other reeds.

Checkout and Operation. Connect a 117-VAC lamp to S01 and any small speaker to test terminals BP1 and BP2. Temporarily connect a jumper across RY3's No. 3 and No. 8 terminals. Plug the unit in and set S4 to the *test* position—RY2 should close. Hold the tone generator directly over the speaker and press S1 and S3. Using a small screwdriver, adjust R1 until the correct reed vibrates, as indicated by the test lamp coming on. Move the tone generator as far as possible from the test speaker and readjust R1—the object is to set R1 so the reed relay vibrates with the minimum possible input signal from the tone generator.

Disconnect the temporary jumper across RY3's lugs and connect the unit to the phone lines. Set S4 to *on*. Make certain if you have a three wire circuit that BPA and BP3 are connected to the talking pair.

Have your friend or neighbor call you. At or before you hear the first ring, RY1 will close, the ringing signal will stop and RY2 will close. Relay RY1 will release and remain open. After about 20 seconds RY3 should release RY2, readying the unit for the next call.

Keying The Remote. We recommend that each time you plan to use the control that you check out the control unit through the test binding posts (BP1, BP2). Hard knocks may jar the settings of R1.

We suggest R1 be adjusted at about 70° room temperature as an increase in the ambient temperature will cause the output frequency to rise very slightly.

When operating the tone generator, always press S3 first, then S1 (it may be done almost simultaneously) and move the control within ½ to ¼ in. of the telephone mouthpiece. Make one single tone burst of approximately one second as soon as you hear the ringing signal stop. Then make certain you release S3 before S1. Hold S1 down for about 1 second after you release S3. When releasing, S3 opens the connection from the battery, C5 discharges, taking about ½ second to discharge. The decreasing voltage from C5 causes the control tone to glide down slightly, and it is the glide tone that compensates for changes in the control unit's basic frequency.

If you release S1 before S3, there will be no glide-tone, and if the control has drifted off-frequency the receiver will fail to operate. Therefore, the rule is: activate S3 first, and release it first.

EI At Large

Continued from page 25

mikes built into Environ-Ears and played back through a stereo headset will seem to come from the same direction as the original —not just to right and left but above, below, behind. Cost of an Environ-Ears system: $950. But imagine what a stereo-FM Inner Sanctum could do with it!

Need a schematic? Supreme Publications now has a service that will supply schematics and service information on most TV receivers, radios, phonographs or changers from files going back into the '30s. Usual charge per model is $1 for radio, $1.50 for TV. If you've interested, write them at 1760 Balsam Rd., Highland Park, Ill. 60035.

UFOlogists don't seem to get much quarter in a booklet issued by Uncle Sam and provocatively titled Aids to Identification of Flying Objects (36 pp., 20¢ from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402). Reading that title, you'd expect to find out the difference between Martian and Venusian craft. But once you get into the text you're not told how to identify what you see but why what you saw wasn't a flying saucer. Maybe the title should have been Aids to Nonidentification of Nonflying Objects.

Electromagnetoinstamatics could be a name for a system of home movie making we can glimpse in a development announced by Dr. Siegried S. Meyers of Madison College (Va.). Dr. Meyers, for the record, was involved in the development of wire recording and has come up with several related ideas since going to Madison. One of the most recent involved putting oxide on both sides of recording tape with a ferrite shielding layer between to prevent magnetic interaction. Object: double capacity on a given length of recording tape.

His latest is a device he calls a plaque. It looks a little like a selenium photocell and, like a photocell, appears to convert light intensities into electrical signals. But the output is magnetic rather than electronic. Recording tape, run through a plaque that has been inserted in a movie camera comes out with a video recording. An adaptor would

play back the tape through a regular TV receiver.

Not many details of the system have been announced yet but Dr. Meyers seem to feel that adding audio for home talkies would be simplicity itself. In any case, the system would be instant in the sense that, unlike photographic movies, the picture could be viewed immediately. Scanning, incidentally, seems to take place only in the playback adaptor—making the system quite different from conventional video recording. Color? A Madison College press release hedges on the point: "The use of color in this process has been foreseen."

The View From Space is the title of an hour-long network special to be presented by ABC-TV next March 14 (2200 EST). It's part of a string of specials that are supposed to explore the idea that scientists and technologists are real, honest-to-gosh people and not just wonders who work wonders. Other programs still to come are Cosmopolis (Jan. 13, 2200 EST and April 11, 1800 EST) and The Scientist (Feb. 9. 1900 EST—repeat from last Nov. 29). -

Ultrasonic Burglar Alarm

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You're now ready for the final test. Stand in front of the receiver about 5-ft. away from it. Now walk toward the receiver. The relay should close. You may have to experiment with the placement of the receiver and the adjustment of R3 and R10 for maximum sensitivity and stability. Relay RY1 should only be used to actuate an external relay, which can operate a bell or any other alarm device.

Keep in mind that spurious responses could be caused by a slowly moving curtain, the movement of a rattling window pane, or the noise of a steam valve.

The Listener

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Space Hoax Dept. . . . While most radio listeners aren't aware of it, there is a segment of DXing that spends its time hunting for alien signals from outer space. Human nature being what it is, we're not overly surprised—though international broadcasting already supplies us with far more interesting *real* fun and games. What does amaze is that UFO radio people are so gullible.

Recently, a leading saucer publication allocated two pages to a well-known contactee. He claims to have heard high-speed CW messages from some new space people who then sent three men in black to threaten him. (These unearthly Hell's Angels seem to have replaced the Jolly Greer Midgets as a favorite image of saucerdom.)

The message consisted of 11 five-letter cipher groups followed by "COMPUTE 744-K. CL-5 OUT." The reply was, "CL-9 ACKNOWLEDGES. OUT." We suspect the CL stands for Clarion, a planet popular in UFOlogy during the early '50s (and, incidentally, promoted by one of the Mexican border stations). We don't understand why Clarionites converse with each other in English and it's unlikely anyone transmitting messages via *high-speed* CW would spell out *acknowledge* (what's wrong with *QSL*?), while *out* would be abbreviated *CL*. Of course, that makes their call letters a little awkward.

Oh well, back to the believability of R. Bucharest! -

EI Kit Report

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trols' cut measured 13db at 20 cps and 16 db at 20 kc. Boost was 13db at 20 cps and 12db at 20 kc. The Stereo 120's input sensitivity for rated output was 2 V (rms).

The PAT-4's mono switching system is, as far as we know, unique. Pressing the *A mono* switch or the *B mono* switch causes both speakers to produce only the single channel in question. Pressing both of them, however, will give you a stereo signal with channel separation reduced to 6db. Sound weird? On headphones many stereo program sources (particularly on pre-recorded tapes where channel separation can be just about absolute) can sound even weirder (ping pong effect). Reduction of separation to 6db solves the problem. If you want full mixing of both channels to get a mono signal from stereo sources. Dyna tells how to install a jumper.

Both industry and the consumer waited a long time for the Dyna to go solid state. Based on the features and performance of the PAT-4/Stereo 120, it was well worth it.

The Ham Shack

By Wayne Green
W2NSD/1

IF YOU tend to inhabit the science pages of newspapers and magazines you have read about pulsars. This is the name given to the recently discovered radio signals coming in from space. The articles I have seen all tried to explain the mysterious signals in terms of some sort of cosmic natural function. I (and perhaps you) dismissed the whole matter as one of interest only to astronomers, figuring that one of these days a smart cookie would come up with the answer.

Thus I was surprised during a recent visit to the radio telescope in Arecibo, Puerto Rico, to find that the scientists investigating the signals had found precious little to support the natural phenomenon thesis and a long list of data that they have entered on their LGM (Little Green Men) list. Sam Harris, W1FZJ/KP4 brought me up to date on their findings.

The signals are 40-millisecond pulses that appear to contain energy evenly distributed over a broad frequency range, like white noise. The pulses are extraordinarily regular in timing, except that one is missing every now and then. The power levels required to generate these signals are so enormous that many scientists have stated flatly that it is impossible for them to be produced artificially. Well, men of science have been terribly positive about some other things in the past, too. . . .

The LGM crowd particularly discomforts the natural phenomenon group by pointing out that there are only four sources of these signals and that they are not randomly placed but all in a line on a Great Circle route across our galaxy. The nearest is about 100 light years away and the farthest 400 light years.

The LGMers ask this: if pulsars are a natural phenomenon why are there only four of them in our galaxy? And why are they spaced so evenly? And why are the signals always 40 ms long? And why are some pulses missing every so often? And what kind of event can generate these pulses with ms rise time? And how about that bandwidth . . . it goes out to well over 3000 mc!

A study of the missing pulses might give evidence of an attempt by the LGM to communicate with alien civilizations. Though they seem to be in some sort of code little has been done to investigate it as yet. It has been noted that each pulse seems to be different from the next but this could be the result of shifts caused by the signals traveling through the plasma of space. If the signals are being used for communications purposes it would be possible to transmit enormous amounts of information in those 40-ms pulses. All of the radio and television signals for our earth could be sent via such a system, with room to spare.

One other possibility. The signals are quite similar to those used by our Loran for radio locating. Might these be giant Loran stations spread out across the galaxy for spaceship navigation? For that matter the stations may turn out to be doing all three of these things. In fact, pulse communications are ideal for a system where you want to be able to transmit *and* receive continuously.

The pulsars are difficult to tune in because they are so wide-band. Radio astronomy has been listening to extremely narrow frequency bands in the past and these signals were missed. Add to that the frequency changes brought about by the slowing-down of the lower frequencies as they pass through the plasma of space and you find yourself trying to copy a 3000-mc-wide signal that is starting at the highest frequency and bleeooping down to DC. You can tune it in and watch the signals flit across a Panadaptor screen. But how on earth (ha!) do you stop those pulses and examine them closely?

Pulsars are strong enough to be heard by interested amateurs and I suspect that we will be seeing articles before long giving further information on antennas and techniques for investigating them.

End of a Story . . . One of the larger recent controversies in amateur radio has been the adventures of Don Miller, W9WNV, a doctor who forsook medicine to spend the last several years as a professional ham DX operator. His bag has been to travel from weird place to weird place around the world, operating a station for a few days to give

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Swap Shop

Individual readers (not commercial concerns) may swap electronic gear by sending one listing, name and address to Swap Shop, ELECTRONICS ILLUSTRATED, 67 West 44th Street, New York, N.Y. 10036. Space is limited; only most interesting offers are published

CITIZENS BAND

LAFAYETTE transceiver. Will swap for Lafayette RK-77 or similar astronomical telescope or best offer. Larry Stafford, 553 Victor Ave., Lebanon, Tenn. 37087.

REGENCY RG II ground planes. Will swap for stereo tape recorder or best offer. Bill Hadley, 2004 Morgenthau Dr., Mobile, Ala. 36618.

KNIGHT C-555 walkie-talkies, other gear. Want auto tape player or reverb. Charles Tang, 855 Victor Ave., #217, Inglewood, Calif. 90302.

LAFAYETTE HA-85, other walkie-talkies. Want Heath GW-12A or Allied C-540 transceiver. Bill Clarke, 95 Highfield Ave., Port Washington, N.Y. 11050.

RADIO SHACK Pacer 8-channel base. Want short-wave receiver. David Hailey, 1013 Graybar, La., Nashville, Tenn. 37204.

SONAR G transceiver. Want general-coverage or ham-band receiver. Leonard Batch, 14-04 Bell Blvd., Bayside, N.Y. 11360.

ROSS RE-011 walkie-talkies. Want CB transceiver or Lafayette Dyna-Com 5 walkie-talkie. Doug Neely, 2403 Gardner Dr., St. Louis, Mo. 63136.

LAFAYETTE HB-115A transceivers. Want 23-channel transceiver. Robert Landrith, Jersey City, N.J. 07307.

MIDLAND 2-channel walkie-talkie, accessories. Bob Mudroncik, 2110 Wespark Ave., Whiting, Ind. 46394.

CONTACT 23 transceiver, accessories. Want combo electronic organ. Lanny Windham, Rt. 4 Box 198, Gordo, Ala. 35466.

LAFAYETTE HB-555 transceiver. Want 3- to 5-watt walkie-talkie or best offer. Edward Stone, 9613 Bristol Ave., Silver Spring, Md. 20901.

POLY-COM/OSBORN 300 4-channel transceiver. Want VTVM, oscilloscope, CB rig or best offer. Gary Alose, 321 Mitchell Ave., Linden, N.J. 07036.

LAFAYETTE HE-20T transceiver. Want tube-type transceiver. Ray Gagne, 48 Westbrook St., Hartford, Conn. 06106.

AUDIO & HI-FI

PHILIPS cassette tape recorder. Want short-wave receiver. E.A. Szolander Jr., 119 7th St. W., Ashland, Wis. 54806.

ELECTRO RA-11 tape recorder. Want 2-meter CW transmitter or antique radio. Keith Frank, 555 E. Franklin St., Berne, Ind. 46711.

FISHER K-10 Spacexpander reverb. Want tape recorder or best offer. W. Dugan, 2260 Flagg Dr., Reno, Nev. 89502.

REALTONE AM/FM/VHF AC/DC portable radio. Want ham receiver. Wendell Waites, 1643 N. 55th, Philadelphia, Pa. 19131.

HEATH AJ-53 AM tuner. Want Fisher K-10 reverb or best offer. F.C. Filippone, 543 Joralemon St., Belleville, N.J. 07109.

GRANCO T-160 FM tuner. Want portable short-wave portable receiver of Knight T-60 transmitter. John Karien, 213 8th St., Franklin, Pa. 16323.

RCA cartridge tape recorder. Want Heath GR-54, Lafayette HA-230 receiver or best offer. John Arnold, 589 Robinson, Orangeburg, S.C. 29115.

GENERAL ELECTRIC AM/SW radio. Want stereo headphone amplifier. Dave Felix, 1741 Thames St., Clearwater, Fla. 33515.

SPEAKERS—12-in. Want Lafayette GT-50A or HA-305 walkie-talkies. James Lichten, 13 Cliff Dr., Bayville, N.Y. 11709.

TELECTRO model 1960 tape recorder. Want Knight Safari III CB transceiver or similar. Ethan A. Van Matre, 1575 N.E. 66th, Apt. B, Portland, Ore. 97213.

RCA Filteramic AM/FM radio. Want Philco Transistor 800 and Realistic 12-674 portable radio. Neil Parks, 8044 Amherst Ave., St. Louis, Mo. 63130.

GENERAL ELECTRIC cartridge tape recorder, leather cases. Want CB transceiver or portable short-wave receiver. Frank Jasek, 136 Onieda St., Clayville, N.Y. 13322.

EMERSON mono tape recorder, tape. Make swap offer. Daniel Upton, Pleasant View Rd., Pleasant Valley, N.Y. 12569.

AUDIO AMPLIFIER—30 watt. Want novice ham transmitter or best offer. Joseph Benoit, 6340 Cottage St., Philadelphia, Pa. 19135.

CARTRIDGE TAPE DECK, 8-track stereo, accessories. Want RCA WA-504A and electronics course books or best offer. S. Glass, Box 10531, Dallas, Tex. 75207.

RCA 1YB29A mono cartridge tape recorder. Want Heath Twoer or other ham transmitter. Paul Kammeyer, RR3, Sumner, Iowa 50674.

AMPEX 450D tape player. Want Ampex 300 or best offer. Greg Virtue, 6600 Stockton Blvd., Sacramento, Calif. 95823.

GATES 2-channel remote audio mixer. Want tape cartridge unit or QRK turntable. Teddy M. Long, 5227 Revere Rd., Durham, N.C. 27707.

CBS Masterwork 800 tape recorder. Want tuner or receiver. Frank Dubiel, 1253 S. Main St., Fall River, Mass. 02724.

PANASONIC RQ-156S tape recorder. Want Eico 1030 regulated power supply or similar. Larry Marcais, 23 McLaren St., Gloversville, N.Y. 12078.

RCA 45-rpm auto record player, other gear. Want Heath HR-20 receiver. Bill Killion, 409 Flora St., Washington, Ind. 47501.

VM turntable. Want oscilloscope or best offer. Alexander E. Cavallari, 1103 E. 17th St., Brooklyn, N.Y. 11230.

MARTEL TR-1001 AC/DC tape recorder. Want CB antenna or Knight R-55 short-wave receiver. Henry Kaul, 622 McDonough St., Eau Claire, Wis. 54701.

STROMBERG-CARLSON AU-33 PA amplifier. Want stereo components or tube tester. Patrick Tully, 18 Hichborn St., Revere, Mass. 02151.

SCOTT LT-10 stereo FM tuner, wood case. Want audio color box or best offer. S/Sgt. Richard Gronowski, 63 CEMS, Box 1002, Norton AFB, Calif. 92409.

MARTEL 560 tape recorder. Want oscilloscope. Joseph Rotello Jr., 1341 S. Edlin Ave., Tucson, Ariz. 85711.

OTHER EQUIPMENT

ASSORTED PARTS. Will swap for best offer. Jack Shea, 4343 Ludwick St., Pittsburgh, Pa. 15217.

TV CAMERA. Want laser parts, service gear or best offer. Thomas Mayfield, Box 446, Yarnell, Ariz. 85362.

TV PICTURE TUBES—10BP4, 21CBP4. Want antique receiver or best offer. Tony Preston, 12996 Kerr, Southgate, Mich. 48192.

RCA ACR-20A aircraft receiver manual. Want RF preamp or Q-multiplier. Joseph Rotello, Jr., 1341 S. Edlin Ave., Tucson, Ariz. 85711.

KUHN 353D AM/FM receiver—25-54 mc, 88-174 mc. Want 11- or 15-band portable receiver or best offer. W. Morrison, 4041 River Rd., Schenectady, N.Y. 12309.

HOME-BREW low-power BCB transmitters. Want transistor car radio (12-V negative ground), 8-mm movie splicer/editor. Larry Kilmer, 1770 S. Madison St., Stockton, Calif. 95206.

X-RAY TUBE, D1.7. Want RCA WV-76 VTVM. Dan Williams, 4614 Broadmeadow Ct., Huntsville, Ala. 35810.

COAX RELAY—DK60, 52-ohm. Will swap for best offer. Glenn Stout, N.E. 86 St., Kansas City, Mo. 64155.

BLONDER-TONGUE UHF converter. Want 6-meter converter or 3-30 mc preselector. Mike Wilson, 132 Matthews Cir., Horseheads, N.Y. 14845.

SOLA power supply—24 VDC, 6 amp. Will swap for FM-stereo receiver. Louis Hall, 46 Douglas Dr., Norwalk, Conn. 06850.

GUITAR AMPLIFIER. Want short-wave receiver or service gear. Larry Finley, WB6OFR, 197 Cherry Ave., Porterville, Calif. 93257.

BIG EAR electronic eavesdropper (EI, May '63). Want 80-meter receiver (EI, Nov. '67) or other ham gear. Rodney Sebby, 7917 Rowland, Kansas City, Kan. 66109.

SB2-DCP mobile power inverter—150 watts continuous. Want Heath modulation scope. George Oom, WB4EGM, 434 Lansbury Dr., Danville, Va. 24541.

RCA 60-watt AM marine transceiver. Want KT-320, T-150 or best offer. Dave Weintraub, WB2RSC, 29 Wyman Ave., Huntington Station, N.Y. 11746.

ASSORTED RADIO PARTS. Will swap for best offer. William Savko, 411 Princeton Dr., Pittsburgh, Pa. 15235.

ASSORTED TUBES—2C43s, etc. Want components for UHF power transistor work. Steve Lohr, Box 15, Eastham, Mass. 02642. *(Continued on page 118)*

TV POWER TRANSFORMERS. Make swap offer Mike Fortner, Rt. 1 Box 270, Cashmere, Wash. 98815

TRANSISTOR RADIO, other gear. Want 2-meter transceiver. Bud Hansen, 80 Braeburn Dr., New Canaan, Conn. 06840.

GENERAL ELECTRIC business-band transceiver—30-40 mc. Want CB transceiver or best offer. James D. Long, Montreal, Mo. 65591.

ASSORTED TUBES. Want VHF receiver or stamp collection. A. Lane, WN8YYY, RR2, Sparta, Mich. 49345.

5-IN. OSCILLOSCOPE, other gear. Want 8- or 16-mm sound projector or best offer. Leslie Mabes, RR3, Richmond, Ky. 40475.

TELEPHONE INTERCOM SYSTEM. Want ham, CB or service equipment. Richard Deubel, 19 Bruen Ave., Irvington, N.J. 07111.

SURPLUS ASB-4 radar equipment. Want CB transceiver, walkie-talkies, ham gear or best offer. James Single, Holabird, S.D. 57540.

MISCELLANEOUS GEAR. Want ham transceiver. Warren Tucker, WN4IYN, Box 265, Ochlochnee, Ga. 31773.

DIGITAL VOLTMETER—5-digit readout. Want receiver with coverage up to 10 gc. Arthur Storer. 15 Willow St., Waltham, Mass. 02154.

ELECTRIC GUITAR, amplifier. Want ham gear. David Gammon, 9 Kenwood Dr., Dartmouth, N.S., Canada.

ASSORTED SURPLUS TUBES. Want oscilloscope or best offer. Robert Levy, 185 Woodbridge Ave., Buffalo, N.Y. 14214.

MISCELLANEOUS parts, tubes. Want RCA CTC-16 or best offer. Mark James, 1521 Vine St., Belmont, Calif. 94002.

GEIGER COUNTER, other gear. Want oscilloscope or Hallicrafters short-wave receiver. Allan Schear, 50 W. Gunhill Rd., Bronx, N.Y. 10467.

TELEPHONE ANSWERER. Want Collins NC-300, similar 2- and 6-meter transceiver or best offer. N Harkness, Box 182, Winnetka, Ill. 60093.

The Ham Shack

Continued from page 115

hams a contact there. The DXpeditions were paid for (handsomely) by these hams via contributions.

Miller, as time went on, was beset by a band of critics and disbelievers. Repeatedly he would announce that he was operating from so-and-so island, only to hear other amateurs say his signals seemed to come from the wrong direction.

Whenever anyone sticks his neck out of the crowd and does something—whether it be good, bad or indifferent—some people will be all for him, another group will do everything they can to tear him apart and an enormous remainder couldn't care less. Amateur radio—and its magazines—divided into these three groups. 73 magazine gave voice to the doubts about Miller. CQ gave him space to reply. QST kept quiet. However, the general manager of the ARRL (which publishes QST) wrote some letters to radio societies around the world that made accusations against Miller, who responded with a lawsuit. He also sued 73 (which I publish).

The suits opened Miller to an examination before trial under oath. When proof of visits to certain countries was demanded, it was

said that the records had been lost or stolen and that Miller's passport also had been lost. At length, Dr. Miller acknowledged that he had perpetrated a hoax on amateur radio.

This, a sad end to a sad story of a man who, log-wise, heard the siren call of far-away places but didn't bother to visit them all.

UFO Watch . . . More and more amateurs feel called upon to volunteer their efforts in the attempt to solve the UFO question. As signs that our government still is asleep on the problem become more evident there has been a growing feeling that perhaps we, the people, can form a posse to look into the mystery.

The UFO net was established a few months ago as an alerting system for the whole country in case of a UFO sighting. The basic idea was to make it possible for interested groups around the country to have a warning of the approach of a UFO so they could be ready for it, take pictures and perhaps run some scientific tests. But if you've read my last few columns you know all about that.

The net originally met on Wednesday nights at 2100 EST (0200 GMT) on 14.3 mc. With over a hundred stations calling in and interest growing weekly, the meetings have been made nightly. There are two net control stations each night so that stations from any part of the country can be checked in. There has been a growing interest in the net from DX operators but it will be some time before the net can be organized on a world-wide basis.

Amateur radio is set up, as is no other service or hobby, to provide the communications that are needed to investigate this UFO situation. It is up to us now.

$10 Beam Antenna For 10 Meters

Continued from page 97

all the mast clamps securely using lockwashers, and be sure the mount is perpendicular to the plane of the array.

To reduce the surface area exposed to the wind, plug the open ends of each element with a cork. (This will also prevent water from accumulating in the driven element.) Slip the previously-prepared length of coax into the driven element as shown in Fig. 2. Connect the feed line to the porcelain insulators. To insure maximum efficiency, place the antenna at least 8 to 10 ft. above the ground

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