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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 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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MARINE COMMUNICATIONS
Covers transmitters, direction finders, depth indicators, Radar, Sonar, other equipment on commercial ships, pleasure boats. Prepares for FCC License with Radar Endorsement.

MOBILE COMMUNICATIONS
Learn to install and maintain mobile transmitters and receivers used by police and fire departments, public utilities, construction firms, taxis, etc. Prepares for FCC License.

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Includes all new lessons and training equipment so you can build your own 3-band phone/cw 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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SPECIAL SECTION
An Introduction to Hi-Fi and Stereo ........................................ 57

AMATEUR RADIO
Outposts Awards for Hams and SWLs ........................................ 69
$10 Beam Antenna for 10 Meters .................................. Ronald Lumachi, WB2CQM 95
The Ham Shack ................................................................. Wayne Green, W2NSD/1 115

CITIZENS BAND
Pocket FSM for CB ............................................................ Joseph Ritchie 31
CB Corner: Morse Code for CB? .................................. Len Buckwalter, KQA5012 56

AUDIO & HI-FI
Super-Mini Speaker ......................................................... Harry Kolbe 73
Hi-Fi Today: Success Story ........................................... John Milder 84
How to Hi-Fi a Playtape ................................................ Victor Kell 100

SHORT-WAVE LISTENING
Notes From EI’s DX Club .................................................. 46
Outposts Awards for Hams and SWLs .............................. 69
DXing the Top of the World ........................................ Alex Bower 98
The Listener: Czechmate .............................................. C. M. Stanbury II 108

ELECTRONICS FOR EXPERIMENTERS
Tele Remote Control ....................................................... Vince Daniels 38
Build Your Own Ultrasonic Burglar Alarm ...................... Herb Cohen 85

ELECTRONIC MUSICAL INSTRUMENT
Easy-to-Build Electronic Bass ....................................... Fred Maynard 27

KIT REPORTS
Organ Rhythm Section .................................................. 45
Stereo Preamp and Power Amp ...................................... 76

THEORY & PRACTICE
Can Hard Rock Make You Stone Deaf? ............................ Eric Leslie 47
The Private War of Color TV ....................................... Vernon Simms 90

YOUR LIBRARY
Broadsides ................................................................... 24
Good Reading .............................................................. Tim Cartwright 68

NEW PRODUCTS
Electronic Marketplace .................................................. 10
Electronics in the News ................................................ 82

HOBBY AND BUSINESS OPPORTUNITIES
Swap Shop ..................................................................... 116

REGULAR FEATURES
Feedback ...................................................................... 6
Product Information Service ....................................... 15
Uncle Tom’s Corner ......................................................... Tom Kneitel, K2AES/KQD4552 20
EI at Large .................................................................. 25
1968 Index .................................................................. 102
Over & Out .................................................................. Rodrigues 110
Subscription Blank ........................................................ 122

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January, 1969
CIRCLE NUMBER 16 ON PAGE 15

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feature editor Robert Long
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associate editor Alan R. Surpin
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adv. director John F. Webster
eastern adv. mgr. Stanley Tessler

CONTRIBUTING EDITORS
amateur radio Wayne Green, W2NSD/1
citizens band Len Buckwater, KQA5012
swl-dx C. M. Stanbury II
special projects Herb Friedman,
WZZL/KB19457
audio Harry Koinbe
audio John Miller

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ELECTRONICS ILLUSTRATED is published bi-monthly by Fawcett Publications, Inc., Fawcett Bldg., Greenwich, Conn., 06830. Second-class postage paid at Greenwich, Conn., and at additional mailing offices.

EDITORIAL OFFICES: 67 W. 44th St., New York, N.Y. 10036 (phone 212-661-4400). Manuscripts should be accompanied by sufficient postage and will be handled with care, though the publishers assume no responsibility for return thereof.

ADVERTISING OFFICES: 67 W. 44th St., New York, N.Y. 10036 (phone 212-661-4401); 101 E. Ontario St., Chicago, Ill. 60611 (phone 312-645-1540); 801 Market St., San Francisco, Calif. 94103 (phone 415-775-1250); 681 Market St., San Francisco, Calif. 94105 (phone 415-624-4241); 1430 W. Wauchee St., N.W., Atlanta, Ga. 30308 (phone 404-732-6727); James B. Hoytton, 373 Tesouste Dr., Jupiter, Fla. 33458 (phone 561-444-8401) 122 N. Broad St., Philadelphia, Pa. 19109 (phone 215-461-5610).

SUBSCRIPTIONS: $3 per year (6 issues) in U.S. and possessions and Canada. All other countries $4 for 6 issues. All subscription correspondence, including changes of address (P.O. Box 3578), should be addressed to ELECTRONICS ILLUSTRATED, Subscription Dept., Fawcett Bldg., Greenwich, Conn. 06830. Foreign subscriptions and sales should be handled by International Money Order in U.S. funds payable at Greenwich, Conn.

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January, 1969
A Word Before You Go-Go

An electronic rhythm, section [Nov. '68 El]—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 El], 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 El]. 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 El]. 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 El.

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]
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CIRCLE NUMBER 41 ON PAGE 15

January, 1969
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Feedback from Our Readers
Continued from page 6

• LOOK, UP IN THE SKY!
Your article on weather satellites [July '68 EL] 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. WJAW also transmits APT satellite orbital data containing orbital information for tracking the satellite and geographically orienting the pictures obtained from it.


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.

• LOSERS
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 losers 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.

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January, 1969

CIRCLE NUMBER 8 ON PAGE 15
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 11⅝ 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 ¾ in. long and ½ 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 ± 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.
BUILD 20 RADIO CIRCUITS AT HOME with the New Improved PROGRESSIVE RADIO "EDU-KIT®"
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January, 1969

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You will receive all parts and instructions necessary to build twenty different radio and electronic circuits, each guaranteed to operate, use, and learn how to build and use the radio equipment. You will also receive a useful tool kit, a professional radio-soldering iron, and a self-powered Dynamo Radio and Electronics Trainer. The "Edu-Kit" also includes free course materials and free course instruction.

In addition, you receive all Printed Circuit materials, including Printed Circuit chassis, complete Printed Circuit kit, and other useful kit materials, plus the new method known as "Printed Circuit." These circuits operate on your regular AC or DC house current.

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- PROGRESSIVE RADIO TROUBLE-SHOOTING BOOK

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CONSULTATION SERVICE & F.C.C. LICENSE ELICITATION
PRINTED CIRCUIT

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, unique Signal Finder and the Dynamo Radio and Electronics Trainer.

In learning this practical way, you can institute your own repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consulting Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Statton, of 23 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 could afford the "Edu-Kit.""

Ron Valerio, P. O. Box 21, Magna, Utah: "The "Edu-Kits" are wonderful. Here I am an electronics student in school, and also the answers for them. I have been in it for a year and a half, and like the "Edu-Kits." They have given me the tools to build the radio equipment. I am very happy with them and the different kits, the Signal Tracer works fine. Also, I plan to make a good set, and have the feel of experience and also the feel of becoming a member of your Radio-TV Club."

Robert L., Shiff, 1534 Monroe Ave., Huntington, W. Va.: "Thoughts would drop you a few lines to say that I received my "Edu-Kit," and was just amazed that such a bargain can be had at such a low price. I have already started my own repair shop, and my friends were very surprised to see me in the "Edu-Kit."" The Trouble-shooting Tester that comes with the Kit is just what I need for the trouble, if there is any to be found."

Unconditional Money-Back Guarantee

Progressive "Edu-Kits" Inc., 1186 Broadway, Dept. DD0785, New York, N. Y. 15977

Progressive "Edu-Kits" Inc., 1186 Broadway, Dept. DD0785, New York, N. Y. 15977

January, 1969

CIRCLE NUMBER 10 ON PAGE 15
Weller makes first class soldering the easiest part of any job

The original Dual Heat Soldering Guns
Preferred by technicians for their fast heating copper tips, exclusive trigger-controlled dual heat, and high soldering efficiency. Available in 3 wattage sizes, each with spotlight:
- 100/140-watt Model B200, 145/210-watt Model D-440, and 240/325-watt Model D-550. Also in complete kits:

Dependable MARKSMAN Irons in a size for every job

Ideal for deep chassis work and continuous-duty soldering. Marksman irons outperform others of comparable size and weight. All five feature long-reach stainless steel barrels and replaceable tips:
- 25-watt, 1½-oz. Model SP-23 with ¼" tip (in kit with extra tips, soldering aid, solder—Model SP-23K)
- 40-watt, 2-oz. Model SP-40 with ¼" tip
- 80-watt, 4-oz. Model SP-80 with ¼" tip
- 120-watt, 10-oz. Model SP-120 with ¼" tip
- 175-watt, 16-oz. Model SP-175 with ¼" tip

25-watt Technician's Iron for intricate circuit work

Industrial rated pencil iron weighs only 1½ ounces, yet delivers tip temperatures to 860°F. Cool, impact-resistant handle. All parts readily replaceable. Model WPS with ½-inch tapered tip.

Also available: A new Battery Operated Iron for use with 12 volt battery or 12-24 volt AC/DC source. Complete with 12 ft. cord and battery clips. Model TCP-12.

Complete Weller Line at your Electronic Parts Distributor.

WELLER ELECTRIC CORPORATION, Easton, Pa.
WORLD LEADER IN SOLDERING TOOLS.

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 7 ½ in. Powered by 117 VAC. $199.99. Olson Electronics, Inc. 260 S. Forge St., Akron, Ohio 44308.
Our Research People

Golf clubs . . . fishing rods . . . antennas . . . bows and arrows . . . vaulting poles . . . pool cues and hot sticks have all evolved from Shakespeare's genius with fiberglass. Expert research reliability and people proven dependability let Shakespeare put a world-wide reputation for quality on the line with each product.

Want the best? . . . get a dependable Shakespeare fiberglass WonderShaft antenna. There's one for your requirement.

C/P CORPORATION
a subsidiary of Shakespeare
R.F.D. 3, Columbia, South Carolina 29205
Telephone (803) 787-8710

January, 1969
now...a dozen tools for dozens of jobs in a hip pocket set!

Really compact, this new nut driver/screwdriver set features 12 interchangeable blades and an amber plastic (UL) handle. All are contained in a slim, trim, see thru plastic case which easily fits hip pocket. Broad, flat base permits case to be used as a bench stand. Ideal for assembly and service work.

7 NUTDRIVERS:

2 SLOTTED SCREWDRIVERS:
3/16" and 9/32" tips.

2 PHILLIPS SCREWDRIVERS:
±1 and ±2 sizes.

EXTENSION BLADE:
Adds 4" reach to driving blades.

HANDLE:
Shockproof, breakproof. Exclusively positive locking device holds blades firmly for turning. Permits easy removal.

WRITE FOR CATALOG 162

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 assure 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. 90034.

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 5 1/4 x 13 7/16 x 8 1/2 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.
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.

Mail the completed coupon to ELECTRONICS ILLUSTRATED at the address shown—We'll take care of the rest.

<table>
<thead>
<tr>
<th>ELECTRONICS ILLUSTRATED</th>
<th>VOID AFTER FEBRUARY 15, 1969</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
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<td>12</td>
<td>13</td>
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January, 1969 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 step 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 Drafter, 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.

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January, 1969
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?


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 M2300—18 tube performance. Unique modulation sampler. Range expand. All 23 channels. Dual conversion. Built-in PA system — transistorized power supply. $189.95

MODEL XM2300 — 19 tube performance. Cascade front end. Nuvisor mixer. All 23 channels. Our most sensitive and quiet rig. $199.95

MODEL T23 — Solid state engineering for unsurpassed reliability. 23 channels. Fiberglass epoxy 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 XT23 — 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

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

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

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CIRCLE NUMBER 45 ON PAGE 15

January, 1969
IN ELECTRONICS CALCULATING

Still plodding through math and electronics problems the slow pencil-and-paper way? Smash the paperwork barrier with this new Electronics Slide Rule.

Even if you’ve never used a slide rule before, you can whiz through resonant frequency calculations and inductive or capacitive reactance problems. You can find reciprocals for resistance formulas instantly. You can even locate tricky decimal points in a jiffy.

You can also work regular math problems in a flash: multiplication...division...square roots...logarithms...trigonometry.

Anyone can use this sturdy 12-inch, all-metal slide rule. We show you how with our complete 4-lesson instruction course. Slide rule, course, and handsome leather carrying case deliberately priced low as our way of making friends with men in Electronics. FREE booklet gives full details. Mail coupon below today.

MAIL THIS COUPON FOR FREE BOOKLET

CIE Cleveland Institute of Electronics
1776 East 17th Street, Cleveland, Ohio 44114
Please send me your FREE booklet describing the Electronics Slide Rule and 4-lesson instruction course. Also FREE if I act at once—a handy pocket-sized Electronics Data Guide.

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CIRCLE NUMBER 25 ON PAGE 15

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 WIXAA joined USAF MARS he would use the call AFIXAA. 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, hearing 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, WA2JVS
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—sounding 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 I.YG 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.

January, 1964
What kind of investment is Freedom Shares?

- Shrewd?
- Safe?
- Patriotic?
- Exclusive?

You're right if you checked all four boxes. Freedom Shares are a shrewd investment because they pay 4.74%, when held to maturity. They mature in just four-and-a-half years, and are redeemable after one year.

There is no safer investment because Freedom Shares are backed by The United States of America.

Exclusive? Absolutely. Not everyone can buy Freedom Shares. You have to belong to the Bond-a-Month or Payroll Savings Plan. Freedom Shares are a bonus opportunity for these regular Bond buyers.

And, as you help yourself by buying Freedom Shares, you're also helping your country. Sign up for Freedom. Get all the facts from the payroll people where you work or any officer where you bank.

U.S. Savings Bonds, New Freedom Shares

The U.S. Government does not pay for this advertisement. It is presented as a public service in cooperation with the Treasury Department and the Advertising Council.

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 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 Jansen 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.
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 hit 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 multi-section 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.
... 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 C₂ and going up to C₁. (The 2½-octave range of a real string bass goes from E₃ up to B₁.)
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 (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 C4 to C1—the second to the first octave below middle
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: 1/2 or 1/4 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 Trimport, Lafayette 33 T 1671 or equiv.)
R22 through R25—5,000 ohm, linear-taper miniature potentiometer (Mallory MTC-53L4 Trimport, 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.

<table>
<thead>
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<th>Freq. (cps)</th>
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Electronics Illustrated
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 2½ x 1½-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

January, 1969
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 1/8 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 1-1/8-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
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.

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 ½ and ¾ 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.

January, 1969
Hunting for a better job?

Here's the license you need to go after the big ones.
A Government FCC License can help you bring home up to $10,000, $12,000, and more a year. Read how you can prepare for the license exam at home in your spare time—with a passing grade assured or your money back.

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Right now there are 80,000 new openings every year for electronics specialists—jobs paying up to $5, $6, even $7 an hour...$200, $225, $250, a week...$10,000, $12,000, and up a year! You don't need a college education to make this kind of money in Electronics, or even a high school diploma.

But you do need knowledge, knowledge of electronics fundamentals. And there is only one nationally accepted method of measuring this knowledge...the licensing program of the FCC (Federal Communications Commission).

Why a license is important
An FCC License is a legal requirement if you want to become a Broadcast Engineer, or get into servicing any 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.

So why doesn't everyone who wants a good job in Electronics get an FCC License and start cleaning up? The answer: it's not that simple. The government's licensing exam is tough. In fact, an average of two out of every three men who take the FCC exam fail.

There is one way, however, of being pretty certain that you will pass the FCC exam. And that is to take one of the FCC home study courses offered by Cleveland Institute of Electronics.

CIE courses are so effective that better than 9 out of 10 CIE graduates who take the exam pass it. That's why we can back our courses with this ironclad Warranty: Upon completing one of our FCC courses, you must be able to pass the FCC exam and get your license—or you'll get your money back!

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2. Electronics Engineering...covers steady-state and transient network theory, solid state physics and circuitry, pulse techniques, computer logic and mathematics through calculus. A college-level course for men already working in Electronics.

Ed Dulaney, Scottsbluff, Nebraska, for example, passed his 1st Class FCC License exam soon after completing his CIE training...and today is the proud owner of his own mobile radio sales and service business. "Now I manufacture my own two-way equipment," he writes, "with dealers who sell it in seven different states, and have seven full-time employees on my payroll."

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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If you'd like to succeed like these men, send for our FREE 24-page book "How To Get A Commercial FCC License." It tells you all about the FCC License...requirements for getting one...types of licenses available...how the exams are organized and what kinds of questions are asked...where and when the exams are held, and more.

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City ____________________________
State ______ Zip ______ Age ______
☐ Check here for G.I. Bill information E1-79

January, 1969
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-
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 3½ x 3½ x 1½ 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-
Television Remote Control

Fig. 3—Tone generator. Oscillator should be built on L-shaped perforated board (2 1/8 x 2 3/4 x 5/8 in.) before installing board in plastic box. Switches S1, S2 and S3 mount in left and right side of box. Note where 1/4-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.
At the intersection of each horizontal and vertical line to make a speaker grill.

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 1/2-in. centers. Drill through the cabinet with a 1/4-in. 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 1/2-in. centers. Drill through the cabinet with a 1/4-in. drill speed. A high-speed drill will melt the plastic and gum up the bit.

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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 1/4-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 1/4-in. standoff or stack of...
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 5/8 in. long screws. Then, run down a second set of nuts on three of the screws until they're 1/2 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 amplifier 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.

January, 1969

PARTS LIST

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<th>Part</th>
<th>Description</th>
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<td>B1</td>
<td>9-V battery (Burgess 2U6 or equiv.)</td>
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<tr>
<td>BPA,BP1,BP2,BP3</td>
<td>Five-way binding post</td>
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<tr>
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<td>C4</td>
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<td>2N301 transistor (RCA)</td>
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<tr>
<td>L5</td>
<td>115 VAC, 1500-ohm coil</td>
</tr>
<tr>
<td>L6</td>
<td>4700 ohms</td>
</tr>
<tr>
<td>L7</td>
<td>4700 ohms</td>
</tr>
<tr>
<td>L8</td>
<td>4700 ohms</td>
</tr>
<tr>
<td>L9</td>
<td>1N34A diode</td>
</tr>
<tr>
<td>L10</td>
<td>25 VDC, 250-mA, 500-pF coil</td>
</tr>
<tr>
<td>L11</td>
<td>85 VAC, 1000-pF coil</td>
</tr>
<tr>
<td>L12</td>
<td>12-VDC, 1200-pF coil</td>
</tr>
<tr>
<td>L13</td>
<td>610 VAC, 100-pF coil</td>
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<td>L14</td>
<td>90 VAC, 250-pF coil</td>
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<tr>
<td>L15</td>
<td>100 VAC, 10-pF coil</td>
</tr>
<tr>
<td>L16</td>
<td>150 VAC, 1-pF coil</td>
</tr>
<tr>
<td>L17</td>
<td>50 VAC, 0.1-pF coil</td>
</tr>
<tr>
<td>L18</td>
<td>50 VAC, 0.01-pF coil</td>
</tr>
<tr>
<td>L19</td>
<td>50 VAC, 0.001-pF coil</td>
</tr>
<tr>
<td>L20</td>
<td>50 VAC, 0.0001-pF coil</td>
</tr>
</tbody>
</table>

Fig. 8—To test receiver, plug a small lamp in SO1 and connect speaker to B01,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]
**El Kit Report**

**Organ Rhythm Section in a Kit**

**Heathkit** (Band Box) **Playmate**

**R**ight 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 heat out 15 rhythms—waltz, Viennese waltz, jazz waltz, fox trot 2/4, hoogie 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.

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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.

*January, 1969*
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 beam 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.

Electronics Illustrated
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

January, 1969
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:

- Noise definitely can lift the threshold of hearing—the volume level below which we can hear no sound—as much as 30db 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

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**Can Hard Rock Make You Stone Deaf?**

<table>
<thead>
<tr>
<th>Threshold of Pain</th>
<th>DB</th>
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</thead>
<tbody>
<tr>
<td>Jet Takeoff 200 Ft. Away</td>
<td>140</td>
</tr>
<tr>
<td>Rock-and-Roll Peak</td>
<td>130</td>
</tr>
<tr>
<td>Riveting Machine</td>
<td>120</td>
</tr>
<tr>
<td>Average Rock-and-Roll</td>
<td>110</td>
</tr>
<tr>
<td>Printing Plant</td>
<td>90</td>
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<tr>
<td>Pneumatic Drill 50 Ft. Away</td>
<td>80</td>
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<td>Normal Speech</td>
<td>70</td>
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<tr>
<td>Expressway Traffic</td>
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</tr>
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<tr>
<td>Extreme Quiet</td>
<td>20</td>
</tr>
<tr>
<td>Threshold of Hearing</td>
<td>10</td>
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</table>

Fig. 1—Typical sound-level readings give some idea how electronically-amplified music compares with other sound sources and threat it poses.
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 not 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 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 by 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.
The HEATHKIT "Booie-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... high country lakes & streams... through rough 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 husker than a mini-bike, smaller, lighter and substantially more powerful than a motorcycle-type trail bike... and yet has the uplift, spring, traction and sheer guts of a mountain goat. Here's why: Pre-mounted on the welded 7/16" 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 x 4.50") but the tubeless rear tire is nothing short of huge (18 x 8.30"). And that's what's behind the amazing all-season performance... that 85" 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 (G-18-18-1) at $16.50. Heathkit's unique "grap-lock" mounting eliminates any need for tools too!

And stopping is easy and safe with the big hand-operated Bendix drum type rear brake. It's backed 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.

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. A/C makes AM tuning easy. The "Auto" position on the Telechron clock turns only the radio on, or use the "Alarm" setting for both radio and the alarm. You can even enjoy fresh coffee when you wake up. And you can wake up again, thanks to the clock-controlled accessory ACocket 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 plastic cabinet and top reliability make this GR-58 the clock radio for you. 7 lbs.

HEATHKIT TA-38 Solid-State Bass Amplifier

The new Heathkit 1A-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 music power, 230 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 1/2" pressed wood cabinet... these 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. A 15 hour assembly to the widest bass amp on the market. Order one today and surprise the guys with the high-priced gear. 140 lbs.

HEATHKIT SB-310 Professional SW Receiver

The finest shortwave receiver you can buy. Covers six shortwave broadcast bands (40, 31, 20, 19 & 16 meters), 80, 90 & 11 meter CB. And the new optional SHA-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-calibrated 1 linear Master Oscillator... crystal-controlled "front end" for same-rate tuning on all bands... linear tuning with 1 kHz calibrated... separate RT and AF gain controls... 5 kHz crystal filters included for clear AM, CW & SSB reception... high input & output levels and upper and lower sideband coverage... built-in 1000 kHz calibrator... headphone jack... calibrated 5 meter... famous Heathkit Shortwave styling and much more. For the finest shortwave listening, order your SB-310 today. 24 lbs. SHA-310-3, 15 Meter Conversion Kit 1 lb., 59.95.

CIRCLE NUMBER 3 ON PAGE 15
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 AIRC 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. Fandem 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 mute or light tells you if the program is in stereo. A C puts an end to drift too. The BSR Automatic Turntable has features normally found only in very expensive units, like tuning and mute control, variable anti-skating device, phasing pressure adjustment, and automatic system power too. Comes complete with a famous Shure diamond stylus magnet 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 new, 41 lbs.

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-300 Automatic Turntable and put both of these fine components in a handsome walnut-finished cabinet. The result is the"17" - ? Watts music power, 12 Hz to 60 kHz response, auxiliary & tuner inputs. less than 1 Harmonic & IM distortion, adjustable stylus pressure & anti-tilt control and much more. Order your "17" now, 27 lbs.

HEATHKIT AS-18 Miniature Speaker System

Minute in size, but not in performance. This new Heathkit acoustically coupled 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 1/4" x 1/4" W x 6" D walnut cabinet is protected by clear vinyl for lasting good looks. Pick a pair of these performers for stereo compacts, 16 lbs.

HEATHKIT MI-18 Solid-State Tachometer

The new Heathkit MI-18 has advanced performance features like unique inductive pickup for connection in any spark-type engine and any ignition system, 0-9000 & 0-6000 RPM ranges, temperature compensated 4½" accuracy, stainless steel hardware, splash proof 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.

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 its 34 inch antenna, three IF stages and 5 KV sensitivity, performs like a high priced table model receiver. A C 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.

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 3-year warranty on the plug-in tone generators. Ten trumpets . . . ten bass drums . . . variable repeat percussion switch . . . 13 voice select and toe bass pedals for C1 to C4 range . . . two optional 37-tone keyboards, range C2 thru C# each . . . Color-Glo keyights . . . 75 watt peak music power amplifier . . . 12 speaker . . . vibrato . . . manual balance control. Engineers at Heathkit 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 fantastic tone unit is written and tuned with its ease to follow instructions and multi-fold out pictorials make the 50 hour assembly enjoyable. Comes with finished walnut cabinet and bench plus 40-lesson self-teaching course. Put the sound of music in your home this Christmas with the GD-325C from Heathkit, 172 lbs.

CIRCLE NUMBER 3 ON PAGE 15
Now There Are 4 Heathkit Color TV's...
All With 2-Year Picture Tube Warranty

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

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 is only 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 FCA-681S 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 booster and color filter. Built-in sound output; two VHF antenna inputs plus the built-in self-servicing aids that are standard on all Heathkit color TV's. It can't be bought on any other set for any price... plus all the features of the famous "227" below. Compare the "681" against the others.

GRA-295-4, Mediterranean cabinet shown...
$199.50
Other cabinets from $62.95

Deluxe "295" Color TV... Model GR-295
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 butter-free pictures under all conditions... preassembled H strip with 3 stages instead of the usual two... Deluxe VHF tuner with "memory" fine tuning... three-waB installatron wall, custom or any of the beautiful Heathkit 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
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Deluxe "227" Color TV... Model GR-227

Has same high performance features and built-in servicing facilities as the GR-295, except 227 sq. in. viewing area. The same rugged 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...
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Mediterranean style also available at $99.50

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

Same high performance features and exclusive self-servicing facilities as the GR-295, except for 180 sq. in. viewing area. Large 18" screen is the Heathkit "180" is your best buy in deluxe color TV viewing...

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The Heathkit AR-15 has been highly praised by every leading audio and electronics magazine, every major testing organization and thousands of owners. This powerful solid-state circuit delivers 150 watts of music power, 75 watts per channel, at 1 watt distortion at 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... Cassette 2-stage HF IF amplifier and an IF mixer for high overload capability, excellent cross-modulation and image rejection. Sensitivity of 15 db 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. 14 lbs. Optional walnut cabinet, V-16, 16 lbs., $24.95

HEATHKIT AJ-15 Deluxe Stereo FM Tuner

The remarkable solid-state FM stereo tuner section from the famous Heathkit AK-15. If you already own a line stereo amplifier, the AJ-15 is the stereo IFM tuner for you. It has the exclusive design Heathkit 12 IFM tuner with two L14442 amplifiers and an IF mixer for 1.8 MHz 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, V-18, 8 lbs., $19.95

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The powerful solid-state amplifier section from the famous Heathkit AR-15. If you already have a line stereo tuner, the AA-15 is the perfect mate for it. It offers a total of 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 tonefort 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 lights. Put the world's best stereo amplifier in your system now... the AA-15 28 lbs. Optional walnut cabinet, V-18, 8 lbs., $19.95

HEATHKIT AS-48 High Efficiency System

Our best Heathkit System... the new AS-48 with famous JBL speakers. The specially constructed 14-inch woofer employs a 4-inch voice coil, 1½ pounds of magnet assemblies and an inert, self-damping material to deliver clear, full-bodied bass down to 40 Hz. Open highs, up to 20 kHz came from the 2½ direct radiator. L-C 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 plywood finished cabinet for easy construction. For very high performance stereo, order two of these amazing bookshelf systems today. 4 lbs.

HEATHKIT AS-38 Bookshelf System

Our 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 for use with the best of components. The 12-inch woofer and 2½ tweeter produce clean, natural response from 4 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 $8 lbs.
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.

Nevertheless, 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-
Frequency 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...
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, 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 0.5%, 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 phone 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. At 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 (phone, 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.

See the complete Cortina® Line at your EICO Dealer.
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.

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**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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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, $2\mu\text{V}$ for 30db quieting. This means that $2\mu\text{V}$ 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.
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 3 3/4 ips sound that is virtually indistinguishable from that at 7 1/2 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 El). Until specially-processed prerecorded tapes are available, its advantages will apply only to tapes you make yourself.
Good Reading
By Tim Cartwright


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. Dezett. Howard Sams & Bobbs-Merrill, New York and Indianapolis. 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.


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.


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.


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...


Transistor Substitution Handbook. Howard Sams. 128 pages. $1.95


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.
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 faraway, romantic DX countries and partly be-

**EI’s OUTPOSTS LIST**

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January, 1969
caused by the shrinking totals in the cases 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 address.

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### HANDY GUIDE TO EI’S DX AWARDS

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<thead>
<tr>
<th>CLASS OF AWARD</th>
<th>TYPE OF AWARD</th>
<th>FREQ. LIMITS</th>
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<td>Major Cities-25</td>
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<td>Outposts-6</td>
<td>SWL</td>
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</tbody>
</table>
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 .......................................................... HAM CALL .......................................................... (last name) (first name and initial)

ADDRESS ........................................................................................................................................

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

TYPE OF AWARD {  □  SWL  } □  HAM  }

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

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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 \( \frac{1}{2} \) 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.

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

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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.

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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.

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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
½ x ¼-in. pine cleats
½-in. plywood, flake board, or walnut-veneer plywood
Grille cloth
Rubber mounting feet
Walnut wood tape
8-32 x ¾-in. flat-head screws and washers
No. 6 x ½-in. round-head wood screws
Foam-rubber strips
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 1¼-in.-long piece of 1-in.-dia. dowel attach 1¾-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]
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 pre-amp 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.
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 1.5 db at 6 kc, 4.5 db at 7 kc and 15 db at 10 kc.

The lo-filter (for rumble) switch is similarly effective and the cut is 3.5 db at 70 cps and 20 db at 10 cps. The loudness control provides only bass boost—approximately 11.5 db 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 sub-assembly 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 photographs 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 +1.5 db, -0.5 db from 5 to 50,000 cps. The system is extraordinarily quiet—the magnetic-input noise level was better than 70 db down.

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

[Continued on page 113]
6 good reasons to get into electronics:

1. (Image of a convertible car)

2. (Image of the Eiffel Tower)

3. (Image of a wallet)

4. (Image of a man with a car)

5. (Image of a formal dining setting)

6. (Image of a ring in a box)
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!
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?
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 1/4-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 ¼ 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 1¾-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.
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—El. 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

<table>
<thead>
<tr>
<th>INTERNATIONAL ALIGNMENTS IN THE COLOR-TV WAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NTSC (American)</strong></td>
</tr>
<tr>
<td>Canada</td>
</tr>
<tr>
<td>China (Formosa)</td>
</tr>
<tr>
<td>Ecuador</td>
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<tr>
<td>Japan</td>
</tr>
<tr>
<td>U.S.A.</td>
</tr>
<tr>
<td>Saudi Arabia</td>
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<tr>
<td>Algeria</td>
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<td>Bulgaria</td>
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<td>Cameroon</td>
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<td>Central African Rep.</td>
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<td>Colombia</td>
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<td>Congo (Brazzav.)</td>
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<td>Cuba</td>
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<td>Czechoslovakia</td>
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<td>Dahomey</td>
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*Only a few countries: U.S., Canada, Japan, U.K., Germany, France, for example, are on the air with regular color broadcasts. Russian NIK, 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 interleave 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

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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-

SECAM

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.
distributed 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) it 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

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**PAL**

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.

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**Diagram 1:**
- **RED**
- **BLUE**
- **ERROR, LINE 2**
- **RESULTANT (=NORMAL COLOR)**
- **ERROR, LINE 1**

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.

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**Diagram 2:**
- **RED**
- **BLUE**
- **NORMAL COLOR**
- **ERROR COLOR**

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]

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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 6 dB and spurious-signal rejection at sides and rear is about 30 dB and 35 dB, 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. 5 1/2-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. 2 3/4 in.) carefully cut through the outer jacket with a sharp knife. Make additional cuts in the jacket 3 1/2 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 1 1/2 in. of the jacket, peel back the shield and cut off about 1 1/2 in. of the dielectric. Do not cut the inner conductor short.

Twist the shield around the center con-
**$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 ¾-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

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**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 ¾-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.
antenna around 28.6 mc., depending on your installation.

When installing the end pieces, insert about 4 to 5 in. of 7/8-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 1 1/2-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 1/4-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 1 1/4-in. dia. wood dowel to the dimensions in Fig. 4. Drill 1/4-in. holes in the wood support for the mast clamp.

Six in. from the inside ends of the driven elements, drill a 3/8-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 4 1/2 x 9 x 1/2-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]
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.

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 free-power AFRTS transmitters at Cape Lusborne, 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

**DXing the Top of the World**

By ALEX BOWER

**EI’s GUIDE TO ARCTIC BROADCASTING**

<table>
<thead>
<tr>
<th>FREQUENCY (kc)</th>
<th>STATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>Tromso, Norway</td>
</tr>
<tr>
<td>209</td>
<td>R. Iceland</td>
</tr>
<tr>
<td>380</td>
<td>Archangel, U.S.S.R.</td>
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<td>656</td>
<td>Murmansk, U.S.S.R.</td>
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<td>660</td>
<td>KFAR, Fairbanks, Alaska</td>
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<td>790</td>
<td>KFRB, Fairbanks, Alaska</td>
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<td>860</td>
<td>CHAK, Aklavik, Northwest Territories (Canada)</td>
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<td>1425</td>
<td>AFRTS, Thule, Greenland</td>
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<tr>
<td>5980</td>
<td>Godthaab, Greenland</td>
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<tr>
<td>11735</td>
<td>Tromso, Norway</td>
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Electronics Illustrated
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 ORM from an LW station at Brasov, Romania) 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 El). The CBC has attempted a similar approach, but using 50-kw BCB outlets much further 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 like the best yet. –  

January, 1969
How to Hi-Fi a PlayTape

By VICTOR KELL

FIRST it was the transistor radio that teeny-hoppers used to assault our ears. They drove us absolutely mad in buses, at the beach and even in the flics. 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 1/8- 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.

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.
El's 1968 Index

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

AMATEUR RADIO

Antennas:
Ground Plane, 6-Bit Maziars (C) Jan. 106
Tuner, Compact Antenna Richards (C) May 49
Transmitter for Vehicle Antennas Alexander (C) Nov. 94
Award for HAMS & SWLs 25 Major Cities
Clipped: The Modumax Friedman (C) May 71
Converter, 6 & 10 Green, Chas. (C) July 71
GPO, Buffered Daniels (C) Nov. 40
CW Monitor, Wireless Friedman (C) July 93
Ham Station, Lunchbox Buckwalter (C) Jan. 57
Incentive Listening is back! Blatz (F) Jan. 38
Mike Preamp, A UniFET? Mann (C) May 57
Transmitters:
40 and 80, 20 Watts for White (C) Mar. 29
2 Meters, 2 Tubes for Green, Charles (C) Sept. 42
VOX, The FET Powell (C) May 61

AUDIO, STEREO & HI-FI

FM Radio, Automatic Green, Chas. (C) July 87
Mike Preamp, A UniFET? Mann (C) Mar. 57
Power House, How to cope with the Locke (TP) Mar. 41
Preamp, Phono/Tape Ritchie (C) July 38
Records:
Care, The ABCs of Record Angus (TP) Mar. 82
How Long Do Stere o Records Last? Swathmore (TP) Sept. 70
Speakers:
Extensions Division, Milton Buckwalter (TP) Nov. 70
Mini Min Speaker Kolbe (C) May 65
Shoebox Speaker, A Real Capotosto (C) Nov. 29
Super, Super Thin Speaker Capotosto (C) Mar. 71
Stereo Balancer, Super Glenn (C) May 56
Stereo Control Center, Bedroom Salm (C) Jan. 67
Stereo FM, Who goofed on? Roberts (F) Sept. 63
Tape Recording:
Aha! FM Cartridges for Tape Players (F) Jan. 42
Bootleg Tapes, The Boom in Angus (F) Sept. 89
Dust-Cover for Tape Recorder Capotosto (C) Sept. 32
Tape Cartridge, Continuous Play Karmin (C) Nov. 101
Tapes, El Tests the Popular Audio Angus (F) Jan. 93
Tape Player in Your Car, How to Install a Capotosto (C) Mar. 49
Tape Player to Your Phone, How to Hook a Davidson (C) Nov. 109

CB License—The First Time, Buckwalter (F) Mar. 75
How to Get A! Levesque (F) Sept. 82
Clipped: The Modumax Friedman (C) May 71
Installation Guide, Roof to Basement CB Ritchie (C) Nov. 84
Jamboree Swing, Making Glenn (C) Sept. 99
Your CB Levesque (F) Nov. 91
Mike Preamp, A UniFET? Mann (C) Mar. 57
Nightmare in Indiana, CB Buckwalter (C) May 82
Receiver, Pocket CB Daniels (TP) May 75
State of the CB Art, The Transmitter, Junior Ham Ritchie (C) May 86
VOX, The FET Powell (C) May 61
Walkie-Talkies:
Rocky Road to 50 mc, Long (F) Jan. 102
Those Cheapie Walkie-Talkies Garret (F) Jan. 73

KIT REPORTS

Guitar Amp, Junior (Heathkit K-37) Sept. 93
Ignition System, Capacitive Discharge (Knight-Kit KG-177) Nov. 51
Power Pack, Two Way (Knight-Kit KG-666) May 47
Receiver, Extended Coverage (Ameco R-5) Sept. 72
RF Generator With Calibrated Output (Knight-Kit KG-684) May. 107
Stereo Receiver, A First Rate (Heathkit AR-15) Sept. 38
Stereo FM Tuner, Budget (Eico Cortina 1200) July 44
Stereo Tuner, FET (Scott LT-1128) Jan. 84
Transceiver for Novices, A (Heathkit HW-16) July 77

SERVICING

Calibrator for Your Scope's Sweep Green, Clare (C) Nov. 88
Career at the Service Bench for You, A? Margolis (F) Jan. 87
Electronics: Coping With TV's No. 2 Bed Guy, Margolis (TP) Sept. 67
Gyp the TV Repairman, How to Millivoltmeter, An FET Henry (C) Sept. 73
Printed-Circuit Servicing Made Easy Ritchie (TP) Mar. 93
Servicing, How To Make Money in Part-Time O'Donnel (F) Nov. 67
Transformers, A Handy Guide to Unmarked Buckwalter (TP) July 56
VTVM, Pocket Green, Clare (C) July 29

SHORT-WAVE LISTENING

Antennas:
Ground Plane, 6-Bit Multi-Dipole SWL Maziars (C) Jan. 106
Antenna, The Latest on DXing Maziars (C) Sept. 86
Apollo, Which is the Best? Davis (F) Jan. 104
Award for HAMS & SWLs, 25 Major Cities Eavesdropping on Big Brother Kneitel (F) Jan. 90
Folk Music, DXing Bower (F) July 32
Great Cities, How to Log 25 Bower (F) Mar. 68
Language Via Short Wave, Learn A Cookfair (F) Jan. 33
S. Niner, The FET Charrell (C) May 47
Time Standard, Portable Green, Charles (C) Nov. 45
2-Faced Clock, Would You Believe? Lincoln (5) Nov. 108
Utilities, DXing the Sunspot Bower (F) Nov. 32

SPECIAL CONSTRUCTION PROJECTS

Band Scanner, CB Kolbe (C) July 64
Beam for CB, Mobile Morris (C) May 72
CB: A Reappraisal Levesque (F) May 69
Buq, Build Your Own Henry Jan. 29
Flasher, Auto Effenberger Nov. 75
**El's 1968 Index**

<table>
<thead>
<tr>
<th>Category</th>
<th>Article</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal Locator, Super-Sensitive</td>
<td>O'Donnell</td>
<td>May 30</td>
</tr>
<tr>
<td>Military Planes, Evesdrop on El</td>
<td>Green, Charles</td>
<td>Jan 41</td>
</tr>
<tr>
<td>Musical Instruments:</td>
<td>Friedman</td>
<td>July 83</td>
</tr>
<tr>
<td>Fuzz Box for Swingers</td>
<td>Maynard</td>
<td>Mar 38</td>
</tr>
<tr>
<td>Gildophone, The</td>
<td>Maynard</td>
<td>Nov 57</td>
</tr>
<tr>
<td>Rhythm Section You Can Build, A</td>
<td>Walker</td>
<td>May 38</td>
</tr>
<tr>
<td>Theremin, Wide-Range</td>
<td>Daniel</td>
<td>Sept 57</td>
</tr>
<tr>
<td>PA, Portable</td>
<td>Ritchie</td>
<td>Jan 70</td>
</tr>
<tr>
<td>Spial Stopper</td>
<td>Ritchie</td>
<td>Sept 47</td>
</tr>
<tr>
<td>Stroboscope, Pinch-Penny</td>
<td>Ritchie</td>
<td>Sept 47</td>
</tr>
<tr>
<td>Switch, Sonic</td>
<td>Ritchie</td>
<td>Sept 47</td>
</tr>
<tr>
<td>Test Equipment:</td>
<td>Ritchie</td>
<td>Sept 47</td>
</tr>
<tr>
<td>Calibrator for Your Scope's Sweep</td>
<td>Green, Clare</td>
<td>Nov 88</td>
</tr>
<tr>
<td>Millivoltmeter, An FET</td>
<td>Henry</td>
<td>Sept 73</td>
</tr>
<tr>
<td>VTVM, Pocket</td>
<td>Green, Clare</td>
<td>July 29</td>
</tr>
<tr>
<td>Time Standard, Portable</td>
<td>Green, Charles</td>
<td>Nov 45</td>
</tr>
<tr>
<td>2-Faced Clock, Would You Believe?</td>
<td>Lincoln</td>
<td>Nov 108</td>
</tr>
</tbody>
</table>

**SPECIAL FEATURE ARTICLES**

<table>
<thead>
<tr>
<th>Article</th>
<th>Authors</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery, Instant</td>
<td>Angus</td>
<td>Sept 40</td>
</tr>
<tr>
<td>Bootleg Tapes, The Boom In</td>
<td>Angus</td>
<td>Sept 89</td>
</tr>
<tr>
<td>Careers:</td>
<td>Margolis</td>
<td>Jan 87</td>
</tr>
<tr>
<td>Career at the Service</td>
<td>Margolis</td>
<td>Jan 87</td>
</tr>
<tr>
<td>Bench for You, A?</td>
<td>Margolis</td>
<td>Jan 87</td>
</tr>
<tr>
<td>Career In Airline Electronics, How About</td>
<td>Surpin</td>
<td>July 69</td>
</tr>
<tr>
<td>a High-Flying</td>
<td>Surpin</td>
<td>July 69</td>
</tr>
<tr>
<td>Historical:</td>
<td>Surpin</td>
<td>July 69</td>
</tr>
<tr>
<td>Radio 1212, The Short</td>
<td>Althouse</td>
<td>Sept 95</td>
</tr>
<tr>
<td>Treacherous Life of</td>
<td>Angus</td>
<td>Nov 41</td>
</tr>
<tr>
<td>Sayville, The Secret of</td>
<td>Angus</td>
<td>Nov 41</td>
</tr>
<tr>
<td>WBHH, The Station With</td>
<td>Kneitel</td>
<td>Nov 82</td>
</tr>
<tr>
<td>Everything—Except a License</td>
<td>Kneitel</td>
<td>Nov 82</td>
</tr>
<tr>
<td>Radio Americas, El Visits</td>
<td>Ritchie</td>
<td>July 45</td>
</tr>
<tr>
<td>Telephone Answerer, Low-Cost</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>TV-Tower Crisis, New York's</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Uncle Tom's Cabin, A</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Peek In</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Voicing For Wind</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Instruments, Electronic</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Walkie-Talkies, Those</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Cheapsie</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Weather Forecasting, What</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>Have Satellites Done For?</td>
<td>Ritchie</td>
<td>Sept 94</td>
</tr>
<tr>
<td>THEORY &amp; PRACTICE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bugged Pigeon, The Case</td>
<td>Hill</td>
<td>Nov 38</td>
</tr>
<tr>
<td>of the</td>
<td>Buckwalter</td>
<td>Sept 29</td>
</tr>
<tr>
<td>Diodes, What's New in?</td>
<td>Buckwalter</td>
<td>Nov 70</td>
</tr>
<tr>
<td>Extensions (speaker)</td>
<td>Cookfair</td>
<td>Jan 33</td>
</tr>
<tr>
<td>Division, Hi-Fi How-To</td>
<td>Cookfair</td>
<td>Jan 33</td>
</tr>
<tr>
<td>Language via Short Wave, Learn a</td>
<td>Cookfair</td>
<td>Jan 33</td>
</tr>
<tr>
<td>Power Hoax, How to Cope</td>
<td>Locke</td>
<td>Mar 41</td>
</tr>
<tr>
<td>With the</td>
<td>Locke</td>
<td>Mar 41</td>
</tr>
<tr>
<td>Printed-Circuit Servicing</td>
<td>Locke</td>
<td>Mar 41</td>
</tr>
<tr>
<td>Made Easy</td>
<td>Locke</td>
<td>Mar 41</td>
</tr>
<tr>
<td>Protect Electronic Gear in Your Car, How to</td>
<td>Ritchie</td>
<td>Mar 93</td>
</tr>
<tr>
<td>Record Care, The ABCs of</td>
<td>Ritchie</td>
<td>Mar 93</td>
</tr>
<tr>
<td>Tapes, El Tests the Popular</td>
<td>Ritchie</td>
<td>Mar 93</td>
</tr>
<tr>
<td>Audio</td>
<td>Ritchie</td>
<td>Mar 93</td>
</tr>
<tr>
<td>Tape Player in Your Car, How to Install a</td>
<td>Joseph</td>
<td>Mar 39</td>
</tr>
<tr>
<td>Tape Player to Your Phone, How to Hook a</td>
<td>Joseph</td>
<td>Mar 39</td>
</tr>
<tr>
<td>Transistor Experiments, 10 Really Basic</td>
<td>Joseph</td>
<td>Mar 39</td>
</tr>
<tr>
<td>SIA—Tiniest Antenna or Biggest Bust</td>
<td>Joseph</td>
<td>Mar 39</td>
</tr>
<tr>
<td>Transformers A Handy Guide to Unmarked</td>
<td>Joseph</td>
<td>Mar 39</td>
</tr>
</tbody>
</table>

**January, 1969**

**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 le: out a howl because it is as hot as lava. Instead of scaring your fingers again, make a tube puller by attaching a rubber furniture tip to a dowel. A ½-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.”
Ask any man who really knows the electronics industry.

Opportunities are few for men without advanced technical education. If you stay on that level, you'll never make much money. And you'll be among the first to go in a layoff.

But, if you supplement your experience with more education in electronics, you can become a specialist. You'll enjoy good income and excellent security. You won't have to worry about automation or advances in technology putting you out of a job.

How can you get the additional education you must have to protect your future—and the future of those who depend on you? Going back to school isn't easy for a man with a job and family obligations.

CREI Home Study Programs offer you a practical way to get more education without going back to school. You study at home, at your own pace, on your own schedule. And you study with the assurance that what you learn can be applied on the job immediately to make you worth more money to your employer.

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□ Electronic Engineering Technology
□ Space Electronics
□ Nuclear Engineering Technology
□ Industrial Electronics for Automation
□ Computer Systems Technology

APPROVED FOR TRAINING UNDER NEW G.I. BILL
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 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.

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-kilowatts 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.

WANT TO BE AN EDITOR OF EI?

Our job at EI is to fill our pages with the kind of articles and projects you want to see. Now we want to give you a chance to help us decide what we should publish. All you have to do is fill out this questionnaire and send it to us. As the newest member of our editorial staff, you'll earn our thanks . . . and the first 25 replies will earn a book on TV repair!

Bob Beason
Editor

What subjects in EI are you interested in? Indicate your choices by number. For example, No. 1 would indicate your greatest interest.

1. Amateur Radio
2. Citizens Band
3. Careers and Education in Electronics
4. Electronic Musical Instruments
5. Electronic Projects for the Home
6. General Experimenting
7. Hi-Fi and Stereo
8. Photography
9. Science Fair
10. Short-Wave Listening
11. Servicing

Do you feel our coverage of your field(s) of interest is adequate?

Yes
No

In what areas, other than those listed above, would you like to see more articles?

Mail completed Questionnaire to:
Bob Beason, Editor
ELECTRONICS ILLUSTRATED
67 W. 44 St.
New York, N.Y. 10036

Your Name
Address
City . . . . . . State . . . Zip
"So, Mr. Favorite Grandson! What shall we buy with our 135 QSL cards?"

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

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

Continued from page 44

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. 
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

Continued from page 89

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

Continued from page 108

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 UFOology 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!

El Kit Report

Continued from page 77

trots' 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 First New Top in 40 Years—Amazing Circling Train Top

Colorful miniature 4-car train mysteriously whistles as it circles inside, while the outside dome stands perfectly still. About 11" high and 9" in diameter, it keeps the kids and you too, completely fascinated on each "trip" for hours! A new joy, this one! Each only $2.98; 2 for $5.98. Money back guarantee if not delighted.

MAIL 10-DAY NO-RISK COUPON TODAY!

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Please rush Train Tops checked below. I understand that if I'm not completely satisfied, I may return items within 10 days for a full refund. Enclosed is check or m.o. for $ Rush me:

Train Tops 3 $3.98 2 Train Tops for $5.98

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CITY STATE ZIP
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 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 bleeeooping 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...Continued on page 118
CITIZENS AND

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-11 ground plane. Will swap for stereo tape recorder or best offer. Bill Hadley, 2004 Morgen- thau Dr., Mobile, Ala. 36618.

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

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Want TVM, oscilloscope, CB rig or best offer. Gary Aloise, 321 Mitchell Ave., Linden, N.J. 07036.


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


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

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COAX RELAY—DK60, 50-ohm. Will swap for best offer. Glenn Stout, N.E. 86 St., Kansas City, Mo. 64115.

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

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


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


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(Continued on page 118)

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CIRCLE NUMBER 40 ON PAGE 15
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...
January, 1969

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 worldwide 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.

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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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CIRCLE NUMBER 18 ON PAGE 15

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