Build a Unitized Stereo Speaker System

ELECTRONICS ILLUSTRATED

NOVEMBER 1970 50c
By the Publishers of MECHANIX ILLUSTRATED

Bugging the Fuzz
DXing the Indies
Paint-Can Dummy Load for Hams
Vertical Antenna for CB+10+15+20
Build the Strange Glowworm Voltage Tester
Accessories for Cassette Recorders

AN ALL-MASTER INTERCOM
Easy to Build for Your Home!

CONSISTENTLY THE BEST IN HOBBY ELECTRONICS
266 ways to make more money

ICS is the oldest, largest school of its kind. 266 courses for men and women, high school, business, secretarial, interior decorating, engineering. One for direct, job-related. Bedrock facts and theory plus practical application. You learn from experts. Diploma to graduates. Clip and mail the card now or write ICS, Scranton, Pa. 18515. You'll receive, absolutely FREE, 3 valuable booklets that have helped thousands. But don't delay. Make your move for a more successful future today.

ACCOUNTING
Accounting (U.S.A.)
Accounting (Canadian)
Accounting for Business
Accounting for Mgt.
Auditing
Business Law (U.S.A.)
Canadian Business Courses
Cost Accounting
EA Review (U.S.A.)
General Accounting
Income Tax (U.S.A.)
Industrial Accounting
Junior Accounting
Office Accounting
Practical Accounting
Public Accounting
Small Business Accounting
(U.S.A.)
Starting and Managing a Small Bookkeeping Service (U.S.A.)

ARCHITECTURE AND BUILDING
Architectural Drawing and Design
Architectural Drawing and Design
Architectural Drafting
Building Contractor
Building Estimator
Building Inspector
Building Maintenance
Carpenter-Builder
Carpentry and Millwork Fundamentals of
Urban Planning
House Planning and Interior Design
Mason
Painting Contractor
Reading Architectural Blueprints
Review in Architectural Design and Practice
Review of Mechanical Systems in Buildings

ART
Amateur Artist
Commercial Art
Commercial Cartooning
Illustrating with Options:
—— Magazine
—— Advertising Layout and Illustration
Interior Decorating
Oil Painting for Pleasure
Show Card Writing
Sign Painting and Designing
Sketching and Painting

AUTOMOTIVE
Automatic Transmission Specialist
Automatic Body Rebuilding & Refinishing
Automatic Engine Tune-Up
Automatic Mechanic
Automatic Technician
Diesel Engine Technician
Gas Motor
Vehicle Engines

BUSINESS
Advertising
Business Administration
Business Prac. (Cond.)
Canadian Business
Course
Condensed Marketing
Direct Mail and Mail Order Advertising
Industrial Psychology
Inventory Control
Magazine & Newspaper Advertising
Managing a Retail
Bank
Managing a Small Store
Marketing Management
Marketing Research
Modern Exec. Mgt.
Office Automation
Office Management
Production Management
Purchasing Agent
Retail & Local Advertising
Retail Bus. Management
Retail Merchandising
Retail Selling
Systems and Procedures Analysis

BUSINESS: SALES
Creative Salesmanship
Real Estate Salesmanship
Salesmanship
Sales Management

BUSINESS: SUPERVISION
Basic Supervision
Industrial Foremanship
Industrial Supervision
Management, Salesmanship and Sales
Manager as a Supervisor
Personality Development
Personal: Order: Relations (U.S.A.)
Supervision

CHEMICAL
Analytical Chemistry
Chemical Engineering
Chemical Laboratory
Chemical Process Equip.
Design & Operation
Elements of Nuclear Energy
General Chemistry
Instrumental Laboratory Analysis

CIVIL ENGINEERING
Civil Engineering
Construction Eng'g Tech.
Highway Eng'g Tech.
Principles of Surveying
Reading Highway Blueprints
Reading Structural Blueprints
Sanitary Engineering Tech.

ENGINEERING
Civil Engineering
Construction Eng'g Tech.
Highway Eng'g Tech.
Principles of Surveying
Reading Highway Blueprints
Reading Structural Blueprints
Sanitary Engineering Tech.

ELECTRICAL
Electrical Engineering
Construction Eng'g Tech.

ENGINEERING
(Refresher Courses for Graduate Engineers)
Chemical Civil Electrical Industrial
Mechanical Sanitary Structural

ENGLISH AND WRITING
Better Business Writing
English for Spanish (U.S.A.)

FREE LANCE WRITING
For Fun and Profit
Introductory Tech.
Writing
Modern Letter Writing
Practical English
Short Story Writing

HIGH SCHOOL
High School Business
High School (Canadian)
High School General
High School Math.
High School Secretarial
High School Vocational
High School College
Preparatory—Arts
High School College
Prep—Engineering
and Science
Preparatory Course
for High School
Equivalency Test

MACHINE SHOP PRACTICE
Grinder Operator
Industrial Metallurgy
Lather Operator
Mech. Shop Inspection
Mach Shop Practice
Metalurgical Eng'g Tech.
Multicraft Maintenance
Mechanic
Practical Millwrighting
Reading Shop Prints
Rigging
Tool & Die Making
Tool Engineering Tech.
Welding Engineering
Welding Process

MATHEMATICS
Advanced Mathematics
Math. and Mechanics for Engineering Tech.
Math. and Physics for Engineering Tech.

MECHANICAL
Mechanical Engineering
Aircraft and Power Plant Mechanics
Hydraulic and Pneumatic Power
Industrial Engineering
Industrial Eng'g Tech.
Industrial Instrumentation
Machine Design
Quality Control
Safety Eng'g Tech.
Tool Design
Vibration Analysis
and Control

PETROLEUM
Natural Gas Production and Trans
mission
Oil Well Technology
Petroleum Production
Engineering Tech.
Design of Plastic Prol.
Plastics Tech.

PLUMB'ING, HEATING
AND AIR CONDITIONING
Air Conditioning

STEAM AND DIESEL POWER
Boiler Inspector
Industrial Building Eng'g
Power Plant Engineering
Stationary Diesel Eng'g
Stationary Firemen
Stationary Steam Eng'g

TEXTILES
Carding
Carpentry and Spinning
Dyeing and Finishing
Loom Fixing
Spinning
Textile Mill Supervision
Textile Technology
Warping and Weaving

TRAFFIC
Motor Traffic Man’s
Traffic Management

TV-RADIO-ELECTRONICS
Color Television
Principles & Serv.
Electronics
Instrumentation and Servo Fundamentals
Electronics Technician
First Class Radio
Telephone License
Fundamentals of
Electronic Computers
General Electronics
General Electronics with Equipment Training
Hi-Fi Stereo and Sound System Servicing
Industrial Electronics Technician
Numerical Control Electronics & Maint.
Practical Telephony
Principles of
Semiconductor
Radio & TV Servicing
Radio & TV Servicing
with Equipment Training
Second Class Radio
Telephone License
Telecommunications Systems
Specialist
Telephony, Electronics, and Radio Commun.
And a brand new one!

Special $5 Offer

Learn TV repair...10 day trial!

Don't take our word for it—prove it to yourself! If you don't agree with every word we say about ICS's new TV Servicing/Repair course—we lose the bet and you lose nothing.

Send Just $5

Simply send us $5 for the first text of the course. Read through it. See how simple and easy-to-understand the instruction is. And how thorough. Then decide for yourself. While this first text will not, by any means, give you a complete training—it will convince you how easy it is to learn—the ICS way.

And, if by chance you're not convinced—simply return the text within the 10 day trial period and receive a full refund.

Worth Much More

As a part of the complete course, this text is worth much more than $5. This special trial is simply our way of showing you how completely confident we are that the ICS TV Servicing/Repair course can measure up to any TV Repair training you can get—yet the full cost is only $99.

In just a few months you can be trouble-shoot- ing on color sets. Just the first two texts combined will enable you to repair 70 percent of all TV troubles. Instruction is simple, very easy to grasp. Photos show you what a TV screen looks like when everything is normal, and what it looks like when trouble fouls it up. The texts tell you how to remedy the problem and why that remedy is best. What's more, quizzes are spotted throughout the course so you can check your progress.

Course is Short...Complete

All in all, the course consists of 6 texts...936 pages of concise, easy-to-follow instruction...plus 329 detailed illustrations...a dictionary of TV terms geared directly to course material—which will be invaluable during the course and later.

At the end, you get the coveted ICS diploma. And by that time you will be able to handle tough, multiple TV problems on color sets as well as black and white. This could mean a tremendous future for you. Full-time, part-time, your own business.

The National Electronic Associations found this ICS course so thorough, so helpful, easy to grasp that they approved it (first home study course ever to receive such an honor) for use in their own apprenticeship training program.

Act Now

You have nothing to lose. Send coupon today or write ICS, Scranton, Pa. 18515. Then examine the first text. See for yourself. If, during the 10 day trial period, you're not convinced—just return the text. And we'll refund quickly.

ICS International Correspondence Schools
Division of Intext

ICS, Scranton, Pa. 18515 Q2892J

Here's my $5.00 Send me the first text of the ICS TV Servicing/Repair Course. If I'm not convinced within 10 days that this is the most thorough and easy to understand way to learn TV repair, you'll refund my money and that's that.

Name_____________________________(please print)

Address__________________________

City_________________State________Zip#

□ Send the full course I've included $99—plus state tax (And I'll still have the 10 day trial refund privilege.)

Return This Coupon Today For 10 Day Trial.

Accredited Member, National Home Study Council
AMATEUR RADIO
Vertical for CB + 10 + 15 + 20 ........................................ Edward M. Noll, W3FQJ 47
Paint-Can Dummy Load for Hams ........................................ R. Galgano 56
The Ham Shack ............................................................... Wayne Green, W2NSD/1 81

CITIZENS BAND
Vertical for CB + 10 + 15 + 20 ........................................ Edward M. Noll 47
CB Corner: 15 Legal Watts ........................................ Len Buckwalter, KQA5012 63

AUDIO & HI-FI
Hi-Fi Today: Four-Channel Noise ........................................ John Milder 38
Unitized Stereo Speaker System .......................................... Harry Kolbe 64
Buyer’s Guide to Cassette Accessories ................................ Robert Angus 74
How to Control Your Recorder ......................................... Joseph Ritchie 84

SHORT-WAVE LISTENING
El at Large: A Letter from Georgetown ................................... 14
Bugging the Fuzz ......................................................... Len Buckwalter and Tom Kneitel 43
DXing the Indies .......................................................... Alex Bower 50
The Listener: Jamming the U.S. ......................................... C. M. Stanbury 11 92

SERVICE
Free-Power Square-Wave Generator for Audio Testing .............. Harry Kolbe 78
Glowworm Voltage Tester ............................................... Charles L. Andrew 87
Service Tips ............................................................... Art Margolis 95

ELECTRONICS FOR THE HOME
All-Master Intercom ...................................................... Herb Friedman, W2ZLF 27
Neon Crap Shooter ........................................................ Herb Cohen 39

MEDICAL ELECTRONICS
Electronic Eyes ............................................................. W. Stevenson Bacon 31

KIT REPORTS
A New Name in Color TV Kits ........................................... 82
Blister-Pack Tube Tester ................................................ 93

THEORY AND PRACTICE
The Long Nights of Uncle Tom .......................................... Tom Kneitel 59

YOUR LIBRARY
Broadsides ........................................................................ 10
Good Reading ...................................................................... Tim Cartwright 77

NEW PRODUCTS
Electronic Marketplace ...................................................... 24
Electronics in the News ................................................... 68

HOBBY & BUSINESS OPPORTUNITIES
Swap Shop ......................................................................... 94
Classified Ads ..................................................................... 104

REGULAR DEPARTMENTS
Uncle Tom’s Corner ........................................................... Tom Kneitel, K2AES/KQD4552 6
Product Information Service ............................................ 11
Feedback ........................................................................... 12
Over & Out ......................................................................... Rodrigues 102
Be creative—and thrifty too!

Save up to 50% with EICO Kits and Wired Equipment.

NEW “TREASURE HUNTER” KIT
Finds metals, pipes several inches underground. EICO TH-30 Solid State Treasure Hunter locates iron, steel, tin, gold, silver, copper etc. Beep pitch increases as you near object. Battery operated. $29.95.

NEW “BULLHORN” KIT
Carries your voice up to 400 feet. EICO BM-18 Solid State Bullhorn, 2½ lbs. light, is perfect for all outdoors, camping, sports. Battery operated. $15.95.

NEW EICO CRAFT
The electronic science project kits for beginners, sophisticated educators. 42 kits to date.

FREE 1970 EICO CATALOG
Send the FREE catalog describing the full EICO line of over 200 best buys, and name of nearest dealer.

COLOR IMAGES
“CHROMA-CUBE”
Classic white 18” Cube features a fantastic audio-responsive light display.

“CELESTIAL LITES”
Constantly flowing color images move in rhythm to music. 24” x 24” x 6”.

NEW “LIGHT FANTASTIC”
Translucent dome provides 3-dimensional world of ever changing light patterns in response to music. 38” high.

NEW STEREO KITS


“FLEXI-CAB”
Build your own customized cabinet in minutes! Give your EICO CRAFT and other projects that finished professional look with decor-styled FLEXI-CAB vinyl clad steel cabinets. Fast, easy, push-together assembly. 3 sizes from $1.49.

NEW SOLID STATE TEST INSTRUMENTS
The finest and best solid state test equipment guaranteed for 5 years!

EICO 248 Solid State FET-TVM. Kit $59.95, Wired $79.95.
EICO 242 Solid State FET-TVM. Kit $69.95, Wired $84.95.
EICO 150 Solid State Signal Tracer. Kit $49.95, Wired $69.95.
EICO 330 Solid State RF Signal Generator. Kit $89.95, Wired $109.95.

NOW YOU CAN SEE THE MUSIC YOU HEAR.

NEW EICO CRAFT

COLOR ORGANS
The now dimension to music pleasure. EICO all electronic solid-state Audio-Color Organs transform sound waves into moving synchronized color images.

MODEL 3450 Giant (30” x 12” x 10”) 4 Channels. Kit $79.95, Wired $109.95.
MODEL 3445 (24” x 12” x 10”) 4 Channels. Kit $64.95, Wired $99.95.
MODEL 3460 (10” x 15” x 16”) 3 Channels. Kit $49.95.
Wired $79.95. Other models to choose, from $19.95 and up.

STROBE LITES
Burst of white light flash in cadence of each beat of audio. Kit $39.95, Wired $69.95.

FREE 1970 EICO CATALOG


November, 1970

CIRCLE NUMBER 6 ON PAGE 11
Electronics Technicians: Earn Your

DEGREE

in Electronics. If you have at least one year of experience as an electronics technician, you can earn your Associate Degree by correspondence plus two weeks of review and examination at the School.

This degree is accredited by the Accrediting Commission of the National Home Study Council, and the course is approved under the G.I. Bill. Get complete details in our free catalog. Write:

Dept. E-70
Grantham School of Engineering
1505 N. Western Ave.
Hollywood, California 90027

by the Publishers of MECHANIX ILLUSTRATED

editor ROBERT G. BEASON
managing editor Robert D. Freed
feature editor Charles P. Wallace
art editor Lou Rubsamen
editorial associate Jean E. Lee
production editor Priscilla Moody
adv. director John F. Webster
national adv. mgr. Stanley Tessler

publisher George H. Allen

CONTRIBUTING EDITORS
amateur radio Wayne Gordon, W2NSD/1
citizens band Len Buckwalter, KQA5012
swl-dx C. M. Stanbury II
special projects Herb Friedman, W2ZLF/KB19457
service Art Margolis
audio Harry Kolbe
audio John Milder

EXECUTIVE STAFF
president Roger Fawcett
secretary-treasurer Gordon Freccatt
circulation director Roscoe K. Fawcett
vp., magazine div. George H. Allen
vp., asst. to pres. Frederick A. Klein
vice president Ralph Daigh
circulation manager Luther Bugbee, Jr.
subscription manager Ted Sloat
vp., comptroller F. Paul Simmering
production director Thomas R. Marvel
art director Ralph Mattison

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.

ADVERTISING OFFICE: 77 W. 44th St., New York, N.Y. 10036 (phone 212-661-1000). Contributions must be accompanied by sufficient postage and will be handled with care, though the publishers assume no responsibility for return thereof.

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 (Form 3579), should be addressed to ELECTRONICS ILLUSTRATED, Subscription Dept., Fawcett Bldg., Greenwich, Conn. 06830. Foreign subscriptions and sales should be remitted by International Money Order in U.S. funds payable at Greenwich, Conn.

COPYRIGHT © 1970 by Fawcett Publications, Inc. The title ELECTRONICS ILLUSTRATED is registered in the U.S. Patent Office. Reproduction in whole or in part is forbidden without written permission of the publisher; however, permission is hereby granted to quote from this issue of this magazine on radio or television, provided a total of not more than 1,000 words is quoted and credit is given to the title of this magazine and issue, as well as the statement, copyright 1970, by Fawcett Publications, Inc. Member A.B.C., M.P.A.

PRINTED IN U.S.A. BY FAWCETT PRINTING CORP.
LOUISVILLE, KY. 40201. Microfilm copies of current and back issues are available from University Microfilms, 313 N. First St., Ann Arbor, Mich. 48103.
FREE! 1971 CATALOG NO. 710
JUST OFF THE PRESS!!
SEND FOR YOUR EXCITING COPY NOW!

Just Published
Your Complete Buying Guide to Everything in Electronics

LAFAYETTE Catalog 710
Send me the FREE 1971 LAFAYETTE Catalog 710
Dept. 29110, P.O. Box 10
Syosset, L.I., N.Y. 11791

Mail the Coupon Today for your FREE 1971 Lafayette Catalog 710

November, 1970
About nine months ago I purchased an AM-FM receiver and turntable. Four months later the unit seemed to turn into a CB receiver and every time a local CBer came on he would wipe out all AM signals. Right now the sets' not picking up much CB but I am concerned about the future.

Gary Russo
Brooklyn, N.Y.

So are the CBers. When the band is so dead that you can’t even raise a turntable in Brooklyn things are getting pretty bad.

Whenever I drive under an overpass there is no effect on FM stations but all AM stations suddenly vanish. What should I do?

F. R. Wolff
Abilene, Tex.

You’d better stay away from overpasses. You’re a menace to AM broadcast stations.

I have a four-band receiver on which I pick up New York City broadcast station WHN (1050 kc) on the primary frequency and also on 153 kc (long-wave band). Is this a new service of theirs?

R. M. Preston
Yorktown Heights, N.Y.

Not one they intended to give. You’ve got an image of their 50-kw signal, either from front-end overload in your receiver or from mixing with another strong signal. Their transmitter is about 30 mi. from you and the signal pattern is aimed right at you.

Local Boy Makes Good Dept. Bruce Haack liked to tinker around with little transistor circuits. One day he put together a junkbox special, powered by three 9-V batteries, which he found could make unusual sounds. He built a modulator so that he could feed his voice into the gadget. It worked. From there, Bruce worked up some strange melodies to demonstrate his device. The result was so unusual that he took his demo tapes to Columbia Records. They dug the offbeat sounds and signed Bruce to a contract. You can judge for yourself at any record store. Bruce’s record is called The Electric Lucifer (#CS-9991). Well done, Bruce!

I have a 50-watt guitar amplifier which has two 8-in. speakers in its cabinet. What problems would I have in adding two more 15-in. speakers to this unit?

Mark Chrisman
Bloomington, Ill.

Make sure that the net impedance of the speakers connected in parallel equals the output impedance of the amplifier. A slight mismatch won’t create much grief and if you are playing rock, any distortion you can get probably will be a bonus.

Why does everybody always try to put you down?

Beverly Forrest
Big Sur, Calif.

At my size, it’s easier than trying to lift me.

Here’s a hair-tearing problem. I have this old S-38 receiver which has burned out a fair share of rectifier tubes along with a quantity of resistors at the socket of the tube. The heater circuits check out and now I’m stumped.

Mike McCollum, WN2LKK
Bellmawr, N.J.

First check out the 50L6 to see whether it is okay. Next, replace the three-section filter capacitor (60-40-40µf), then the .005 µf capacitor at pin 5 of the 50L6.

[Continued on page 8]
The New 1970 Improved Model 257

A REVOLUTIONARY NEW TUBE TESTING OUTFIT

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

ANNOUNCING... for the first time

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

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

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

The Model 257 is housed in a handsome, sturdy, portable case. Comes complete with all adapters and accessories, ready to plug in and use. No "extras" to buy. Only $52.50

NOTICE

We have been producing radio, TV and electronic test equipment since 1935, which means we were making Tube Testers at a time when there were relatively few tubes on the market, "way before the advent of TV. The model 257 employs every design improvement and every technique we have learned over an uninterrupted production period of 35 years.

Accurate Instrument Co., Inc.

SEND NO MONEY WITH ORDER

PAY POSTMAN NOTHING ON DELIVERY

Pay Cash or in EASY MONTHLY PAYMENTS AFTER 15 Day Trial!

Try it for 15 days before you buy. If completely satisfied remit $52.50 plus postage and handling charge. (If you prefer you may PAY MONTHLY ON OUR EASY PAYMENT PLAN.) If not completely satisfied, return to us, no explanation necessary.

ACCURATE INSTRUMENT CO., INC. Dept. 794
2435 White Plains Road, Bronx, N. Y. 10467

Please rush me one Model 257. If satisfactory I agree to pay at the terms specified at left. If not satisfactory, I may return for cancellation of account.

Name
Address
City State Zip

☐ Save Money! Check here and enclose $52.50 with this coupon and we will pay all shipping charges. You still retain the privilege of returning after 15 day trial for full refund.

CIRCLE NUMBER 11 ON PAGE 11

November, 1970
Have your own Radio Station!

Learn
AMATEUR
RADIO

AT HOME IN YOUR SPARE TIME

Get your Amateur Radio license and "go on the air." NRI, leader in Electronics home training for more than 50 years, offers a choice of training plans leading to required FCC licenses, ranging from Basic Amateur Radio for the beginner to Advanced Amateur Radio for the ham who already has a license and wants to move up.

HAM RADIO EQUIPMENT INCLUDED


MAIL COUPON TODAY
NATIONAL RADIO INSTITUTE 53-110
Washington, D.C. 20016
Please send me information on Amateur Radio training.

Name ______________________ Age ________
Address ______________________
City __________ State ______ Zip ______

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

BRAND NEW!
ELECTRONICS GUIDEBOOKS

PERFECT for REFERENCE — GUIDANCE — STUDY!

Key To BASIC ELECTRONICS. A short, easy-to-understand course in modern electronics. Electron Tubes, Amplifiers, Oscillators, Radio, Transistors, Servo Systems, Radar, Sonar and more, all thoroughly explained and illustrated. $4.00 ppd.

Key To ADVANCED ELECTRONICS. Features advanced Concepts and Theories with emphasis on Components and Circuit Behavior. Includes: Tuned Circuits, Modulation & Demodulation, Test Equipment, Computers, etc. $4.00 ppd.

THE ELECTRICAL ENGINEERS HANDBOOK. Hundreds of designs, drawings, charts and tables covering modern engineering principles utilized in industry and construction, arranged for quick reference. $7.95 ppd.

Money-Back Guarantee—NO C.O.D.'s.

KEY PUBLISHING CO. 830 Broadway, Dept. E1 New York, N.Y. 10003

CIRCLE NUMBER 7 ON PAGE 11

Uncle Tom's Corner
Continued from page 6

★ You seem to delight in doing stories which announce the location of our secret radio stations. Why jeopardize their mission by revealing their locations? They must be hidden for a good reason.

Robert Holbrook
Plattsburgh, N.Y.

If an amateur like me can unearth the locations of secret stations then how secret do you think they are from the bad guys with professional teams of espionage agents? Maybe they ought to be hidden better—eh, Bob?

★ I have an old AM/SW push-button radio. One button is marked for station WEAF. I believe that this was a New York City station and I'm curious to know whatever became of it.

Rick Weibezahl
Washington, N.J.

Rest your fears, Rick. WEAF is alive and well in New York. Over the years they have had a few call sign changes but now they call themselves WNBC. The station is the flagship of the NBC radio network.

★ I built a CW transmitter from plans I found in an old ARRL Handbook. Whenever I try to transmit there are sparks jumping all over the place from the tank coil. I've checked and rechecked all of the circuits but I don't see anything wrong. Now where do I stand?

Alvin McReady
Bristol, Mass.

About 6 ft. from the thing.

SWL Club Dept. Don't look now, Fred, but SWL clubs are falling on hard times. In the past year several have taken that long walk to the big QRT in the sky, while others seem to be dwindling away with each thinning monthly news bulletin. Problem is, for many years the whole SWL hobby has been carried along by a hard core of old timers—fellows who started the clubs in the 1930s.

The fellows who were SWLs way-back-when were in the hobby to stay. Today's kids are in and out in less than three years, drifting to ham radio, CB, or stealing hub caps.
If you can't come to the world's newest, largest and most exciting electronics department store, we'll mail the store to you!

Exclusive! Knight-Kit and Science-Fair Kits. Exciting build-your-own kits made to our own exacting standards. Stereo, CB, automotive, ham radio, science, hobby, test equipment, photography and more!

Exclusive! Realistic Lifetime Tubes. Never worry about buying another tube. We guarantee ours will last as long as your set — or we replace it FREE!

Exclusive! Battery-A-Month Club. Join the Allied Radio Shack Club and receive a powerful battery every month for a full year — FREE!

Exclusive! Quality Audio Products at Factory-Direct Savings

Allied TD-1099 3-Had Stereo Tape Deck. New one-piece head makes tape threading a snap. With case. Spectacular value! $179.95

Realistic STA-120 Wideband AM, FET-FM Stereo Receiver. 140 Watts. With case. $269.95

New Allied Radio Shack Catalog! Thousands of electronic values!

Allied Radio and Radio Shack have joined forces to form the largest electronics distributing company in the world! This new 1971 460-page catalog offers you the best of both companies: famous-name brands, exclusive new products you'll find nowhere else (including some items you didn't even think were invented yet), and special money-saving prices that only the combined buying power of these two great companies could offer!


Mail Coupon To Address Below

Yes! I want your big new 1971 catalog. I enclose $1 for mailing and handling (refundable with my first purchase of $1 or more).

NAME: ___________________________ MIDDLE: ___________________________ LAST: ___________________________

ADDRESS: ___________________________ STREET: ___________________________ CITY: ___________________________

STATE: ___________________________ ZIP: ___________________________

Mail Coupon To Address Below

Allied Radio Shack

50th Anniversary

Allied Radio Shack Catalog 1971

November, 1970
Pulling power.

When you think of relocating or expanding your industrial plant, think about Florida’s “Gold Coast.” You think it would be a great place to live? You’re right. A great place to work? You’re right.

Superb climate, recreation. Clean air. Good housing. Excellent schools, technical colleges. These are a few reasons why pick-of-the-crop scientists and engineers are eager to settle in Broward County, Florida.

Staying power.

Lower land costs, worldwide transportation — and a big welcome — are a few reasons why high technology industries such as Motorola, Bendix, Westinghouse, Burroughs have built plants here. May we accommodate your next plant? For free booklet “Facts For Industry,” Call collect or write: John I. Dabney, Exec. Director, Broward Industrial Board, 2240 E. Sunrise Blvd., Ft. Lauderdale, Fla. 33304 — (305) 565-6709.

CIRCLE NUMBER 18 ON PAGE 11

Broadsides

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

Most hobbyists have a thing about collecting gadgets and the latest catalog from Edmund Scientific Co., should satisfy all their desires. It contains a veritable surfeit of material of every size, shape and description. Lasers, weather balloons, lighting equipment, telescopes and lenses are just a sampling of what is included. A free copy is available from Edmund Scientific Co., 701 Edscorp Building, Barrington, N.J. 08007.

If you are in need of replacement semiconductors a good place to turn for information is the recently released Cross Reference and Product Guide by International Rectifier. The guide details IR’s line of substitutes for transistors, SCRs, diodes and capacitors in table form for quick selection of parts. The guide is free from International Rectifier, Semiconductor Division, Dept. 781, 233 Kansas St., El Segundo, Calif. 90245.

No matter how good your ham equipment is, you’re not going to get far without a decent antenna. Cush Craft has assembled a colorful booklet showing their 50 various antennas, including high performances VHF yagis, dual and quad arrays and HF monobeam. For a free copy write to Cush Craft, 621 Hayward St., Manchester, N.H. 03103.

To get the most out of what you have to say it is important to use a good microphone. Included in the latest Turner catalog is a section on how to choose mikes, along with a product listing of ham, CB, PA and broadcast microphones. The listing is available from The Turner Co., 909 17th Street, N.E., Cedar Rapids, Iowa 52402.

Getting schematic diagrams and repair information on obsolete equipment can be quite a task. Supreme Publications has a reference library of service material for radio, hi-fi and TV that covers almost all makes and models of sets ever manufactured in the U.S. This information is indexed in their 48-page Master Index which is available free from Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 60035.

If your wife’s been telling you that you need a switch, look into the line of switches available from the Grayhill Co. The switches are displayed along with design information in their new catalog. Included are momentary and alternate-action push-button switches, key-operated rotary switches and spring-return rotary switches. Request Catalog G-306-A from the Grayhill Co., 561 Hillgrove Avenue, Le Grange, Ill. 60525.
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 one of the handy coupons below and circle the PRODUCT INFORMATION SERVICE number or numbers you find beneath the advertisements in this issue.

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

NAME _____________________________________________
ADDRESS ____________________________________________
CITY _____________________________________________ STATE ______ ZIP ______

NAME _____________________________________________
ADDRESS ____________________________________________
CITY _____________________________________________ STATE ______ ZIP ______
Feedback from Our Readers

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

UNION LIFE
I read with interest your article on a career in a recording studio (HOW ABOUT A GLAMOROUS JOB IN A RECORDING STUDIO? Sept. '70 El). You forgot one thing. How do you get in the union?

Pete Sanchez
New York, N.Y.

BUBBLE BUZZER

The pool alarm (INTRUSION DETECTOR FOR BACKYARD POOLS, Sept. '70 El) was a useful project. I have found an interesting application that I think your readers would like to know about. When I fill my tub at night I now use the detector to warn me if the water is getting too high. The only hitch that has to be worked out happens each time I get in the tub. The alarm goes off because of the sudden increase in volume.

Bruce Jencks
Duncan, Okla.

Eureka!

SERVICE TIP
I was astonished to read your article BASIC TEST GEAR FOR COLOR TV SERVICING (Sept. '70 El). Your description of the stuff sounds adequate enough, but the costs, oh my aching wallet. What about us once-in-a-blue-moon servicemen? Do we have to shell out that much to fix our own color TV sets?

Drew Lombardi
Chicago, Ill.

If you're in need of one-item service, take it to a serviceman who has already made the investment.

FEEDBACK AT THE FCC
Wayne Green's column in the Sept. '70 issue made some valid points in relation to the FCC and hams. I have the feeling that the FCC would rather not deal with hams at all. Many of the commissioners on the FCC used to represent broadcasters legally. I have never heard of a commissioner representing a ham in private practice.

Paul Andrews
Heppner, Ore.

WATCH THOSE KNOBS
I have just finished building the Heathkit color bar generator that you described in FOUR BAR GENERATORS FOR COLOR TV (Sept. '70 El). In my model of the IG-28 there is no way to make adjustments of the IC counters. Did you guys get a different set than me? What's the story?

Dave Arlen
Portland, Me.

No Dave, we both have the same bar generator. We should have said there were no adjustments to the IC counters.

GOTCHA KEMOSABE

That CB DIRECTION FINDER (Sept. '70 El) was really wild. With a little practice in triangulation of map coordinates I was hunting down many accursed CBers. The thing works so well that I have suggested that the FCC get one or two of them and start helping some of us out. How? By hunting down all of those Lone Rangers who give us all a bad name.

J. D. Reed
Marion, Ohio
Shortstop.

Our exclusive posted-filament design stops shorts in high-voltage rectifiers.

And you know what shorts cause . . . catastrophic failure, or weakened tubes and components.

The result: unprofitable callbacks.

Our 3CU3A, 3BM2A, 3BL2A, and 3DC3 high-voltage rectifiers all use the fail-safe posted-filament design.

Put our shortstops on your team. You'll find that callbacks won't even get to first base.

Sylvania Electronic Components, Electronic Tube Division, West Third St., Emporium, Pa. 15834.

SYLVANIA
GENERAL TELEPHONE & ELECTRONICS
SAMS BOOKS
ESPECIALLY FOR THE BUILDER

Hi-Fi Projects for the Hobbyist
Easy-to-build projects include: rumble filter, noise filter, high-gain antenna, transistorized microphone preamp, etc. Also explains how to improve existing high fidelity systems and how to check them out for optimum performance. Order 20222, only... $2.95

101 Easy Ham Radio Projects
A selection of easy-to-build, inexpensive circuits for a variety of worthwhile ham devices. Provides brief descriptions, construction hints, diagrams, and parts lists; includes substitution guide appendix. Order 20674, only............... $3.95

ABC's of Electrical Soldering
An invaluable book on the art of soldering—what it is and does, how to make a good connection, how to make solder repairs. Explains solder alloys, fluxes, soldering irons, and instant-heat guns. Order 20627, only............... $2.95

49 Easy Transistor Projects
Provides simple, easy instructions, schematic diagrams, and parts lists for building a-m and f-m radios, light relay controls, audio amplifiers, code practice oscillators, and test equipment, using inexpensive parts. Order 20617, only... $1.75

How to Build Electronics Projects
Provides complete description of methods and tools used in construction. Discusses proper circuit layout, metal chassis and panel layout, and drilling and punching. Also includes information on semiconductor and etched-circuit boards construction. Order 20670, only............... $2.95

101 Easy Audio Projects
Furnishes complete instructions for building simple, inexpensive audio projects with the imaginative use of many spare parts found in old radio and TV chassis. Includes intercom systems, wireless microphones, phono and power amplifiers, and a-m tuners. Order 20608, only... $3.50

HOLLO W. SAMS & CO., INC.
Order from any Electronic Parts Distributor, or mail to Howard W. SAMS & Co., Inc. Dept. EL-110 4300 W. 62nd St., Indianapolis, Ind. 46268
Send the following books: Nos.__________________________ $_____________________enclosed
Name__________________________________________________
Address__________________________________________________________________
City____________________State_______Zip____________________

CIRCLE NUMBER 17 ON PAGE 11

El at Large

A Letter from Georgetown

GEORGETOWN, GRAND CAYMAN, B.W.I.

A COUPLE of years ago El mounted an expedition to fabled Radio Americas, the suspected CIA-run station on Swan Island. Swan lies some 185 mi. southwest of this Maughamish tropical isle and we used Georgetown's airport as a kind of staging base from which Tom Kneitel and I made our final assault on the secret hideout, drifting out over the emerald-green Caribbean in an ancient DC-3. We carried a bottle of scotch in each hand as peace offerings.

The main drag at waterside in Georgetown.

The scene in this part of the world (south of Cuba and westward from Jamaica) has changed considerably since then. R. Americas, which began life as R. Swan just before the Bay of Pigs invasion, folded its tents in mid-1969 and has disappeared. Swan's census once amounted to 40 but at this writing stands at no more than 14, though at peak periods (when nobody is ill and away or on leave) it may hit 16 or 17.

Frank Roulstone, Jr., an American who operates the U.S. Weather Bureau in Georgetown, went with Tom and me. It was his first visit to Swan. There followed a year of State-side duty and then he came back to take charge again at Georgetown. Some surprising information followed. Swan is to be given to Honduras late this year.

[Continued on page 20]
check your CB rig's performance 10 ways...

Johnson's new transceiver tester.

Does everything other testers do... and more! Reads power output in actual watts. Reads modulation directly in percentage. And lets you hear what your transmitted signal actually sounds like, with the headphone monitoring jack! Also can be installed to read received "S" units. Constantly monitors your rig while you're on-the-air. Flip a switch and you can make tests using the built-in dummy load. There are built-in RF and audio generators, crystal activity checker, SWR meter, and more—so you can pinpoint problems like a professional. Battery operated and portable, it even has a field strength meter that's great for making comparative checks at jamborees. No serious CBer should be without it!

Other Johnson Accessories for the Advanced CBer...

- CB MATCHBOX ANTENNA TUNER $15.95
- CB ANTENNA METER $14.95
- RECHARGER/BASE POWER SUPPLY FOR HAND-HELDS $28.00
- ANTENNA MATE TUNER AND SWR METER $29.95
- CB MOBILE SPEAKER $13.00

E. F. JOHNSON COMPANY
WA SE CA MINNESOTA 56093

CIRCLE NUMBER 15 ON PAGE 11
Discover the ease and excitement of learning Electronics with programmed equipment

NRI sends you

When you train at home with NRI, you train with your hands as well as your head. You learn the WHY of Electronics, Communications, TV-Radio the NRI pioneering "3-Dimensional" way. NRI training is the result of more than half a century of simplifying, organizing, dramatizing subject matter, and providing personal services unique for a home study school. You get the kind of technical training that gives you priceless confidence as you gain experience equal to many, many months of training on the job.

NRI—The 53 Year Leader in Electronics Training

APPROVED UNDER NEW GI BILL If you served since January 31, 1955, or are in service, check GI line in postage-free card
Earn $5 or more an hour spare or full time in TV-RADIO SERVICING

Color Television has arrived. Sales are soaring, along with the continuing popularity of other home entertainment equipment like portable radios, tape recorders, hi-fi sets, phonographs and auto radios. TV-Radio servicing is one of your best routes to spare-time earnings, a good paying job or a business of your own. NRI not only trains you quickly and expertly, but also shows you how to get started in Servicing soon after you enroll, earning as you learn. NRI trains you in today's methods of installing and repairing all Electronic equipment for the home—including booming Color TV. You even build, experiment with and keep to enjoy your own solid-state radio and your choice of black-and-white or Color TV receiver. Like thousands of others, you can be earning $5 or more an hour extra in spare time starting soon.

There's money and success awaiting you in BROADCASTING—COMMUNICATIONS

The experience you gain from intensely practical NRI training in Complete Communications equals as much as two years of training on the job. With NRI, you can train for a choice of careers ranging from mobile, marine and aviation radio to TV broadcasting and space communications. You learn how to install, maintain and operate today's remarkable transmitting and receiving equipment by actually doing it. You build and experiment with test equipment, like a VTVM you keep. You build and operate amplifier circuits, transmission line and antenna systems, even build and use a phone-cw transmitter suitable for transmission on the 80-meter amateur band. Whichever of five NRI Communications courses you choose, you prepare for your FCC License exams, and you must pass your FCC exams or NRI refunds your tuition in full.

Move ahead in America's fast growing industry as ELECTRONICS TECHNICIAN

Electronics touches everyone's lives. This vast field of opportunity is open to you with NRI training. Industrial/Military Electronics training—like all NRI courses—prepares you quickly, thoroughly the practical "hands on" way. You build with, and learn to understand the functions of, today's miracle solid-state components like printed circuits, diodes and transistors. You build and experiment with Electronic circuits used in automation, data processing, ultrasonics, telemetry. Whatever your interest in Electronics, NRI training can fill your needs. Prove to yourself what nearly a million NRI students could tell you ... that you get more for your money from NRI. Check the postage-free card and mail it today for your FREE NRI Color Catalog. No salesman will call. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D.C. 20016.

YOU GET MORE FOR YOUR MONEY FROM NRI — Build, test, explore, discover. Everything you see here is included in one NRI course—including Color TV. Other courses equally complete. And you'll be surprised at the low tuition costs. Text for text, kit for kit, dollar for dollar—you get more for your money from NRI.
A Letter From Georgetown

Continued from page 14

The U.S. took possession of the island in the 1860s but Honduras always laid claim to it. Now we are in the process of turning it over to her. Swan and its uninhabited neighbor, Little Swan, lie not far off the Honduran Coast and don't perhaps compare in strategic importance with West Berlin or Northern Ireland, but the giving of any territory must be considered a large friendly gesture.

Both the Weather Bureau and the FAA have been hard at work on Swan since the future turn-over was announced. The FAA's light and radio beacons and other facilities are being put in first-class condition so the Hondurans will start out with their fingers on decent buttons. The omnibus station, with the callsign SWA on 407 kc, can be heard by aircraft all over the Caribbean and is important to air operations in this part of the world.

The Weather Bureau's work has more to do simply with improvement because it will continue to be run by the U.S. but will operate on leased territory (which may or may not include Swan's air strip).

Frank Roulstone was given responsibility for the operations at Swan (in addition to his work as head man at Georgetown) and since that first flight to the island with EI's adventurers has returned no less than 17 times.

Supply is terribly important to people like those on Swan, without air or sea service and not close to shipping lanes. R. Americas once had a deal with Bill Cook to fly his Piper Apache twin down from Miami twice a week but the feds have cut this to one round trip a month.

The little vessel Daydream used to call at Swan once or twice a month and still goes by there every 23 or 24 days but also calls at the Channel Isles off Honduras (Guanaja, Roatan, Utila) and sometimes at the mainland ports of La Ceiba and Puerto Cortes, as well as at Georgetown, so she has a lot to do besides worry about Swan.

The Daydream, which we last saw at anchor off Swan, happened to be in port in Georgetown during our visit. She landed a fat steer and some cocoanuts (the latter bound for Miami), took aboard a lot of cargo

[Continued on page 22]
What a Beauty, What a Build And Boy!!!! What Performance!

The 176 is the up-top CB base antenna for on-top people . . . from

Shakespeare

C/P Corporation Division, The Shakespeare Co., P. O. Box 5207, Columbia, S. C. 29205
**A Letter From Georgetown**

being sent out by Frank and disappeared one evening into the gloaming. Daydream now sometimes is joined by a second motor vessel, the Michella, but the general situation for getting people and cargo to and from Swan is a bit grim at present. Consequently, during our stay on Cayman the Weather Bureau in the person of Frank Roulstone was looking for a charter contract for a DC-3 or other large twin to fly twice a week or so between Georgetown and the grassy strip on Swan.

So life runs out for Swan as an American possession and a new existence with Spanish-speaking people begins. Intrigues and anti-Castro radio propaganda are but memories.

But rumors abound in the Caribbean.

The story that interested us most had to do with none other than a certain unnamed somebody who, obviously with a lot of backing, is putting up a big radio station over on Little Corn Island, another dot of tropical landscape just off the Nicaraguan coast. Little Corn and neighboring Great Corn, which are less than 100 miles from the coastal city with the unlikely name of Bluefields, actually belong to Nicaragua but in 1912 went on 99-year lease to the U.S. So Little Corn is foreign territory controlled by us. If you happen to be a CIA type you can see all kinds of possibilities in that situation, such as being responsible yet not being responsible because somebody else owns the real estate.

Perhaps one of these days it would be worth El's while to try to invite itself for a visit to Little Corn.

Meanwhile, back here in Georgetown the relatively few American tourists (or tourists of any kind) realize that Grand Cayman's days as an almost-undiscovered island paradise are numbered. Regular jet service from Miami and available money to build resort hotels are bringing the island slowly into the Miami Beach-Nassau-San Juan whirl. Before long the little resorts along beautiful, white Seven Mile Beach, such as the Beach Club Colony where we stayed, will be asking you please to put on a shirt for lunch and even to wear shoes for dinner. But those days haven't come yet.

R. America types left a lot of laughs at Grand Cayman, where they used to be baited

[Continued on page 100]
"Mag-Ten" is so indestructible that it's guaranteed for ten years! Exclusive Armorweave fiber glass is actually stronger than brass, aluminum, and even many steels! Takes up to 115 m.p.h. winds without damage. Immune to the effects of intense sun, heat, rain, or snow. Its pure white fiber glass won't fade or deteriorate. And non-conductive fiber glass eliminates many detuning and static problems. It's the most exciting Magnum antenna yet!

4-section radiator snaps together
Fastest, easiest installation No screws just snap. Completely secure. Completely weather proof
High-efficiency solid copper radiator
Full 1/2-wave radiator encapsuled inside. Grounded for reduced receiver noise. 4 dB omnidirectional gain makes 4-watt signal radiate like 15 watts!
Adjustable power-tips Loaded radials for minimum wind resistance, maximum range. Adjustable with a simple twist-no tools needed.
Non-corrosive hardware
All metal brackets and hardware are formulated to withstand severe weather conditions. Mounting bracket is heavy-duty aluminum.
Dual phasing coil sealed inside
Magnum dual phasing coil provides an optimum impedance match, low SWR. It's inside the fiber glass mast, protected from rain, snow, and ice.

Model M-317 Suggested Resale $59.95

the antenna specialists co.
Division of Allen Electric and Equipment Co.
12435 Euclid Avenue, Cleveland, Ohio 44104
EXPORT 220 Shames Drive
Westbury L.I., New York 11690
CANADA: A. C. Simmonds & Sons, Ltd.

November, 1970
PACKED With Pep. The sky's no limit with Heath's new linear amplifier, Model SB-220. The amp employs two Eimac 3-500Z tubes in the grounded-grid final to produce as much as 2,000 watts peak envelope power input on single sideband transmission and 1,000 watts on CW and RTTY. It requires only 100 watts drive for complete output. A pretuned broad-band pi input delivers maximum efficiency and low distortion throughout the 80-10-meter ham bands. The SB-220 has a built-in solid-state power supply that can be wired for 120 or 240 VAC. Two panel meters give continuous indication of plate current plus switch selection of grid current, relative power and plate high voltage. $349.95. Heath Co., Benton Harbor, Mich. 49022.

Master Measurement. Included in RCA's line of solid-state test instruments is the model WV-510A, also known as the Master VoltOhmyst. The instrument can be operated from internal batteries or from 120 VAC. The WV-510A measures from 0.01 to 1,500 VDC, current from 0.01 ma to 1.5 A, AC peak-to-peak voltage of complex waveforms from 0.5 to 4,200 V, and resistance from 0.2 ohm to 1,000 megohms. $128. RCA Electronics, Harrison, N.J. 07029.

Electronic Marketplace

Sound Those Slides. Slide shows that talk will be a little easier with 3M/Wollensak's new slide filmstrip cassette recorder and synchronizer. Model 2550 uses a 60-cps tone to activate a tripping mechanism which changes slides. Narration and sync signal can be recorded independently or simultaneously. $299.95. 3M Co., St. Paul, Minn. 55101.

Ranger Station. Courier's Ranger 23 is a tube-type base station CB transceiver designed to provide good results on all 23 channels. The Ranger 23 features a cascode front-end and low-noise nuvisor. Other bonuses in this rugged package are a modulation sampler, S-RF meter, modulation indicator, floating-gate squelch switch, 3.5-watt RF output, and automatic noise limiter. Crystals for all 23 channels are supplied by the manufacturer for this 19 tube rig. A 12-V mobile power supply is available for $29.95. $199.00. Courier Communications, Hillside, N.J. 07205.
Electronic Marketplace

Quite A Card. Conventional tuning falls by the wayside with the introduction of the Scott 433. The tuner utilizes a phase-locked loop, a digital programmable divider, an electronically-tuned RF section and an error correction system that uses a quartz crystal standard to tune any one of the 100 channels in the FM band. The tuner is supplied with a complete set of cards for all of these broadcast channels. The punched information is read by the tuner which then switches to the designated frequency automatically and displays the result on a digital panel meter. The tuner will be available this fall for $500-1,000. H. H. Scott, Inc., Maynard, Mass.

Test Sting. The Mosquito by Don Bosco Electronics has many applications when it comes to intergrated-circuit testing. It is a good trigger signal for computer-type integrated circuits. The Mosquito generates and injects pulses in the audio, IF and RF range. It operates on a AAA size 1.5-V battery. Total weight of the Mosquito is one oz. It can be used for troubleshooting radios and TVs, tape recorders, telephone circuits, amplifiers, tuners and pickups. The Mosquito costs $14.95 and is available from Don Bosco Electronics, Inc., Bridgeport, Conn.

How to "break into" broadcasting!

There's a way to find out--free--if you have a broadcaster's voice. Discover if you can be trained for an exciting career as a newscaster, sportscaster, disc jockey, or announcer.

All you do is mail in the coupon for information about our free voice test. It was created with the help of John Cameron Swayze, Fran Allison, Curt Gowdy, and 5 other radio and TV personalities, the directing faculty of Career Academy's Division of Famous Broadcasters.

If you qualify for training, you can study at one of the Academy's many studios, or at home, in your spare time. Either way, your Career Academy Certificate prepares you for a Federal Communications Commission Third Class Operator's License with Broadcast Endorsement--in as little as a few months.

And, we'll help you prepare your resume, make a professional audition tape...begin to help you find the job you want, even before graduation!

MAIL COUPON NOW...

for details on your free voice analysis, plus a free record and colorful booklet.

There's absolutely no obligation.

CAREER ACADEMY'S
DIVISION OF FAMOUS BROADCASTERS

International Headquarters School
611 E. Wells Street, Dept. 07N204201
Milwaukee, Wisconsin 53201

I want to know if I have broadcasting talent worth developing. Please rush me more information. I am interested in

[ ] Home Study  [ ] Studio Training

Name ____________________________ (please print)
Address ____________________________
City __________ State/Province ______ Zip__________
Phone _______ (Home, Business, or Neighbor) _______ Age _______
Year of high school graduation _______
Check here if eligible for Veteran's Benefits [ ]
Accredited by the NATTS and NHSC.
EVERYTHING IN ELECTRONICS!

VARIABLE BALANCE STEREO HEADPHONE
Unique Sound Level control on each earpiece permits adjustment frequency range 20 to 20,000 + wing tips, cord with stereo plug impedance 16 ohms
Cat. No. O3-117 $17.95 Net

HOBBIEST'S SOLDERING AND TOOL KIT
Diagonals, long nose pliers, soldering iron and solder, solder aid tool, heat sink, and screwdriver. An ideal gift item
Cat. No. H3-308 $7.95 Net.

TAPE RECORDER MICROPHONE
Elaborate performance on music and speech for the recorder/impe-
(nedance matches late model solid state recorders. Immune to most
f. crosstalk. Card with twin plugs exciting response 1000 to 7000 output 97
with impedance 200 ohms
Cat. No. O4-260 $4.95 Net.

EXPERIMENTER'S CIRCUIT BOARD KIT
Contains a 3½ x 4 perforated board, 15 terminals (No. 14-636)
and 4 mounting feet w/screws. Build small circuits, hobby and
science projects etc
Cat. No. 14-660 $9.98 Net

AUDIO ADAPTOR
"Y" Audio Adaptor has a phono pin jack on one end and dual phono
pin plugs on the other
Cat. No. 04-288 $9.99 Net

MINIATURE LAMPS
Type PR2 - 2.5 volt - 0.5 amp
Cat. No. E2-430 - Pkg. of 2 $1.29 Net
Type PR3 - 1.6 volt - 0.5 amp
Cat. No. E2-431 - Pkg. of 2 $2.29 Net

RESISTORS
Attractively packaged 2 per pack, showing values, color codes and
formulas

STANDARD 1000 VOLT CAPACITOR
High quality, compact and reliable

THE "CG" CALECTRO HOBBYIST HANDBOOK
The "CG" Calectro Hobbyist Ref.
book is available everywhere. Order your nearest Calec
electronic Supermarket. When it located near you, WRITE
TODAY and we'll rush you the name and address of your nearest Calect
ho, market.
Except for the most expensive executive models, just about every intercom is the remote-call type. This means that only the master station can originate calls to other stations—the remotes. Remote stations can call only the master, not the other remotes. For a remote station to originate a call it must be a master complete with its own amplifier—and a price tag to match. A solution is for the master to have presetting—a feature that allows several remotes to be tied together. But then someone must be around to do the switching at the master.

With modular solid-state equipment it is possible to design an intercom with a central master amplifier that can be on all the time. Tuck the master deep in a closet or basement (with solid-state equipment there's no heat to worry about) and you can eliminate all electronics in the individual stations. Each remote becomes a master station capable of calling any other station or even answering the door.

Such an all-master intercom system is shown above. The three stations are capable of calling each other or any other stations in the system. Each can also listen and talk to a door station with total privacy—no other station mote can monitor or hear the door conversation. Figures 1 and 4 show the master amplifier which consists of a power supply and a one-watt modular amplifier.

There's room, too, for your own customization. For example, the
schematic in Fig. 3 shows three stations plus door capability, but there's no limit to the number of stations you can use. There are extra switch terminals, so all you must add is larger terminal strips to handle the extra station connections.

The master amplifier also has room for customizing. The module specified provides the volume level of a typical transistor table radio. For greater power you can substitute an amplifier of higher power. The basic construction and wiring must still be followed for both the remote and master amplifier.

Construction

The station in Fig. 1 is assembled on a pre-drilled aluminum panel that is supplied in the Lafayette 99 E 63380 Panel Kit. This panel is drilled for a 2½-in.-dia. speaker. Temporarily position a 16-ohm speaker no smaller than 2½ in. (preferably 3 in.) over the holes and mark the mounting locations for all other panel components. Switches S2 and S3 can be any DPDT spring-return type, either push-button or slide.

Drill the holes for the panel components and then cement the speaker in position with a contact adhesive such as Touch-n-Glue. Mount level control R1, selector switch S1, control switches S2 and S3 then the terminal strip. The terminal strip is mounted with 1-in. standoffs so its lugs clear all other components. If it looks as though terminals 5 6 and 7 will touch the back of the speaker, bend the terminals up toward the strip as far as possible. To avoid feedback loops between the amplifier's input and output leads, install the switch wiring exactly where shown.

Switch S1 should have enough contacts to handle all the stations, though the door(s) is not counted as a station—it has its own switch. We show the wiring for three stations; 12 stations are possible using the switch specified in the Parts List. Connect to the terminal strip numbers shown to avoid confusion. For clarity, we show the terminal numbers out of order in the schematic.

The master amplifier is built in the main section of a 7 x 5 x 3 in. Minibox. Note that the power supply for the specified amplifier is 9-10 V negative; the positive output is connected to the chassis (ground). Not all the supplied amplifier wires are used. Cut off the black input and output leads. Then, using as little heat as possible, solder a 5-in. lead to the metal rivet to which the supplied green input lead is soldered. The 5-in. lead should be cut to size when connected to

---

*Electronics Illustrated*
the terminal strip (lug 6 on TS2).

Transformer T1 is a 6.3-V 500-ma. filament transformer. Capacitors C1 and C2 charge to the peak voltage, which is 1.4 times greater than 6.3 V, to provide a DC output voltage of about 9-10 V.

Note that the amplifier's red lead connects to both terminal-strip lug 8 and to the cabinet. Do not connect it only to terminal 8. Terminal 8 must be grounded for safety.

Door stations consist of only an 8-ohm speaker if one door station is used, a 16-ohm speaker if two door stations are used. (The door stations are connected in parallel.) Because there is considerable noise outside, the door stations should provide the clearest possible sound; hence, use the largest speaker possible—at least a three incher.

Installation

A multiple-wire cable can be used for all connections except the amplifier input. The amplifier input wire from all stations (not the door) should be shielded cable whose shield is connected to ground (terminal 8) only at the master amplifier. The shield at the station should be cut off. You can use a multiple-wire cable that includes a shielded wire. If you use a single multiple cable and an unshielded amplifier input wire, the system may develop a feedback loop which will distort the sound if the cable is longer than 20 ft.

First step is to make the local connection at each station—this is terminal 5. Assign
All-Master Intercom

![Diagram of All-Master Intercom](image)

**Fig. 4**—Master amplifier is built in main section of Mailbox. Mount amplifier with standoffs so back of its board doesn’t touch the cabinet.

**Fig. 5**—Schematic of master amplifier. Only lugs 6, 7 and 8 are active. Others are tie points. Connect lug 8 to external ground (water pipe).

a number to the station and connect a jumper wire from terminal 5 to the terminal that corresponds to the station number. For example, station 1 would have a jumper from terminal 5 to terminal 1. Station 2 would have a jumper from terminal 5 to terminal 2. The jumper provides the connection which allows any station to call any other regardless of what station the called station is switched to.

Any method can be used to interconnect all stations of the system. As shown in Fig. 2, the cables can be connected in any combination of station to station or station to master amplifier as long as at least one cable connects from one station to the master amplifier. The door station(s) can connect to another station or the master amplifier as shown.

For safety’s sake, we strongly suggest that regardless where the master amplifier is mounted, terminal 8—the chassis ground—be connected to an electrical ground such as a cold-water pipe.

The master amplifier’s power supply is on at all times; power consumption is extremely low on standby; therefore, an on-off switch is not needed. To initiate a call simply set S1 to the appropriate station, press S3, and talk. As with all intercoms, identify your station so the receiving station will switch to your number. When S3 is released you will hear the called station when he presses talk switch S3.

To answer the door, push S2. You will hear the door station regardless what S1 is set for. Also, press S2 when talking to the door. The door circuit is private and no other stations will hear you or the door unless they press S2.

**PARTS LIST**

AMP.—1 watt modular amplifier (Lafayette 99 E 90979)

C1, C2—2,000 µf, 15-V electrolytic capacitor

Door Spkr.—20 ohm speaker (see text)

F1—1 A pigtail fuse

R1—20 ohm speaker fader (Lafayette 99 E 61384)

S1—Single pole rotary switch (12-position Mallory 32112 used, see text)

S2, S3—DPDT spring-return toggle or slide switch

SPKR.—8 or 16-ohm speaker (see text)

SR1-SR4—Silicon rectifier; minimum ratings: 750 ma, 25 PIV (Lafayette 19 E 50021 or equiv.)

T1—Filament transformer; secondary: 6.3 V @ 1 A

TS1, TS2—Eight-screw terminal strip

Misc.—Bakelite utility case (6 ⅞ x 3 3/16 x 1 ⅞ in. Lafayette 99 E 62721), panel kit (Lafayette 99 E 63380), 7 x 5 x 3-in. Minibox, multi-conductor intercom cable

**Electronics Illustrated**
MAN sometimes thinks of his eyes as the only way to see the world around him. However, medical science has developed a system of visual perception that will make your eyes just a small part of your seeing apparatus. The system, technically called tactile television, has been undergoing tests at a West Coast hospital and has successfully demonstrated that the blind can "see" objects at a distance. The system will eventually allow sighted persons to perceive things that would have previously been missed by the naked eye.

The system came about because of a desire on the part of two scientists, Drs. Carter Collins and Paul Bach-y-Rita, to provide a practical replacement for the eyes that are lost to the blind.

Tactile television operates on a basically simple principle—all parts of the body send nerve sensations to the brain. For instance, if you step on a ball in your bare feet you know that the ball is round although you cannot see it.

Collins and Bach-y-Rita discovered in their studies that the skin of the back was especially sensitive to these sensations and could be used as a receptor. The skin of the back would then be used in place of the eye's sensors. What would be used in place of the cornea, lens and retina? The doctors borrowed an idea from TV and decided to use a regular closed-circuit TV camera to replace these human parts (Fig. 1). The vidicon camera offers many of the facilities of the eye in that it can focus and perceive varying brightnesses of light. It also offers the mobility that is necessary to see a wide area.

A majority of the task had been accomplished; however, there remained the problem of converting the televised signal into a form that could be impressed on the back. This is where Collins and Bach-y-Rita have made their significant discovery. In order to fully understand the method, a short explanation on how the eye functions is necessary.

Reflected light of an object is focused by the eye's lens in an inverted manner. At the back of the eye are thousands of tiny receptors similar to photocells. Depending on the intensity of light, each cell sends a different amount of energy to the brain. The image that you see is a picture that has been assembled from this information. In other words, the brain is your decoder and monitor.
Fig. 1—Block diagram of tactile TV system. Object is focused on vidicon camera. The image is then amplified and scanned to produce 400-dot outline of object.

**ELECTRONIC EYES**

The doctors reasoned that information transmitted from the sensitive area of the back could, with sufficient training, be assembled in the same manner that the brain assembles messages from the natural eye.

As a matter of economy, the researchers decided to work with a projection device on a simple scale. In the back of a dentist's chair (Figs. 2 and 3) they installed 400 electromagnetic stimulators. These stimulators are solenoids with Teflon-tipped shafts. When a person rests his back against the chair, the stimulators move back and forth to strike the skin at a 60-cps rate as each of the individual magnets is energized. Each stimulator in this crude array represents one point in a picture composed of 400 dots.

In order to have the TV portion of the system produce a picture composed of only 400 dots, it is necessary that the electron beam sweep the photosensitive surface of the vidicon tube and sample the video at 400 pre-selected points. The solenoids are controlled in such a manner that light levels above a certain threshold will produce a pulse of constant duration.

It might seem that the subject is receiving nothing but pressure points with little definition on his back, but remember much of this information will be enhanced by the brain.

Shades are produced by this system, for each sweep the light might one time activate a solenoid, and another time not. Hence the subject feels a lighter grade of light.

Later in their research the scientists discovered that more of a complete picture could be produced by utilizing additional electronic hardware. They discovered that it is helpful to the subject to feel outlines of objects rather than a solid mass. To construct these outlines Dr. Collins uses what is called quasi-random sweep. With this system all of the points of the picture are swept from all four diagonal directions. With signal processing the end result is an image outline that

Fig. 2—Tactile TV in lab. Note converted dentist's chair with electromagnetic probes on back.
is free from extraneous subtleties that would confuse the subject.

In experiments the scientists have found that people who have been blind since birth can discern such objects as a telephone (Fig. 3, bottom) and a human face.

With these encouraging results, the future promises to be even more exciting. If the skin can be stimulated with barely perceptible shocks, the bulky vibratory array in the dentist's chair can be eliminated. Pictures having a much better resolution will become feasible—having as many as 10,000 dots. An enormous number of lightweight electrodes could simply be woven into a garment to be worn next to the skin, something like a seeing-eye sweater. For the blind, use of such a garment in conjunction with a miniaturized camera could restore their lost sight.

Experiments have provided all the necessary parameters for electrical stimulation. The sensation is completely unlike anything you might expect. We are accustomed to think of electrical shock as painful and dangerous.

The researchers all agree that the sensation—whether they feel it as a vibration, buzz, tickle or touch—is quite pleasant. From a scientific standpoint, the important things are that it is painless, well-localized, and can be applied for at least three hours without fading of sensation.

For the sighted, the horizons are broad. Pilots and astronauts may have tactile TV radar pictures projected on their skin while they perform other duties requiring their attention. Messages—alphabetical and numerical—as well as visual information could be transmitted to controllers in airport towers, to battlefield commanders or even motorists where communications demands overload the input capabilities of the eye.

The average person might have a system that would allow him to see in a 360° arc so that nothing would be missed while his back is turned.

More flexibility is offered in scientific estimates when it comes to using tactile TV for the sighted. Instead of replacing eyes, as is necessary with the blind, the system is increasing the versatility of the human eyes for the sighted.

The sweater described above could be adapted to receive regular TV broadcasts, giving one the ultimate in portable TV. A continuous flow of entertainment and information could reach the individual regardless of his location or nearness to a power source.

The research continues at an accelerated clip as Dr. Collins, now working alone, strives to give humans what amounts to an extra set of eyes—with electronics.

---

Fig. 3—A patient who has been blind since birth uses the tactile TV system. Her electronic eyes impress telephone image on her back. She senses a pattern similar to array shown in photo below.
New Heathkit® Solid-State

Design and performance features add up to one-of-a-kind superiority.

Over five years were spent in research and development to achieve the truly superior performance, improved convenience features, and ease of service now embodied in the new GR-270 and GR-370. They are premium quality receivers in the truest sense, and, we believe, the finest color TV's on today's market. Here's why...

Exclusive solid-state circuitry design...total of 45 transistors, 55 diodes, 2 silicon controlled rectifiers; 4 advanced Integrated Circuits containing another 46 transistors and 21 diodes; plus 2 tubes (picture and high voltage rectifier) combine to deliver performance and reliability unmatched by conventional tube sets.

Exclusive design solid-state VHF tuner uses an MOS Field Effect Transistor for greater sensitivity, lower noise, and lower cross-modulation...gives you sharply superior color reception, especially under marginal conditions. Gold/ nickelorium contacts give better electrical connections and longer wear. Memory fine tuning, standard. Solid-state UHF tuner uses hot-carrier diode design for increased sensitivity.

3-stage solid-state IF has higher gain for better overall picture quality. Emitter-follower output prevents spurious signal radiation, and the entire factory-aligned assembly is completely shielded to prevent external interference.

Automatic Fine Tuning—standard on both sets. Just push a button and the assembled and aligned AFT module tunes in perfect picture and sound automatically...eliminates manual fine-tuning. Automatic between-channel defeat switch prevents tuner from locking in on stray signals between channels. AFT can be disabled for manual tuning.

VHF power tuning...scan through all VHF and one preselected UHF channel at the push of a button.

Built-in automatic degaussing keeps colors pure. Manual degaussing coil can be left plugged into the chassis and turned on from the front panel...especially useful for degaussing after the set is moved some distance.

Automatic chroma control eliminates color variations under different signal conditions.

Adjustable noise limiting and gated AGC keeps pulse-type interference to a minimum, maintains signal strength at constant level.

High resolution circuitry improves picture clarity and new adjustable video peaking lets you select the degree of sharpness and apparent resolution you desire.

"Instant-On". A push of the power switch on the front panel brings your new solid-state set to life in seconds. Picture tube filaments are kept heated for instant operation, and extended tube life. "Instant-On" circuit can be defeated for normal on-off operation.

Premium quality color picture tubes. Both the 227 sq. in. GR-270 and 295 sq. in. GR-370 use the new brighter bonded-face, etched glass picture tubes for crisper, sharper, more natural color. And the new RCA HiLite Matrix tube is a low cost option for the GR-370. See below.

Adjustable tone control lets you choose the sound you prefer... from deep, rich bass to clean, pronounced highs.

Hi-fi output permits playing the audio from the set through your stereo or hi-fi for truly lifelike reproduction. Another Heath exclusive.

Designed to be owner serviced. The new Heath solid-state color TV's are the only sets on the market that can be serviced by the owner. You actually can diagnose, trouble-shoot and maintain your own set.

Built-in dot generator and tilt-out convergence panel let you do the periodic dynamic convergence adjustments required of all color TV's for peak performance. Virtually eliminate technician service calls.

Snap-out glass epoxy circuit boards with transistor sockets add strength and durability and permit fast, easy troubleshooting and transistor replacement. Makes each circuit a module.

Built-in Volt-Ohm Meter and comprehensive manual let you check circuits for proper operation and make necessary adjustments. The manual guides you every step in using this built-in capability. Absolutely no knowledge of electronics is required.

Easy, enjoyable assembly...the Heathkit way. The seven-section manual breaks every assembly down into simple step instructions. With Heath's famous fold-out pictorials and simple, straightforward design of the sets themselves, anyone can successfully complete the assembly.

Heathkit Solid-State Modular Color TV represents a significant step into the future...with color receiver design and performance features unmatched by any commercially available set at any price! Compare the specifications. Then order yours today.

Kit GR-270, all parts including chassis, 227" picture tube, face mask, UHF & VHF tuners, AFT & 6x9" speaker, 114 lbs. $489.95

Kit GR-370, all parts including chassis, 295" picture tube, face mask, UHF & VHF tuners, AFT & 6x9" speaker, 127 lbs. $559.95

Kit GR-370MX, complete GR-370 with RCA matrix picture tube, 127 lbs. $689.95

**Modular Color Television!**

**Exclusive Modular Design... Circuit Boards snap in and out in seconds for easy assembly, simple servicing**

New Expedited 48-Hour No-Charge Warranty Service Plan for Solid-State TV Modules! Special service facilities have been established at the factory and all Heathkit Electronic Centers to expedite service and return of Solid-State TV circuit modules within two working days. During the 90-day warranty period, TV modules will be serviced or replaced with no charge for labor or parts. After the initial 90-day warranty period expires, TV modules will be serviced or replaced at a fixed charge of $5.00 per module for labor and parts for a period of two years from date of original kit purchase.

Choose One Of These Handsome, Factory Assembled Cabinets

3 models in 295 sq. in.

Luxurious Mediterranean Cabinet... factory assembled of fine furniture grade hardwoods and finished in a flawless Mediterranean pecan. Stately bronze trim handles. 30-1/2" H x 47" W x 17¾" D. Assembled GBA-306-23, $59.95...

Deluxe Early American Cabinet... factory assembled of fine furniture grade hardwoods & veneers and finished in classic Salem Maple. 29-21/32" H x 37¼" W x 19¼" D. Assembled GBA-307-25, 72 lbs...

Contemporary Walnut Cabinet and Base Combination. Handsome walnut-finished cabinet sits on a matching walnut base. Cabinet dimensions 20-33/32" H x 31-7/16" W x 18¾" D. Base dimensions 27¾" W x 18½" D. Assembled GBA-266-29, Cabinet, 45 lbs. $49.95...GR-266-30 above cabinet, matching base, 58 lbs...

Add extra convenience and versatility to your new GR-270 or GR-370 Solid-State Color TV with this new optional remote control kit. Let's you turn the set on and off, adjust volume, change VHF channels and adjust color and tint from the comfort of your chair. Assembled and installs complete in just a few hours and the built-in meter on the receiver makes final adjustment a matter of minutes. Kit GBA-178-6, 6 lbs...

3 models in 227 sq. in.

Exciting Mediterranean Cabinet... assembled using fine furniture techniques and finished in stylish Mediterranean pecan. Assembled with stately bronze handle. 27-31/32" H x 41½" W x 15½" D. Assembled GBA-202-20, 70 lbs...

Handy Roll-Around Cart and Cabinet Combination. Features the GBA-203-20 walnut cabinet plus a warm-toned wheeled cart with storage shelf. Assembled GBA-200-20, Cabinet, 45 lbs. $59.95...GR-204-30 above cabinet, matching base, 58 lbs...

NEW FREE 1971 CATALOG!

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

HEATH COMPANY, Dept. 39-11
Benton Harbor, Michigan 49022

□ Enclosed is $...

□ Please send model (s)

□ Please send FREE Heathkit Catalog. □ Please send Credit Application.

Name

Address

City State Zip

*Mail order prices; F.O.B. factory. Prices & specifications subject to change without notice.

CIRCLE NUMBER 3 ON PAGE 11

**November, 1970**
This is one of those times when, to paraphrase Casey Stengel, everything is happening slowly but fast. That is, practically every day brings announcements of revolutionary new concepts and products, but putting these ideas into their practical place is a process which is agonizingly slow.

The latest example of this situation is all of the noise being made about four-channel sound. It comes in four varieties—two different versions from RCA, Motorola and Philips of straight four-channel. Then there are two different versions from Scheiber and Dynaco of encoded or matrixed four-channel, which derive four separate channels from a two-channel recording or broadcast format. If I had to bet right now, I'd put my money on the Scheiber or some still-to-be announced matrixing system. I think that straight four-channel will prove far too expensive and cumbersome for a wide market, unless it's cheapened terribly.

The role of Japan in audio was given an interesting twist by the announcement that British Industries, until now the American marketer of English audio products (Garrett, Wharfedale) is branching out with a line of amplifiers, tuners and receivers made in Japan. The brand name, a bit cumbersome, will be BIC/LUX—from the combination of British Industries Corporation with LUX, a Japanese engineering and manufacturing group. The gear will combine Japanese design and manufacture with Anglo-American notions of what the equipment ought to be like.

If the BIC/LUX tag seems formidable, so does the equipment—including two receivers with $500 and $600 price tags. There will be things such as computer tuning, which provides total muting when a station isn't tuned dead-on, an adjustable threshold that won't mute weak stations and human engineering that logically groups control and input functions.

The arrival of the super-cassette deck has been confirmed by the appearance of the Advent 200 tape deck (about $250), the Harman-Kardon CAD-5 (about $200) and the $199.95 Fisher RC-80.

What all these units have in common, of course, is the Dolby System of noise reduction to permit wide-range cassette recording for the first time, without noise.

As far as I'm concerned, the presence of the new super-cassette machines will speed a trend already begun with a vengeance by mediocre cassette decks. Cassette recorders already have almost taken over the market for inexpensive tape equipment, pushing open reel recorders way into the background. Good cassette decks are likely to continue this. I'm sure that the future of open reel, whatever its eventual dollar sales, lies in the area of high-priced equipment.

Apparently, Ampex suspects this also. In announcing its new line of equipment, the company puts its open-reel emphasis on two new and ambitious recorders—the AX-50 and AX-300 decks, at $300 and $650 respectively. With six heads as well as automatic reverse and dual-capstan drive, the AX-300 is obviously not for the casual recordist. It has a heavily professional look, underlined by linear slider controls and a pair of full-scale VU meters that function in both record and playback.

We'll have to wait and see the effect of this move.
 Shoot a no-fix crap game with neon lamps! It’s the In thing—unless you must hear the sound of bones hitting the backboard.

Elbow shakers who have lost the faith: cool it! There’s no need to get uptight about loaded dice. And there will be no more trick rolls, either. Get with it by just pushing two buttons on our Neon Crap Shooter. The rest is up to electronic chance. One of the oldest gambling games has had a touch of the modern computer added to it.

How can you make a dice game electronic? It’s done with neon lamps in ring counters. The neon lamp is a versatile little device. Not only is it a light indicator, it is also a sawtooth generator, a memory element and a voltage regulator. Two of them make a bistable multivibrator.

In our game neon lamps are used as switches and indicators in two six-bit ring counters. Don’t let the term ring counter put you down. It’s really a simple computer circuit. The lamps are connected so each one couples to the next and then back to the first to form a ring. We use two groups of six lamps for the six sides of each die. Since there are two dice there are two independent ring counters.

How it Works

Take a look at the schematic in Fig. 2. Neon lamps NL2 to NL7 represent one die and NL9 to NL14 represent the other die. The circuit is designed so that a chain of pulses triggers the ring-counter lamps to flash on and off, and in such a way that the last lamp to light cannot be predicted when the pulses end. Triggering is accomplished by two other neon lamps, NL1, NL8, which are in a relaxation-oscillator circuit.

Let’s first see how the relaxation oscillator works. When S1 is pressed lamp NL1 fires...
and discharges C3 to ground through NL1 and R4. The voltage across R4 causes Q1 to conduct and this puts a negative pulse at point A. Lamp NL1 fires at about 200 cps.

When S1 is released, NL1 continues to run because of the charge remaining on C2. As the charge decreases, NL1 runs slower and slower then stops. Resistor R1 sets the rundown time. By removing it the rundown can last for a minute.

Now to the ring counters to see how their neon lamps flash on and off. For this example we'll just deal with lamps NL2 and NL3. The lamps used in the ring counter are Signalite Type A257. (Other neon lamps won't work in this circuit.) They fire at 135 V. When they fire, the voltage across them drops to about 80 V.

When DC power is applied to the circuit, only one of lamps NL2-NL7 fires. Say it's NL2. This brings the voltage at point A down to 110 V, which is below the firing voltage of the other lamps.

Let's start the action again by pushing S1 to activate pulse generator NL1. After we do this, you remember, C3 discharges and applies a positive pulse to the base of Q1, causing it to conduct. This pulls the voltage at point A below the sustaining voltage level of NL2 and NL2 goes off.

The trigger pulse is of short duration, and when it ceases the voltage at point A rises. When NL2 was off, the voltage drop across R7 went to zero. The voltage across C5 (it's 30 V below the voltage at
Fig. 3—Print layout isn’t critical, but be sure install diodes DI-D12 correctly. And you must connect lead opposite green dot on NL2-NL7, NL9-NL14 as shown.

Neon Crap Shooter
Neon Crap Shooter

point A), the coupling capacitor connected from NL2 to NL3, snaps back to the voltage at point A. This sends a 30-V pulse to the anode of D2.

Lamp NL3 up to now is off now and its anode is at the same potential as point A. But the 30-V pulse adds to the voltage at NL3's anode causing NL3 to fire. As the voltage at point A rises, the next trigger pulse turns off NL3, which in the same way fires NL4. And so it goes on to NL7, then back via C10 to NL2. (The second ring counter, activated by S2, operates the same way.)

Construction

Take a look at Fig. 3. All the circuit components except the ring-counter neon lamps are mounted on a 4 x 6-in. piece of perforated board. You can use push-in terminals or brass eyelets as tie points. The author's model used brass eyelets for tie points.

Circuit components are not critical except for lamps NL2-NL7 and NL9-NL14. The lamps have a green dot on them near the positive (anode) terminal. Be sure to install them as shown. If installed backwards, they may not work properly.

Our game was built in a 3 x 6 x 9-in. Flexi-

Fig. 4—On board built by author, parts are mounted vertically to save space. However, they may be installed as in Fig. 3 to simplify wiring.

Fig. 5—Indicator neon lamps are held by their leads which are soldered to terminal strips. Sponge-rubber strips prevent light spillover. Board mounts under lamps and is held by wiring to the lamps.

Cab metal cabinet (Lafayette 19 E 22533). To display the side of a die as in Fig. 1, we drilled holes through the top panel corresponding to the spots on each side of a die. We then covered each group of holes with a 1/2-in. square of translucent white plastic.

On the back of the panel near the groups of holes we installed four six-lug terminal strips (TS1-TS4) as shown in Figs. 3 and 5. We soldered the neon lamps' wires to the terminal-strip lugs then, as shown in Fig. 5, we glued small pieces of sponge rubber between the lamps. This prevented the light from one lamp spilling over to another.

ELECTRONICS INSTRUMENTS

<table>
<thead>
<tr>
<th>PARTS LIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1—10 µf, 150-V electrolytic capacitor</td>
</tr>
<tr>
<td>C2,C11—3 µf, 150-V electrolytic capacitor</td>
</tr>
<tr>
<td>C3,C4,C12,C13—0.01 µf, 1,000-V disc capacitor</td>
</tr>
<tr>
<td>C5 through C10, C14 through C19—0.001 µf, 1,000-V disc capacitor</td>
</tr>
<tr>
<td>D1 through D12—1N914 diode</td>
</tr>
<tr>
<td>NL1,NL8—NE-51 neon lamp</td>
</tr>
<tr>
<td>NL2 through NL7, NL9 through NL14—A257 neon lamp (Signalite, see text)</td>
</tr>
<tr>
<td>Q1,Q2—2N1893 transistor (RCA)</td>
</tr>
<tr>
<td>Resistors: 1/2 watt, 10% unless otherwise indicated</td>
</tr>
<tr>
<td>R1,R14—1 megohm</td>
</tr>
<tr>
<td>R2,R4,R5,R15,R16,R17—1,000 ohms</td>
</tr>
<tr>
<td>R3,R17—2.2 megohms</td>
</tr>
<tr>
<td>R6 through R12, R19 through R25—15,000 ohms</td>
</tr>
<tr>
<td>R13,R26—33,000 ohms</td>
</tr>
<tr>
<td>S1,S2—SPST normally-open pushbutton switch</td>
</tr>
<tr>
<td>SR1—Silicon rectifier; minimum ratings: 100 ma, 500 PIV</td>
</tr>
<tr>
<td>Misc.—perforated board, line cord, cabinet</td>
</tr>
</tbody>
</table>

*The Signalite A257 neon lamps are available for 55¢ each (postpaid) from Gailek Solid State, Inc., 434 Avenue of the Americas, New York, N.Y. 10011.
Bugging the Fuzz

Listening in on police calls makes VHF radio the hotspot for SWLs.

Whether you know them as cops, fuzz, flatfeet or bulls, the truth is that the police always have excited the imagination. They have populated everything from comic books to TV shows in an endless barrage of good cop-bad robber adventure stories.

Many SWLs have decided to forget the fiction and eavesdrop on police radio calls. With a little knowledge, good equipment and patience you can join this exciting hobby where the airwaves crackle with intrigue and drama.

The equipment that you need is of a fast-growing breed that tunes local police, fire departments and other emergency services. Thanks to a flood of low-cost gear in the marketplace this special equipment is comfortably within the budget of most SWLs. Until a year or two ago, the monitors were strictly in the professional class but price tags today can dip below $20. Sales of these sets are booming.

Low and High. Police frequencies mainly fall within two sections of the VHF band (30-300 mc) and you should know which one your local agency is using before considering equipment. There’s the low band, which runs from about 30-50 mc and a high band which extends from about 150 to 174 mc. Although both fall within VHF, you won’t find one receiver that continuously tunes the whole VHF band. You’d run into a lot of unnecessary signals, mainly from TV channels 2 through 13. It’s not difficult to identify the local band in use, or even to find out an exact
Fig. 1—Illustration of two types of police VHF antennas. In the drawing at the right is a spike antenna about 1 ½ ft. tall covering 150-174 mc. In the drawing on the far right is the whip antenna covering the low band of 30-50 mc. Note mounting.

Bugging the Fuzz

frequency which must be known for crystal-controlled operation.

How do you know if a local service is on low or high band? A simple way is to look at the antenna on one of the mobile units. If it’s sporting a whip antenna that measures about five or six ft. in height, it’s advertising the low band. As you can see in Fig. 1, a low-band whip is often mounted at the rear and has a spring-loaded base.

Spotting high-band antennas is also easy since they’re barely more than slim spikes jutting up from a car top or trunk deck. The length of the spike is about 1 ½ ft.

Simply knowing whether low or high band is in local operation is enough information to pick a receiver. To locate stations on the dial takes a bit of patience, but you should be able to log various local services. (Expect to do some dial-twiddling because transmissions are short and easily missed.) Trial-and-error tuning is adequate for the occasional listener or hobbyist but it could prove annoying to people with more than a casual interest in monitoring and who want to hear specific frequencies. Many volunteer policemen wish to monitor their department’s channels for example. To tune signals with a minimum of fuss you should choose a receiver capable of crystal-control and obtain a crystal of the exact frequency. It’s easy to find out the frequency if you’re a cop, firefighter, or some other pro—just ask for it down at headquarters. If you have no friends at city hall, you can buy the information from the Communications Research Bureau, Box 56-EX, Commack, N. Y. 11725. They specialize in frequency listing by area and will send you a catalog on request.

The Receivers. Receiving equipment is quite varied in features and price so the best
place to begin is on the bottom rung. There you'll find the low-cost portable which picks up a single band. A model like the Allied A-2587 can tune the high band at just under $20. (An equivalent model is available for low-band coverage.) The performance of simple portables usually boils down to this: they're fine for occasional listening if signals aren't too distant or crowded together. Dial calibration is very approximate and tuning is a touchy proposition because of little bandspread action in the tuning knob. Of course, there are none of the special features found in higher-priced models. But it's a start.

(A Allied Radio, as do others mentioned in this article, offers both simple and advanced monitors.)

Further up the scale, at $33.50, is a unit like the Courier pocket-size monitor. Compared to the simpler set, this one has three differences worth noting. Instead of a continuous tuning dial, there are three crystal-controlled frequencies. This makes the unit a snap to tune on three channels, but less effective for casual listening over the whole band. Another feature is a squelch circuit which keeps the speaker silent when calls are not being received. Squelch on any set is a valuable feature if you're going to monitor over long periods and want to avoid annoying static. Finally, the Courier includes an AM section for entertainment so the receiver serves two purposes. There are many comparable models available including the Hallcrafters CRX-107, (Fig. 2).

You can combine the benefits of crystal and continuous tuning in a home-type receiver of the one-band variety. A selector provides both continuous tune and crystal positions. A crystal can be ordered for fixed-frequency reception at a cost of $5.95 and about a four-week waiting time (since the rock might have to be ground especially to your frequency). With a price tag of about $80, a receiver of this type can be expected to have good sensitivity and snappy squelch action.

These one-banders are fine, but let's say you live in a sizeable city and learn of interesting stations on both low and high band. This dilemma is neatly solved with a two-bander, like Radio Shack's Patrolman Pro-2 shown in Fig. 3 and the cost rises to $99.95 for the additional coverage.

One recent trend in equipment is to beef up a conventional short-wave receiver with a couple of monitoring bands to satisfy almost any interest. The result is a model like Allied's 2660 a $69.95 set that snatches almost anything out of the air (see Fig. 4). In addition to covering regular AM and FM broadcasts, it handles major short-wave bands between 5 and 24 mc (where most international broadcasting occurs). Then there are two bands marked PS for public service—another way of saying police-communications band.

Widespread listening to police broadcasts may be just a few years old, but it has already given birth to some highly specialized gear. One item that could win the prize for novelty is a scanner. Fitted with an impressive row of flashing lights, it's a receiving robot that automatically performs a remarkable num-

Fig. 4—Allied's Model 2660, a versatile portable/AC receiver covering AM and FM, short wave and two VHF bands. $69.95.

Fig. 5—The receiving robot, Regency's TMR-8. Receiver automatically searches for signals on selected frequencies with eight crystals.
Bugging the Fuzz

ber of listening functions. Take the Regency TMR-8 (Fig. 5) as an example. After loading it with up to eight high-band crystals of your choice you turn it on and sit back. A row of eight red lights flash in sequence like a movie marquee. Suddenly, movement stops, one light remains on and you hear something like... Two characters walking down Main accompanied by suspicious looking orangutan... (silence in the speaker and scanning continues)... Respond to alarm at 44th and Sixth. What the receiver is doing is searching out signals and holding open the speaker on each active frequency so you can hear the transmissions. Then it resumes scanning automatically after the transmission ends. Those buttons enable you to program any combination of channels and disable the ones you don't want to hear. Or you can monitor two sides of a conversation being transmitted on different channels.

Build-It, Too. The kit builder hasn't been overlooked by monitor designers. Heath Co. offers a receiver in kit form. The builder installs parts into a printed-circuit board and solders them to the foil, while the critical front-end is supplied prewired, assembled and aligned at the factory. The price of the GR-88 is $49.95, which sounds high when compared to factory-wired equipment, but a look at the circuitry reveals such refinements as four IF stages, two local oscillators (for crystal and continuous tuning), amplified AGC and a multistage squelch circuit. The advanced hobbyist might be interested in a group of experimenter modules offered by International Crystal. To construct a complete police converter for an AM radio, you choose three basic boards: an RF amplifier, a mixer and an oscillator. Assembly is on printed boards which may be housed in a cabinet, or even inside a regular receiver to extend frequency coverage. To build an operational unit costs about $14, including one crystal for operation on any frequency between 3 and 170 mc.

Plucking a local police or fire signal out of the air can be done on the telescoping whip antenna built into most monitoring receiv-

[Continued on page 100]

<table>
<thead>
<tr>
<th>CODE</th>
<th>BREAK THE CODE</th>
<th>CODE</th>
<th>BREAK THE CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-0</td>
<td>Caution</td>
<td>10-3</td>
<td>Stop transmitting</td>
</tr>
<tr>
<td>10-1</td>
<td>Change location</td>
<td>10-4</td>
<td>Acknowledgment</td>
</tr>
<tr>
<td>10-2</td>
<td>Signal good</td>
<td>10-5</td>
<td>Relay</td>
</tr>
<tr>
<td>10-3</td>
<td>Stop transmitting</td>
<td>10-6</td>
<td>Busy unless urgent</td>
</tr>
<tr>
<td>10-4</td>
<td>Acknowledgment</td>
<td>10-7</td>
<td>Out of service</td>
</tr>
<tr>
<td>10-5</td>
<td>Relay</td>
<td>10-8</td>
<td>In service</td>
</tr>
<tr>
<td>10-6</td>
<td>Busy unless urgent</td>
<td>10-9</td>
<td>Repeat</td>
</tr>
<tr>
<td>10-7</td>
<td>Out of service</td>
<td>10-10</td>
<td>Fight in progress</td>
</tr>
<tr>
<td>10-8</td>
<td>In service</td>
<td>10-11</td>
<td>Dog case</td>
</tr>
<tr>
<td>10-9</td>
<td>Repeat</td>
<td>10-12</td>
<td>Stand by</td>
</tr>
<tr>
<td>10-10</td>
<td>Fight in progress</td>
<td>10-13</td>
<td>Weather report</td>
</tr>
<tr>
<td>10-11</td>
<td>Dog case</td>
<td>10-14</td>
<td>Prowler report</td>
</tr>
<tr>
<td>10-12</td>
<td>Stand by</td>
<td>10-15</td>
<td>Civil disturbance</td>
</tr>
<tr>
<td>10-13</td>
<td>Weather report</td>
<td>10-16</td>
<td>Domestic problem</td>
</tr>
<tr>
<td>10-14</td>
<td>Prowler report</td>
<td>10-17</td>
<td>Most complainant</td>
</tr>
<tr>
<td>10-15</td>
<td>Civil disturbance</td>
<td>10-18</td>
<td>Quickly</td>
</tr>
<tr>
<td>10-16</td>
<td>Domestic problem</td>
<td>10-19</td>
<td>Return to ...</td>
</tr>
<tr>
<td>10-17</td>
<td>Most complainant</td>
<td>10-20</td>
<td>Location</td>
</tr>
<tr>
<td>10-18</td>
<td>Quickly</td>
<td>10-21</td>
<td>Call by phone</td>
</tr>
<tr>
<td>10-19</td>
<td>Return to ...</td>
<td>10-22</td>
<td>Dierarged</td>
</tr>
<tr>
<td>10-20</td>
<td>Location</td>
<td>10-23</td>
<td>Arrived at scene</td>
</tr>
<tr>
<td>10-21</td>
<td>Call by phone</td>
<td>10-24</td>
<td>Assignment finished</td>
</tr>
<tr>
<td>10-22</td>
<td>Dierarged</td>
<td>10-25</td>
<td>Meet in person</td>
</tr>
<tr>
<td>10-23</td>
<td>Arrived at scene</td>
<td>10-26</td>
<td>Detaining subject</td>
</tr>
<tr>
<td>10-24</td>
<td>Assignment finished</td>
<td>10-27</td>
<td>License information</td>
</tr>
<tr>
<td>10-25</td>
<td>Meet in person</td>
<td>10-28</td>
<td>Registration into</td>
</tr>
<tr>
<td>10-26</td>
<td>Detaining subject</td>
<td>10-29</td>
<td>Check for wanted</td>
</tr>
<tr>
<td>10-27</td>
<td>License information</td>
<td>10-30</td>
<td>Unnecessary use of radio</td>
</tr>
<tr>
<td>10-28</td>
<td>Registration into</td>
<td>10-31</td>
<td>Crime in progress</td>
</tr>
<tr>
<td>10-29</td>
<td>Check for wanted</td>
<td>10-32</td>
<td>Man with gun</td>
</tr>
<tr>
<td>10-30</td>
<td>Unnecessary use of radio</td>
<td>10-33</td>
<td>Emergency</td>
</tr>
<tr>
<td>10-31</td>
<td>Crime in progress</td>
<td>10-34</td>
<td>Riot</td>
</tr>
<tr>
<td>10-32</td>
<td>Man with gun</td>
<td>10-35</td>
<td>Major crime alert</td>
</tr>
<tr>
<td>10-33</td>
<td>Emergency</td>
<td>10-36</td>
<td>Correct time</td>
</tr>
<tr>
<td>10-34</td>
<td>Riot</td>
<td>10-37</td>
<td>Suspicious vehicles</td>
</tr>
<tr>
<td>10-35</td>
<td>Major crime alert</td>
<td>10-38</td>
<td>Stopping vehicle</td>
</tr>
<tr>
<td>10-36</td>
<td>Correct time</td>
<td>10-39</td>
<td>Use light, siren</td>
</tr>
<tr>
<td>10-37</td>
<td>Suspicious vehicles</td>
<td>10-40</td>
<td>Silent run</td>
</tr>
<tr>
<td>10-38</td>
<td>Stopping vehicle</td>
<td>10-41</td>
<td>Beginning tour of duty</td>
</tr>
<tr>
<td>10-39</td>
<td>Use light, siren</td>
<td>10-42</td>
<td>Ending duty tour</td>
</tr>
<tr>
<td>10-40</td>
<td>Silent run</td>
<td>10-43</td>
<td>Information</td>
</tr>
<tr>
<td>10-41</td>
<td>Beginning tour of duty</td>
<td>10-44</td>
<td>Permission to leave</td>
</tr>
<tr>
<td>10-42</td>
<td>Ending duty tour</td>
<td>10-45</td>
<td>Animal carcass at</td>
</tr>
<tr>
<td>10-43</td>
<td>Information</td>
<td>10-46</td>
<td>Assist motorists</td>
</tr>
<tr>
<td>10-44</td>
<td>Permission to leave</td>
<td>10-47</td>
<td>Emgcy. rd. repair</td>
</tr>
<tr>
<td>10-45</td>
<td>Animal carcass at</td>
<td>10-48</td>
<td>Standard repair at</td>
</tr>
<tr>
<td>10-46</td>
<td>Assist motorists</td>
<td>10-49</td>
<td>Traffic light out</td>
</tr>
<tr>
<td>10-47</td>
<td>Emgcy. rd. repair</td>
<td>10-50</td>
<td>Accident</td>
</tr>
<tr>
<td>10-48</td>
<td>Standard repair at</td>
<td>10-51</td>
<td>Wrecker needed</td>
</tr>
<tr>
<td>10-49</td>
<td>Traffic light out</td>
<td>10-52</td>
<td>Ambulance needed</td>
</tr>
<tr>
<td>10-50</td>
<td>Accident</td>
<td>10-53</td>
<td>Road block</td>
</tr>
<tr>
<td>10-51</td>
<td>Wrecker needed</td>
<td>10-54</td>
<td>Livestock on road</td>
</tr>
<tr>
<td>10-52</td>
<td>Ambulance needed</td>
<td>10-55</td>
<td>Drunk driver</td>
</tr>
<tr>
<td>10-53</td>
<td>Road block</td>
<td>10-56</td>
<td>Drunk pedestrian</td>
</tr>
<tr>
<td>10-54</td>
<td>Livestock on road</td>
<td>10-57</td>
<td>Hit and run</td>
</tr>
<tr>
<td>10-55</td>
<td>Drunk driver</td>
<td>10-58</td>
<td>Direct traffic</td>
</tr>
<tr>
<td>10-56</td>
<td>Drunk pedestrian</td>
<td>10-59</td>
<td>Convoy or escort</td>
</tr>
<tr>
<td>10-57</td>
<td>Hit and run</td>
<td>10-60</td>
<td>Squad in vicinity</td>
</tr>
<tr>
<td>10-58</td>
<td>Direct traffic</td>
<td>10-61</td>
<td>Personnel in assign</td>
</tr>
<tr>
<td>10-59</td>
<td>Convoy or escort</td>
<td>10-62</td>
<td>Reply to message</td>
</tr>
<tr>
<td>10-60</td>
<td>Squad in vicinity</td>
<td>10-63</td>
<td>Make written copy</td>
</tr>
<tr>
<td>10-61</td>
<td>Personnel in assign</td>
<td>10-64</td>
<td>Local message</td>
</tr>
<tr>
<td>10-62</td>
<td>Reply to message</td>
<td>10-65</td>
<td>Net message assignment</td>
</tr>
<tr>
<td>10-63</td>
<td>Make written copy</td>
<td>10-66</td>
<td>Message cancellation</td>
</tr>
<tr>
<td>10-64</td>
<td>Local message</td>
<td>10-67</td>
<td>Net message</td>
</tr>
<tr>
<td>10-65</td>
<td>Net message assignment</td>
<td>10-68</td>
<td>Dispatch information</td>
</tr>
<tr>
<td>10-66</td>
<td>Message cancellation</td>
<td>10-69</td>
<td>Message received</td>
</tr>
<tr>
<td>10-67</td>
<td>Net message</td>
<td>10-70</td>
<td>Fire alarm</td>
</tr>
<tr>
<td>10-68</td>
<td>Dispatch information</td>
<td>10-71</td>
<td>Advise nature fire</td>
</tr>
<tr>
<td>10-69</td>
<td>Message received</td>
<td>10-72</td>
<td>Report progress fire</td>
</tr>
<tr>
<td>10-70</td>
<td>Fire alarm</td>
<td>10-73</td>
<td>Smoke report</td>
</tr>
<tr>
<td>10-71</td>
<td>Advise nature fire</td>
<td>10-74</td>
<td>Negotive</td>
</tr>
<tr>
<td>10-72</td>
<td>Report progress fire</td>
<td>10-75</td>
<td>In contact with</td>
</tr>
<tr>
<td>10-73</td>
<td>Smoke report</td>
<td>10-76</td>
<td>En route</td>
</tr>
<tr>
<td>10-74</td>
<td>Negotive</td>
<td>10-77</td>
<td>ETA</td>
</tr>
<tr>
<td>10-75</td>
<td>In contact with</td>
<td>10-78</td>
<td>Need assistance</td>
</tr>
<tr>
<td>10-76</td>
<td>En route</td>
<td>10-79</td>
<td>Notify coroner</td>
</tr>
<tr>
<td>10-77</td>
<td>ETA</td>
<td>10-80</td>
<td>Chase in progress</td>
</tr>
<tr>
<td>10-78</td>
<td>Need assistance</td>
<td>10-81</td>
<td>Breather/taxi report</td>
</tr>
<tr>
<td>10-79</td>
<td>Notify coroner</td>
<td>10-82</td>
<td>Reserve lodging</td>
</tr>
<tr>
<td>10-80</td>
<td>Chase in progress</td>
<td>10-83</td>
<td>Work school crossing</td>
</tr>
<tr>
<td>10-81</td>
<td>Breather/taxi report</td>
<td>10-84</td>
<td>Meeting ETA</td>
</tr>
<tr>
<td>10-82</td>
<td>Reserve lodging</td>
<td>10-85</td>
<td>Delayed due to...</td>
</tr>
<tr>
<td>10-83</td>
<td>Work school crossing</td>
<td>10-86</td>
<td>Officer on duty</td>
</tr>
<tr>
<td>10-84</td>
<td>Meeting ETA</td>
<td>10-87</td>
<td>Pick-up checks</td>
</tr>
<tr>
<td>10-85</td>
<td>Delayed due to...</td>
<td>10-88</td>
<td>Telephone 2 of</td>
</tr>
<tr>
<td>10-86</td>
<td>Officer on duty</td>
<td>10-89</td>
<td>Pick up prisoner</td>
</tr>
<tr>
<td>10-87</td>
<td>Pick-up checks</td>
<td>10-90</td>
<td>Bomb threat</td>
</tr>
<tr>
<td>10-88</td>
<td>Telephone 2 of</td>
<td>10-91</td>
<td>Bank alarm at</td>
</tr>
<tr>
<td>10-89</td>
<td>Pick up prisoner</td>
<td>10-92</td>
<td>Improper parking</td>
</tr>
<tr>
<td>10-90</td>
<td>Bomb threat</td>
<td>10-93</td>
<td>Blackcat</td>
</tr>
<tr>
<td>10-91</td>
<td>Bank alarm at</td>
<td>10-94</td>
<td>Drag racing</td>
</tr>
<tr>
<td>10-92</td>
<td>Improper parking</td>
<td>10-95</td>
<td>Prisoner in custody</td>
</tr>
<tr>
<td>10-93</td>
<td>Blackcat</td>
<td>10-96</td>
<td>Mental subject</td>
</tr>
<tr>
<td>10-94</td>
<td>Drag racing</td>
<td>10-97</td>
<td>Check signal</td>
</tr>
<tr>
<td>10-95</td>
<td>Prisoner in custody</td>
<td>10-98</td>
<td>Prison/jail break</td>
</tr>
<tr>
<td>10-96</td>
<td>Mental subject</td>
<td>10-99</td>
<td>Wanted indicated</td>
</tr>
</tbody>
</table>

The Associated Public Safety Communications Officers’ (APSCO) and New York City Police codes shown in chart. Listen carefully and it will be easy with practice to break codes of other cities.
AFTER deciding which antenna you want to put up, the next big problem that hits you is where to put it. If a backyard is small, a 33-ft. half-wave dipole for, say, 20 meters could present problems. Since the sky's the only limit, why not go straight up with a vertical?

As skyhooks go, the vertical is an excellent general-purpose antenna. It doesn't take up much space, it has an omnidirectional radiation pattern and the bulk of the energy radiated goes out at a low radiation angle. This makes it ideal for long-distance communications on the 10-, 15- and 20-meter bands. It also performs well on the Citizens Band. The cost is low and it couldn't be easier to erect.

The Design

The length of our vertical antenna is a quarter wavelength. It is fed at the base—a maximum-current, low-impedance point. To obtain a low vertical radiation angle it is necessary to have a good ground system, such as a radial-wire system.

For four-band operation you might think it necessary to use four separate antennas of different lengths. This isn't necessary with our design because a suitable matching system is used at the base to permit four-band operation even though the antenna's physical length corresponds to an electrical quarter wavelength on 15 meters.

A stub matching system is employed for operation on 10 and 20 meters and the Citizens Band. On 15 meters a stub is not required.

The antenna, with the beneath-ground radials, operates equally well on the Citizens Band, too. If the length of the vertical is reduced to 9 ft. it can be fed directly with 50-ohm coax. However, if the antenna is to be used for CB and ham operation (with a length of 10 ft. 11 in.), the shorting stub for CB operation should be 2 ft. long as shown in Fig. 3(B).

The Stub That Matches

When a quarter-wave shorted section of transmission line is attached to antenna terminals (Fig. 2), the impedance of the stub will vary from a maximum at the point of connection at the antenna to zero at the short. By
connecting a transmission line at an appropriate point along the stub, a suitable match can be obtained. Furthermore, by varying the length of the stub so that it is more or less than a quarter wavelength, the stub can compensate for the antenna being longer or shorter than a quarter wavelength at a given frequency.

Construction

The practical antenna shown in the diagram in Fig. 1 takes advantage of these factors. It is a quarter wavelength long on 15-meters (about 11 ft.). Four 20-ft. radials provide the ground system to insure good low-angle radiation. Guy wires are not necessary. The vertical is supported by an 8-ft. 2 x 3, set 2 ft. in the ground. U-bolts hold the vertical firmly to the 2 x 3.

A 4-ft. metal fence post should be driven into the ground right beside it.

Fig. 1—Diagram at right shows construction details and dimensions. Solder radials to fence post. Photo below is of base of antenna. SO-239 connector is mounted in special holder. Mount it similarly in Bakelite. Connect inner lug to antenna and connect the shell to the fence post.
Fig. 3—When operating on 15 meters, connect transmission line (A) from transmitter/receiver directly to antenna. For operation on 10 and 20 meters and Citizens Band, use a 4-ft. 4-in. length of coax and three matching stubs, as in B. 83-IT tee connector is not drawn to scale.

as shown in Fig. 1. The post acts as a ground for the antenna system. The four 20-ft. radials should be soldered to the post (for a good electrical connection) and buried in the ground about 2-in. beneath the surface. They should radiate horizontally and be separated from each other by 90°.

For operation on 15 meters connect the transmission line from your transmitter (or receiver) to the connector at the base.

For operation on 10 and 20 meters, connect a 4-ft. 4-in. length of RG58/U coax between the base of the vertical and an 83-IT coax tee-adaptor as shown in Fig. 4(B). Connect the line from the transmitter to the opposite side of the tee adaptor. Connect the stub (a shorted length of coax) for 10- and 20-meter operation to the third terminal of the tee adaptor.

For operation on 10 meters, the stub must be 1 ft. 9 in. long. For operation on 20 meters, the stub must be 3 ft. long. For operation on the Citizens Band, the stub must be 2 ft. long. The short at the end of each stub is made by soldering the braid and inner conductor together. Tape the connection.

If the antenna is constructed as shown, the stub lengths result in low standing-wave ratios on all bands. If you desire to try other combinations of antenna and stub lengths, it will be necessary to use an SWR meter and to experiment with other stub lengths and tap-on points. Connect the SWR meter between the tee adaptor and the transmission line. You'll then be able to observe the influence of stub adjustments as you attempt to obtain the lowest SWR. The length of the stub is from the base of the vertical to the short.

![Antenna System Diagram]

**Table: MATERIALS**

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Description</th>
<th>Mfg. No.</th>
<th>Lafayette No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PL-258 adapter</td>
<td>83-1J</td>
<td>32 E 20027</td>
</tr>
<tr>
<td>5</td>
<td>PL-259 plug</td>
<td>83-1SP</td>
<td>32 E 20043</td>
</tr>
<tr>
<td>1</td>
<td>M-358 tee adaptor</td>
<td>83-1T</td>
<td>32 E 20068</td>
</tr>
<tr>
<td>1</td>
<td>SO-239 receptacle</td>
<td>83-1R</td>
<td>32 E 20035</td>
</tr>
<tr>
<td>1</td>
<td>8-ft. length 2 x 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>11-ft. length 1½-in. o.d. aluminum tubing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4-ft.  metal fence post</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>U clamps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 ft</td>
<td>No. 12 or No. 14 wire</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

— RG58/U coaxial cable

_November, 1970_
THE islands of the Caribbean are renowned as a cozy spot to spend a winter vacation. There is additional fun in the 13 countries that formerly comprised the British West Indies for they can prove to be a bonanza for medium-wave fans looking to improve their country scorecard.

All of the stations on these islands broadcast in English on MW with only one, Grenada, having a SWBC outlet. Because of the tropical location of the islands, all of these stations can be DXed in winter and summer but some of the locations are not the easiest to log, no matter what the time of year.

Grenada is the central broadcasting location for the Windward Islands Broadcasting Service, which continues to operate despite the fact that the Windwards no longer exist as a political entity and are now British protectorates.

W.I.B.S. operates low-power BCB relays in the mini-states of Dominica on 695 kc, St. Vincent on 705 kc and St. Lucia on 1575 kc. The main station for W.I.B.S. is widely heard at 3285 and 11970 kc on short wave and also has a 5-kw rig broadcasting at 535 kc, the acknowledged bottom edge of the BCB. During the winter months, W.I.B.S. transmits on 2420 kc as well.

W.I.B.S. issues a QSL card at their Grenada headquarters on St. George's; however, they are slow in responding to SW reports and even more erratic when it comes to verifying reports of BCB reception.

St. Lucia is an exception when it comes to reporting, as it has its own 10-kw station, R. Caribbean, in addition to the W.I.B.S. relay. This is a commercial operation and occasionally makes it into the U.S. when QRM from stations in Colombia and Kentucky is...
at a reasonably low level.

Leeward Islands. Antigua's image as a quiet site for international relays was shattered recently by violent labor unrest. This country's station is still on the air, but remains one of the more difficult West Indies stations to log. The Antigua Broadcasting Service was last reported to be transmitting on 644 kc. The station is a slow verifier and to make it tougher it has a very early sign-off at 2000 hours EST.

Antigua's neighbor to the southwest, Monserrat, will make an easier target. R. Monserrat has only 250 watts but this is improved by broadcasting on the split frequency of 885 kc. The best time to receive this signal is around sunset, before interference from a more powerful station called R. Libertad (no relation to the clandestine outlet of the same name) gets on the air. Another station that operates from Monserrat is R. Antilles, a commercial operation on 930 kc.

The station on St. Christopher, sometimes known as St. Kitts, is the toughest of all the West Indies stations to log. The outlet ZIZ operates with low power on the crowded FCC designated channel of 570 kc.

The island of Anguilla was administered by St. Kitts until 1968, at which time a declaration of independence was pronounced by the tiny island. The uprising was quashed by an invasion of the British Army but one of the byproducts of the revolt was R. Anguilla which has been reported by members of the National Radio Club on 1505 kc.

ZBVI at Roadtown on the British Virgin Island, Tortola, has a 10-kw transmitter on 780 kc. Unfortunately, R. Barbados at Black-rock near Bridgetown, the capital of Barbados, also broadcasts on 780 kc. When the interference from the United States is conquered, R. Barbados usually comes into your receiver on top. The best time to try for ZBVI is at their sign-on around 0500 EST. U.S. stations are usually silent Monday mornings at that hour.

Barbados differs from the island states of Leeward and Windward in that she is a completely independent nation, as are Jamaica and Trinidad.

In these other sovereignties in the Caribbean, R. Jamaica and R. Trinidad once operated on SW but switched to all MW broadcasting for greater coverage.

R. Trinidad is easiest to get on 730 kc at 0430 EST when the station signs on. They are quick in responding to reception reports.

Jamaica is the largest of the British West Indies islands and consequently has the largest number of BCB transmitters. The R. Jamaica outlets most often logged are on 720 kc which is located at Kingston and 770 kc at Mandeville. The Jamaican stations are good verifiers, except when they experience transmitter difficulties and are reluctant to verify reports of broadcasts at other than assigned frequencies.

At the present time there are only two broadcast stations operating from the Bahamas, both located at its capital. Nassau ZNZ is on the air 24 hours a day on 1540 kc and is often logged in the U.S. and Canada ZNZ2, on 1240, is generally considered a graveyard channel and is seldom heard at a distance.

If you can't afford to drop down and play in the sun, at least you can have the satisfaction of knowing that you have picked up one of the rare treats left for the DXpeditioner.

### WEST INDIES MEDIUM-WAVE BROADCASTS*

<table>
<thead>
<tr>
<th>Freq. (kc)</th>
<th>Station</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>535</td>
<td>Windward Islands Broadcasting Service (W.I.B.S.)</td>
<td>St. George's, Grenada</td>
<td></td>
</tr>
<tr>
<td>570</td>
<td>ZIZ</td>
<td>Basseterre, St. Christopher</td>
<td></td>
</tr>
<tr>
<td>644</td>
<td>Antigua Broadcasting Service</td>
<td>St. John's, Antigua</td>
<td></td>
</tr>
<tr>
<td>695</td>
<td>W.I.B.S.</td>
<td>Roseau, Dominica</td>
<td>Reports to St. George's, Grenada</td>
</tr>
<tr>
<td>790</td>
<td>Jamaica Broadcasting Corp. (J.B.C.)</td>
<td>Montego Bay, Jamaica</td>
<td>Reports to Kingston.</td>
</tr>
<tr>
<td>785</td>
<td>W.I.B.S.</td>
<td>Kingston, St. Vincent</td>
<td>Reports to St. George's.</td>
</tr>
<tr>
<td>720</td>
<td>R. Jamaica</td>
<td>Kingston, Jamaica</td>
<td></td>
</tr>
<tr>
<td>730</td>
<td>R. Trinidad</td>
<td>Port of Spain, Trinidad</td>
<td>0430 (EST) sign-on</td>
</tr>
<tr>
<td>750</td>
<td>J.B.C.</td>
<td>Point Galina, Jamaica</td>
<td>Reports to Kingston.</td>
</tr>
<tr>
<td>770</td>
<td>R. Jamaica</td>
<td>Mandeville, Jamaica</td>
<td>Reports to Kingston.</td>
</tr>
<tr>
<td>780</td>
<td>R. Barbados</td>
<td>Black Rock, Barbados</td>
<td></td>
</tr>
<tr>
<td>780</td>
<td>ZBVI</td>
<td>Roadtown, Tortola</td>
<td>0500 (EST) sign-on</td>
</tr>
<tr>
<td>840</td>
<td>R. Caribbean</td>
<td>Castries, St. Lucia</td>
<td></td>
</tr>
<tr>
<td>885</td>
<td>R. Monserrat</td>
<td>Plymouth, Monserrat</td>
<td></td>
</tr>
<tr>
<td>930</td>
<td>R. Antilles</td>
<td>Plymouth, Monserrat</td>
<td></td>
</tr>
<tr>
<td>1540</td>
<td>ZNZ</td>
<td>Nassau, Bahamas</td>
<td></td>
</tr>
<tr>
<td>1575</td>
<td>W.I.B.S.</td>
<td>Castries, St. Lucia</td>
<td>Reports to St. George's.</td>
</tr>
<tr>
<td>2420</td>
<td>W.I.B.S.</td>
<td>St. George's Grenada</td>
<td></td>
</tr>
</tbody>
</table>

*Except where indicated otherwise, the best reception is in the early evening hours.

November, 1970
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.

IF YOU'RE OUT TO BAG A BETTER JOB in Electronics, you'll better have a Government FCC License. For you'll need it to track down the choicest, best-paying jobs that this booming field has to offer.

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 other kind of transmitting equipment—two-way mobile radios, microwave relay links, radar, etc. And even when it's not legally required, a license proves to the world that you understand the principles involved in any electronic device. Thus, an FCC "ticket" can open the doors to thousands of exciting, high-paying jobs in communications, radio and broadcasting, the aerospace program, industrial automation, and many other areas.

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!

They got their licenses and went on to better jobs

The value of CIE training has been demonstrated time and again by the achievements of our thousands of successful students and graduates.

2 NEW CIE CAREER COURSES

1. BROADCAST (Radio and TV) ENGINEERING...now includes Video Systems, Monitors, FM Stereo Multiplex, Color Transmitter Operation and CATV.

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."

Send for FREE book

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.

With it you will also receive a second FREE book, "How To Succeed In Electronics," To get both books without cost or obligation, just mail the attached postpaid card. Or, if the card is missing, just mail the coupon below.

ENROLL UNDER NEW G.I. BILL. All CIE courses are available under the new G.I. Bill. If you served on active duty since Jan. 31, 1955, or are in service now, check box on reply card for complete details.

CIE Cleveland Institute of Electronics

1776 E. 17th St., Cleveland, Ohio 44114

Accredited Member National Home Study Council

A Leader in Electronics Training...Since 1934

Cleveland Institute of Electronics
1776 East 17th Street, Cleveland, Ohio 44114

Please send me information:

☐ Electronics Technology ☐ Electronic Communications
☐ Broadcast Engineering ☐ Industrial Electronics
☐ First Class FCC License ☐ Electronics Engineering

Name ____________________________ (PLEASE PRINT)

Address ____________________________

City ____________________________ State ________ Zip ________ Age ________

☐ Check here for G.I. Bill information

Ed-92

November, 1970
Paint-Can Dummy Load for Hams

By R. GALGANO

AMONG the many accessories found around the ham shack, the dummy load is the one most often taken for granted. It's not unusual for amateurs to spend a great deal of money for a transmitter and then hang a light-bulb or a wirewound-resistor dummy load on the end of it.

An inadequate dummy load can lead to serious mistuning of the transmitter which means only a fraction of the power will reach the antenna. And loss of output power is only an inconvenience compared to what may be happening to the transmitter.

If only a small part of the final's power is actually getting out, what happens to the power that isn't? It stays in the final where it is dissipated as heat that can cause serious damage or completely destroy the stage. Expensive RF power transistors in solid-state transmitters won't take this punishment very long. In addition to causing excessive power dissipation, an improper load may make the transmitter final unstable.

We have seen cases where a solid-state transmitter has become unstable and gone into oscillation. In a fraction of a second the predriver, driver and final transistors became inert chunks of silicon and the power supply was demolished.

To adjust the coupling system or check the power and efficiency of a transmitter correctly, a properly-designed dummy load must be used. The load must be a pure resistance and must match the output impedance of the transmitter. It should have absolutely no reactive component. Wirewound resistors are out because they are highly reactive at RF frequencies. Non-inductive power resistors are made but they're costly.

The old standby, a light bulb, is also out for VHF use. Poor enough at any frequency, the lamp load is hopeless at VHF frequencies.

Its impedance changes with temperature at any frequency, and at VHF frequencies the filament is likely to have resonances that make its brilliance unreliable as an indicator of output power. Particularly in the low-power range, lamps are extremely poor loads for VHF transmitter testing; and this includes the Citizens Band.

Our dummy load consists of a 50-ohm resistive load mounted in a quart paint can filled with oil. In addition it includes a wattmeter to tell you your transmitter's output power. The load is made up of ten 510-ohm 2-watt carbon resistors connected in parallel to provide a 51-ohm load. In free air, ten 2-watt resistors in parallel can safely dissipate 20 watts. Immersing the resistors in oil increases their dissipation to 200 watts.

The dimensions of the inner and outer tube that connect the load to connector SO2 are such that a 50-ohm impedance is maintained.

Construction

The resistors are mounted between two 2-in.-dia. copper discs spaced 13/16-in.
Fig. 1—Note in pictorial that SO2 is attached to top of paint can with machine screws. Fasten it to cabinet with two 5/8-24 hex nuts.

Fig. 2—Photo above shows construction of resistor load assembly. Note how outer copper tube is soldered to top of paint can. Small hole in top of tube allows oil to circulate. Photo at the right shows inside of the wattmeter.

Apart as shown in Fig. 1. The leads of the resistors are soldered in 10 holes in each disc. The holes are spaced 36° and are drilled around the discs in a 1 3/8-in.-dia. circle. These dimensions provide spacing to allow the cooling oil to circulate between the resistors. The paint can not only provides a container for the oil, but is also an RF shield for the load.

The wattmeter is built in a 5 x 2 1/4 x 2 1/4-in. aluminum chassis box that is mounted on the paint can's lid with connector SO2. The wattmeter is a two-range (20 and 200 watts) diode RF voltmeter whose scale is calibrated.
in watts. (Paste the scale in Fig. 3 over the specified meter's scale.) The impedance of the wattmeter is high enough so that it doesn't affect the impedance of the load.

First thing to do is cut two 2-1/2 in. dia. discs out of 1/32 in. thick copper. In one disc (upper) drill a hole in the center large enough for a piece of 3/4-in. i.d. tubing (2 in. long) to fit in snugly. In the other disc (lower) drill a 5/16-in. dia. hole in the center. Drill holes in the discs for the resistors' leads.

Solder the 5/16-in. o.d. inner tube to the center terminal on the connector (SO2) mounted on the can's lid. Solder the 3/4-in. i.d. outer tube to the lid making sure it is centered about the inner tube as shown in Fig. 2. Drill a small hole in the large tube near the top to keep the oil from being forced out through connector SO2.

**Paint-Can Dummy Load for Hams**

Solder the 2-in. upper disc (with the large hole) to the bottom end of the 3/4-in. i.d. tube. Solder the resistors to the upper disc. Finally, slip the lower disc on the inner tube and insert the resistors' leads through the holes in the disc and solder them. Solder the inner tube to the lower disc and cut the tube flush with the disc.

Maintain 1/16-in. clearance between the resistors' bodies and the discs. This will minimize the mechanical strain on the resistors caused by heating and cooling. After completing the load, drill a small hole in the lid to provide venting.

Build the wattmeter in the main section of the chassis box as shown in Fig. 2. Be sure that C1, R12 and the lead from the negative side of M1 are soldered to ground at SO2.

Mount the wattmeter on the lid of the paint can with SO2 using two 5/8-24 hex nuts as shown in the pictorial in Fig. 1. Paint the can flat black and fill it to within 1 in. of the top with transformer oil. If you can't get transformer oil, mineral oil is almost as good. Do not use motor oil.

The VSWR of the load checked out as follows: 5 mc: 1.04:1; 30 mc: 1.05:1; 50 mc: 1.05:1. The load was tested with 50 watts of RF for 30 minutes. At the end of this time the can was not too warm to hold and the resistance of the load increased only 0.5 ohm. The power was then raised to 200 watts for five minutes. The can was still cool enough to hold and the load resistance increased only 1 ohm.

**Operation**

Adjust trimmer potentiometer R13 so the resistance between the wiper (which connects to the + side of M1) and the lug to which C1 and D1 connect is 7,500 ohms.

---

**Fig. 4—Schematic. Resistors R1-R10 are load. R11 and R12 attenuate signal for 200-watt range. D1 is detector. C1,C2 bypass RF to ground.**

---

**Fig. 3—Custom face for wattmeter. Cut this out and paste it over face of specified milliammeter.**

---

**PARTS LIST**

<table>
<thead>
<tr>
<th>Capacitor</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1,C2</td>
<td>0.1 uf</td>
<td>500 V disc capacitor</td>
</tr>
<tr>
<td>D1</td>
<td>1N344 diode or equiv.</td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>0.1 ma DC milliammeter (Calectro D1-912)</td>
<td></td>
</tr>
</tbody>
</table>

**Resistors:**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>1 through R10 = 510 ohms, 2 watts, 5%</td>
</tr>
<tr>
<td>R11</td>
<td>2,000 ohms, 2 watts, 5%</td>
</tr>
<tr>
<td>R12</td>
<td>1,000 ohms, 2 watts, 5%</td>
</tr>
<tr>
<td>R13</td>
<td>10,000 ohm, linear-taper trimmer potentiometer (IRC Type R103B)</td>
</tr>
</tbody>
</table>

**Misc:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 x 2 1/4 x 2 1/4-in. chassis box (Calectro J4-740 or equiv.), 5/24-24 hex nuts (2 reqd.), one-quart paint can, 1/4-in. and 3/4-in. copper tubing</td>
<td>1</td>
</tr>
</tbody>
</table>
TOM KNEITEL, or Uncle Tom as he is known to readers of his column in El and the audience of S9, the CB magazine he edits, has this thing about investigating. He wants to know what and why and how. One of his interests is in communications, of course. Trouble was, he said, he'd already run through telegraphy, telephony, radio light waves and smoke signals. What could be next? The current mass interest in the occult gave him a fast answer: a Ouija board. Tom scoffed at the idea, being a Doubting Tom if ever
The Long Nights of Uncle Tom

there was one, but he bought a board, anyway. A Ouija (weegee) board is a device produced by Parker Bros., the games people, and it is supposed to put you in touch with the world beyond... with spirits. The board is printed with the alphabet, numbers, yes, no and good bye. A little table about as big as your palm stands on three legs and has a lens in its top. Two people sit facing each other from either end of the board, their fingers resting lightly on the table. They ask questions. The table moves and the letters that show through the lens spell out messages. Spirits are supposed to be moving the table. Scoffers like Uncle Tom would say the people were pushing the table around. And they'd laugh. Except Uncle Tom does not laugh quite so readily any more. His Ouija board started making a bit too much sense, at least at times. Ouija sessions ran far into the night. Uncle Tom took on a tired, gaunt look. He appeared worried. Talking to spirits, if that's what it was, turned out to be anything but fun and satisfying.

Talking boards were quite a rage in the 1920s but had been around a long time even then. The French Army won the Crimean War, it was said, by taking advice from the long-dead Napoleon via skypHONE (Uncle Tom's name for it). In libraries you can find the books of Patience Worth, whose writings supposedly appeared via Ouija to Mrs. Pearl Curran back in the Teens. Patience Worth, it seems, lived in Massachusetts in the 1600s and was killed by Indians.

Uncle Tom's wizardry on the skypHONE started inauspiciously enough.

"I didn't know what to expect," he says. "A message from Judge Crater? Could I find out where Greta Garbo was or whether I'd get back the $10 I lent my roommate in college?"

A few days later he wasn't poking so much fun. "It was like ham radio without a license... or a radio," he was saying. "I can't explain it."

What follows are excerpts from transcripts of sessions lasting several hours over two days. Those present included Uncle Tom, his wife Judy and a friend, Loretta. Ouija boards have no punctuation so we've left the messages as reported in the transcript. One pseudonym (Helen) is used to denote a real person who was critically ill at the time. As a rule, Tom asked questions and Judy and Loretta worked the board.

Tuesday, first session.
Who are you?
BETH
Do you have a message for Loretta?
PIEW'D
Do you have a message?
PEM A HOME TO LEWEH AT C I AM MAT
MOVE TO HARD
Is it hard to move the words?
HARD TO GET ASCROS
Did you give us an answer?
HIM HERD ME ONCE BEFORE LAMP IS ON
GET A RCJARP ON GO GET BILL AS P FIND
HART
Will you get Bill?
HIM CAN GET ACROSS YOU WANT
Uncle Tom and his cohorts are now in contact with Bill Wheton who is mentioned in Beth's last remarks. Bill is destined to become a major participant in these proceedings.

Is there reincarnation?
BELIEVE IF YOU NEED TO
Was Loretta reincarnated?
AGAIN AND AGAIN
Who was Loretta before?
BETTY REMASOT
Where did I live?
EURI
When did I die?
1692
How?
CHILD HURT I GET YOU ARE WORRIED
ABOUT DEATH
Is there anything to fear?
SOME FIND IT HARD OTHERS FIND IT
BEGANG TO BE FREE AT LAST
Will Helen find freedom?
IF COMING IS NOT TO HARD SHE IS
NEEDED VERY MUCH
Who needs her?
FATHER
Why does he need her?
ALOWN TO LONG MOTHER GOWN HACK
Did she come here?
SEE SHE BELONGS AGNF
Did people ever come here to earth from elsewhere?
ALL ARE FROM GOD
We meant another planet.
NEVER
Is there life on other planets?
FIND OUT SOON AS WE SEND A FLIER
THERE
Where?
SOME ON MARS MORON VENUS
Where else?
TO COLD
Do the inhabitants look like us?
NO PEOPLE YOU SAID LIFE
Will man land on Mars?
YES NOT TO FAR IN FUTURE
Will we find life similar to earth?
ALL LIME SAME
Will there be species like on earth?
NOT LARGE
Are these found on Mars?
VERY SMALL
What would these forms be known as on earth?
WHAT YOU WOULD CALL BUGS
What about God?
HE IS WHAT MAKES ALL A SPARK
Is God unhappy with us?
WE ARE ALL GOD IN THE END
Are we part of God?
Uncle Tom and his wife rest fingers on table of Ouija board. When contact is made with someone, the table will begin to move and letters will appear in lines of table. Besides the alphabet and numbers from one to zero, it says yes and no and signs off with a good bye.

WITHOUT THE ANIMAL WE CANNOT GO ON
What can't we do without the animal?
LIVE
Are we then spirits?
YES WE LIVE AS LONG AS MAN LIVES
Bill delves into Politics.
Will Ted Kennedy be President?
NEVER TO MUCH TROUBLE
Did he cause that girl's death?
DID NOT MEAN TO
Where was he taking her?
KIGHT WITH OTHERS AT PARTY SHE WENT WITH HIM FOR RIDE TO COOL OFF
What was the fight about?
HE DID NOT WANT TO TALK BROTHER A new theory on the Kennedy assassination.
Who killed Jack Kennedy?
MORE ENVOLMED OSWALD WAS ONLY ONE CAUGHT
Names of others?
TWO ARE DEAD ONE IS STILL ALIVE HIS FRONT IS EFFONAW
What front?
HE KNEW HIS DAYS WERE OVER IN UNIONS HE WAS A RED EVERYONE KNEW WAS ABOUT TO CAUSE A LOT OF PAIN FIND FOR A BANK BE TO DID GET BURFIWNEAD NO PROOF
Who are the two dead people with him in the killing?
CARL HAVER ED BROCK GET WHAT THEY DESERVED
Who killed them?
ONE CAR OTHER HEART
What about Jack Ruby?
ONLY IN AS FAR AS SURFACE HE NEVER KNEW WHY SEED
Why have there been so many lies and cover-ups?
NO PROOF IT WAS NEVER AS TOLD Should I tell this to the FBI or CIA?
IT WOULD NOT HELP TO MANY CRAZE IDEARS ALREADY JHONSON WANTED TO BE TOP MAN STOPPED STORIES
What about CIA or FBI?
HOOVER FIGHTING HIS OWN NECK Wouldn't Nixon care?
ALL OVER EVEN WIFE WANTS TO LET HIM REMAIN HERO TO COMUNTRY Were foreign governments involved?
JUST UNIONS
Why?
MONEY GETING OUT OF COUNTRY Do you mean that Kennedy was after unions sneaking money out of the country?

YES
The matter is closed now?
UNIONS HAVE GOOD THING DONT ROCK
BOAT
Was I right about Radio Americas?
EVERY GETS MIXED UP ONE DOES NOT WHAT THE OTHER IS DOING
(Uncle Tom once visited Radio Americas on Swan Island and was convinced it was a CIA propaganda station.)
Is the CIA mixed up?
YES
Where was Radio Libertad?
BOAT
A clandestine radio station is rumored to be a building on Little Corn Island.
Are there any broadcasters on the Corn Islands?
RADIO AND WEATHER WASTCH A I mean actual broadcasts.
FROM TIME NOT STEADY
What was the name of the broadcaster?
HE BE MAYDAY
A Mayday message from Corn Island?
HIT
Someone was hit?
SENT MAYDAY
(The tale takes a new twist. Later Bill talks more about a "Mayday to the people.")
Who?
CIA TO PEOPLE
You don't make sense.
PEOPLE NEED HELP Is there a story here?
HOUNDUS IS GOOD STORY CUBA IS OLD
Some personal items about Bill.
Can I get to you another time?
MAYBE I LIKE RADIO Were you a ham?
PLAYED AROUND WITH YEARS AGO
CODE IS EASIER THEN THIS What was your last name?
9WAEHOM
Repeat.
WHEUNOM
What country?
HERE.
What city?
FRISCO.
When did you die?
WAR?
Repeat: your last name. It didn't make sense.
WHETON OM YOU SHOULD UNDERSTAND ME
Do you call me OM, like in ham-radio slang?
The Long Nights of Uncle Tom

Tell us about the war in Vietnam.
I AM TALL, DAR AND HANDSOME
Were you before?
ALWAYS
What about the war?
I HAD ENOUGH WITH MINE
Will it ever end?
SO WHAT IF IT DOES ANOTHER WILL
TAKE ITS PLACE
Goodbye
GERONIMO

Tuesday, second session.
Can we speak to Bill?
ME BILL
Does the boat named Daydream mean anything to you?
IT IS RAIDO
(Daydream is a boat that supplies Swan Island, where R. Americas was located.)

Can you tell us what it was or is?
PIGS BAYS

Is this your first contact like this?

NO
Will you come back to earth in another body?
NOT IF I CAN HELP IT

How are things there?

WHAT DO YOU EXPECT THEM TO BE LIKE
YOU ARE BETTER THEN ARE

Explain.
YOU ARE FUNNY IT IS GOOD WHY DO
YOU THINK I DONT WANT TO TRY AGAIN
Is it good for everyone there?

IF YOU TAKE IT SUCH
Tell my father we think of him.
10 4 WA

Do you mean Ten-Four, like in radio talk?
10 4 QUIT

OUT? If that's radio talk I don't know it by heart.
MINE TRYING TO SHOW OFF

What outfit were you with in the war?
148 RAIN

Is that the Rainbow Division?

YES

Do you have advice or a message for Tommy?

DO YOU THINK I DONT WANT TO TRY AGAIN

HOW ABOUT PUTTING MY NAME ON

SOMETHING YOU WRITE

OK, do I have the spelling right?

WHATON WILLIAM

Do you have a call sign?

WOULD LIKE ONE

Do you prefer any one in particular?

TRY GETTING A NUMBER FOR HERE

(Apparently a joke—a ham call for the world beyond.)

Will you know if I put your name on an article?

YES

Do you have a final message?

BONZI

Goodbye. I hope people will believe us

EVERYONE HERE WONT BELIEVE

Do you see us?

NO

Can you do anything that we can see to give us

a sign you are here?

I NEVER TRIED

Can you move this piece of paper?

I CANT SEE

You can't see the piece of paper?

YES

You can't see the piece of paper?

CAN YOU DO ANYTHING HERE

Are you a spirit?

I GUESS SO

Do you have a body?

I AM NOT THE WAY I WAS BEFORE

Bill seemingly always must finish one subject before switching to another, as in the following when he keeps talking about himself.

Tell us about the war in Vietnam.
I AM TALL, DAR AND HANDSOME
Were you before?
ALWAYS
What about the war?
I HAD ENOUGH WITH MINE
Will it ever end?
SO WHAT IF IT DOES ANOTHER WILL
TAKE ITS PLACE
Goodbye
GERONIMO

Tuesday, second session.
Can we speak to Bill?
ME BILL
Does the boat named Daydream mean anything to you?
IT IS RAIDO
(Daydream is a boat that supplies Swan Island, where R. Americas was located.)

Can you tell us what it was or is?
PIGS BAYS

Is this your first contact like this?

NO
Will you come back to earth in another body?
NOT IF I CAN HELP IT

How are things there?

WHAT DO YOU EXPECT THEM TO BE LIKE
YOU ARE BETTER THEN ARE

Explain.
YOU ARE FUNNY IT IS GOOD WHY DO
YOU THINK I DONT WANT TO TRY AGAIN
Is it good for everyone there?

IF YOU TAKE IT SUCH
Tell my father we think of him.
10 4 WA

Do you mean Ten-Four, like in radio talk?
10 4 QUIT

OUT? If that's radio talk I don't know it by heart.
MINE TRYING TO SHOW OFF

What outfit were you with in the war?
148 RAIN

Is that the Rainbow Division?

YES

Do you have advice or a message for Tommy?

DO YOU THINK I DONT WANT TO TRY AGAIN

HOW ABOUT PUTTING MY NAME ON

SOMETHING YOU WRITE

OK, do I have the spelling right?

WHATON WILLIAM

Do you have a call sign?

WOULD LIKE ONE

Do you prefer any one in particular?

TRY GETTING A NUMBER FOR HERE

(Apparently a joke—a ham call for the world beyond.)

Will you know if I put your name on an article?

YES

Do you have a final message?

BONZI

Goodbye. I hope people will believe us

EVERYONE HERE WONT BELIEVE

Do you see us?

NO

Can you do anything that we can see to give us

a sign you are here?

I NEVER TRIED

Can you move this piece of paper?

I CANT SEE

You can't see the piece of paper?

YES

You can't see the piece of paper?

CAN YOU DO ANYTHING HERE

Are you a spirit?

I GUESS SO

Do you have a body?

I AM NOT THE WAY I WAS BEFORE

Bill seemingly always must finish one subject before switching to another, as in the following when he keeps talking about himself.
THE document is hidden behind the locked door of a safe in Laconia, N.H., not far from the shores of Lake Winnipesaukee. With this precious piece of paper, Browning Labs claims to have the highest transmitter power in the CB industry in its new single-sideband rig, the Model SSB-15. The surprise is that earlier sideband circuits boasted power ratings of 10 watts peak envelope power (PEP) as the legal FCC limit, but Browning is raising it to 15. The higher rating is derived from a special two-tone method for sizing up sideband signals. It has also elevated an eyebrow or two among the competition.

Challengers to Browning's formidable 15-watts are now warned. If anyone doubts the claim, the company will swing open the safe, withdraw that precious document and shove it under his nose. It's a letter from Washington, D.C. that's signed and sealed by an FCC chief engineer. By confining to the two-tone test procedure, Browning received the official nod for, as the company says, "ultimate legal power."

There's another surprise on the new sideband rig—it has a VFO (variable frequency oscillator) to shift the transmitter frequency. VFO operation, of course, is forbidden in CB because transmitters must be tightly controlled by crystals. I challenged a Browning spokesman on the point and he flicked away the objection. It seems that the new SSB-15 is in fact controlled by crystals, but the VFO can shift each channel's frequency by plus or minus 700 cps. Since the frequency still remains within the lawful tolerance, the VFO is an acceptable trimmer.

Browning says the VFO is there for a good reason. In sideband, a shift of as little as 50 cps can cause the voice to sound like Donald Duck or worse. The VFO enables all units to zero onto the precise frequency, a process called netting, to avoid a lot of receiver retuning. As sideband stations create no carriers, several units can talk at once without the usual ear-splitting squeals.

Blasting Burglars. "They steal anything that's not nailed down," complained one CB dealer about shoplifting in his store. Rigs are getting so small that heisting one gets easier all the time. So store managers resort to locked cabinets, wired alarms, mirrors and closed-circuit TV to foil the light-fingered. Maybe they're overlooking one of CB's hidden benefits: a set can sound its own alarm.

The idea was shown technically feasible several years ago at the United Nations in New York. Special receivers to interpret proceedings into four languages were handed to guests attending U.N. sessions. The trouble was that some receivers were mistakenly carried off the premises. So technicians devised an electronic reminder. They fitted each receiver with a low-power oscillator in the CB band and circled the exit door with a coil of wire. If the bearer of a hidden receiver walked through the door, the signal entered the coil and sounded the alarm.

The idea was a failure, but for diplomatic, not technical reasons. If this concept of crimestopping were applied to shoplifting, it would hardly demand any sort of protocol. During a CB theft, the oscillator of one channel could start emitting SOS—warning the manager to Save Outgoing Set!  

Browning Labs' new SSB-15 SSB-CB transmitter with companion receiver. The SSB-15 boosts 15 watts of PEP power and a VFO that eliminates Donald Duck voices. Use of upper and lower sideband gives the transmitter 46-channel coverage.
Unitized Stereo Speaker System

By HARRY KOLBE  ALTHOUGH stereo has been with us quite a while now, only a few single-cabinet stereo speaker systems have ever been marketed. And most of these systems failed to interest the audiophile and quickly disappeared from the scene. The one or two single-cabinet stereo speaker systems that have survived are very large—at least five or six ft. wide. Until now the consumer with limited space and/or a limited budget has been out of luck.

Small single-cabinet systems of the past have been unacceptable because the separation of the speakers has been relatively small. As a result, the auditory perspective of the reproduced sound is very narrow. Stereo separation is difficult to achieve because the distance of the listener from the speakers must be reduced to correspond to the short distance between the speakers. Such confined listening is not satisfactory. The object is to make a system with small physical separation between the speakers that will produce apparent sound sources with greater separation.

The Design

An early approach to a unitized stereo speaker system is shown in the top sketch in Fig. 1. The effective separation between the apparent sound sources of the speakers was inadequate.

Another approach was to mount the two speakers in the ends of the cabinet as shown in the middle sketch in Fig. 1. A consider-
able increase in the spread of the sound sources are projected to points beyond the speakers. The separation here is somewhat greater. Unfortunately, this approach has a serious drawback. The middle sketch shows that because of directional characteristics there will be considerable loss of high-frequency response and resultant frequency discrimination at the customary listening location in front of the system.

Thus, one system produced very limited stereo separation while the other produced good separation but at the expense of forward high-frequency response.

Our approach allows you to have your cake and eat it, too. The approach is shown in the bottom sketch in Fig. 1. This system is able to maintain as much spread as the apparent sound sources of the system shown directly above but restores the high-frequency response in the forward direction.

To accomplish this, we mounted the speakers at an angle and put an acoustic waveguide in front of each. The high-frequency sound which is emitted by the speakers is aimed in a forward direction by the waveguides. The results are excellent. Although the enclosure is only about 40-in. wide, the apparent separation is as good as two separate speaker systems five or more ft. apart.

The acoustic waveguides, which are very simple to make, are 1/16 in. thick aluminum vanes. The dimensions and spacing of the vanes shown in Figs. 5 and 6 are critical.

The enclosure is a tunneled-port bass-reflex design which has been carefully matched to the resonant frequency and compliance of Olson S-786 ($13.98) speakers. The resultant bass and mid-range response is very respectable. The system works best mounted on a wall at ear level but will still give outstanding performance away from a wall.

Construction

The tunnel port is a 4 in. long piece of 33/8-in. o.d. cardboard mailing tube mounted flush with the front of the enclosure. The aluminum vanes of the acoustic waveguide are held in place with silicone rubber adhesive and glue.

A 1 in. wide piece of weather stripping with adhesive backing should be cemented to the rear cleats to which the back panel is attached because the enclosure must be airtight—except for the port.

November, 1970
Unitized Stereo Speaker System

The cabinet is made of ¾ in. thick plywood or particle board. If a router or shaper is available the top and bottom edges may be decoratively shaped, otherwise they may be left square. As an alternate you may wish to use decorative molding such as nose and cove. This will simplify construction and it is an excellent way to conceal the raw edges of the plywood. If you prefer a square-edge appearance, simply put matching wood tape on the edges with contact cement.

After the sections are cut out, carefully locate and lay out the lines for the aluminum vanes, as well as the speaker boards. Best way to cut the grooves is with a router fitted with a 1/16-in. bit. Set it to project 1/16
in. and proceed to cut free-hand or with the aid of a guide strip nailed on the work. Repeat this for each slot. If a router is not available, use a sharp knife cutting two parallel lines 1/16 in. apart then clean out the area between with a small chisel or a knife.

Fasten the cleats to the underside of the top panel then mount the front and diagonal speaker boards using white glue and screws. Cleats are not used on the bottom panel. Instead, you can use screws through the bottom because they won't show.

Install the cleats for the rear panel then mount the speakers. Staple fiberglass batting where indicated and apply the weather stripping to the face of the rear cleats. Install the rear panel with round-head screws.

The type of grille cloth you use is optional. However, we recommend an open-weave material, such as burlap, to prevent high-frequency attenuation. We used a piece of tan burlap. The price is reasonable and more important it is available in 54 in. widths and any length.

Fig. 8—Inside view from rear. Note fiberglass batting on front panel and installed vertically at side of each speaker. It is also on rear panel. Use staple gun to hold batting in place.
Electronics in the News

Pressed Duck . . . Television screens are getting larger as the depth of the set decreases. One reason why maybe the b&w Mallard line from Philco shown in the photo at right. The set uses a unique CRT that measures 5½ in. from front to rear. The CRT incorporates magnetic deflection so that the electron beam travels to the screen in an oblique pyramid rather than the symmetrical pyramid of standard tubes. This system of deflection allows the gun to be placed on the side of the screen, (rather than behind it) at a right angle. The photo above is of a prototype of Philco's color Mallard.

A WATCH WITHOUT HANDS
The Hamilton Pulsar wristwatch computer offers accurate time with a digital face and push-button time keeping. The time keeper of the watch is a quartz crystal which vibrates at 32,768 cps. The vibrations are reduced to one pulse per second by a multi-stage IC binary counter. The watch is equipped with a demand button which conserves power. When the button is pushed, an array of dots displays the time in hours and minutes. If the button is continuously held down, the hours disappear and the seconds will begin to tick off. The matrix is located behind a TV-like filter screen. The complex device senses light conditions and varies the amount of light in the matrix with surrounding light conditions. The watch will sell for $1,500.
Keeping Pace With the Heart...
A pacemaker is a device similar to an electronic clock, producing 70 pulses of current a minute. The impulses stimulate a weak heart to beat. In conventional pacemakers batteries are employed to power the pacemaker and provide the power for the pulses. These batteries have to be replaced annually. Bell Labs has developed a pacemaker that employs piezoelectric discs to convert variations in blood pressure into electricity. The benefit is that once installed, the device will never have to be removed.

Under Cover Radio...
The trend in crime prevention nowadays is toward better communication. Until a few years ago this meant sending out squads in radio cars. This was found to be cumbersome in addition to taking the neighborhood cop off his beat. Hallicrafters has developed a line of personal two-way FM communications equipment that is much smaller and more compact than personal radio equipment employed today. The concept is of a multi-component system that straps on the upper portion of a policeman's body like a shoulder holster or bandolier. The system consists of a transceiver, a battery compartment, combination speaker-microphone, flat press-to-talk switch and 3 to 4 in. antenna. Weight is less than 24 oz.
Can you solve these two basic problems in electronics?

This one is relatively simple

When Switch S₂ is closed, which lamp bulbs light up?

Note: If you had completed only the first lesson of any of the RCA Institutes Home Study programs, you could have solved this problem

This one's a little more difficult:

What is the output voltage (p-p)?

Note: If you had completed the first lesson in the new courses in Solid State Electronics, you could have easily solved this problem.

These new courses include the latest findings and techniques in this field. Information you must have if you are to service today's expanding multitude of solid state instruments and devices used in Television, Digital, and Communications equipment.

If you had completed an entire RCA Institutes Home Study Course in Semiconductor Electronics, Digital Electronics, or Solid State Electronics, you should now be qualified for a good paying position in the field you choose. Send for complete information. Take that first essential step now by mailing the attached card.
RCA Institutes Autotext learning method makes problem-solving easier... gets you started faster towards a good-paying career in electronics.

Are you just a beginner with an interest in electronics? Or, are you already making a living in electronics and want to brush up or expand your knowledge? In either case, RCA has the training you need. And Autotext, RCA Institutes' own method of Home Training will help you learn more quickly and with less effort.

Wide Range of Courses
Select from a wide range of courses. Pick the one that suits you best and check it off on the attached card. Courses are available for beginners and advanced technicians.

Electronics Fundamentals
Black & White Television Servicing (Transistorized TV Kit Available)
Color Television Servicing (Color TV Kit Available)
FCC License Preparation
Automatic Controls
Automation Electronics
Industrial Electronics
Nuclear Instrumentation
Electronics Drafting
Computer Programming

Plus these new up-to-the-minute courses
Semiconductor Electronics
Digital Electronics
Solid State Electronics
Communications Electronics

Prepare for good paying positions in fields like these
Television Servicing
Telecommunications
Mobile Communications
CATV
Broadcasting
Marine Communications
Nuclear Instrumentation
Industrial Electronics
Automation
Computer Programming
Solid State Electronics Drafting

Variety of Kits—Yours to Keep
A variety of RCA Institutes engineered kits are included in your program of study. Each kit is yours to keep when you've completed the course. Among the kits you construct and keep is a working signal generator, a multimeter, a fully transistorized breadboard superheterodyne AM receiver, and the all-important oscilloscope. These 4 kits are at no extra cost. Compare this selection with other home study schools.

Two Convenient Payment Plans
Pay for lessons as you order them. No contract obligating you to continue the course. Or, you can take advantage of RCA's convenient monthly payment plan. No interest charges!

Classroom Training Also Available
RCA Institutes operates one of the largest technical schools of its kind. Day and evening classes. No previous training is required. Preparatory courses are available. Classes start four times a year.

Job Placement Service, Too!
Companies like Bell Telephone Labs, GE, Honeywell, IBM, RCA, Westinghouse, Xerox, and major radio and TV networks have regularly employed graduates through RCA Institutes' own placement service.

All RCA Institutes courses and programs are approved for veterans under the new G.I. Bill.

Send Attached Postage Paid Card Today. Check Home Study or Classroom Training.

Accredited Member National Home Study Council.
"The human mind can conceive of nothing," Ben Franklin once wrote, "but that another mind can improve upon." The inventors of the cassette recorder can say amen to that, for their brainchild has spawned products that are designed to improve on the original.

The deluge of equipment can be divided into two practical groups. There are those accessories that add to the versatility of a machine and those that are helpful when it comes to keeping it in tip-top shape.

If you've got a portable cassette recorder and would like to have a portable radio in addition, there are plug-in tuners available that are built in the standard cassette package (see Fig. 1). You can buy just AM (about $10), AM-FM ($20) or wait until the AM/stereo-FM tuners are introduced. If you're an old salt, Panasonic now has a marine-band tuner for cassette recorders. A word of advice in this department—be sure to try the tuner in your recorder before purchase for some manufacturers design these devices for their own brands and all are not compatible with other makes.

There is a family of accessories available to convert your cassette portable into a dictating machine. Produced primarily by such recorder manufacturers as Norelco, Sony and Craig, the group includes stenographic headsets and a foot pedal to start and stop the machine while keeping your hands free for typing.

Battery power is not always the most convenient and there is a host of supplies to bridge the gap (Fig. 2). There are nickel-cadmium powerpacks such as Craig's model 9205 ($17) and Norelco's BP2204 ($25). Both of these are designed for their own Carry-Corder models but can be used with some other makes of equipment. Panasonic manufactures an AC adaptor which can supply four different DC voltages. Again, before purchasing a power supply make sure it will operate with your particular recorder.

There are specialized recording devices like lapel microphones, parabolic reflectors, telephone pickup coils and microphones with a switch to turn the recorder on and off. These vary in price and quality, depending on the degree of fidelity you need and the quality of your recorder. Some telephone coils produce a hum which all but obliterates the conversation they're supposed to pick up. Among those which don't are Norelco's TP 86 for $7.65 and Craig's Model 9501 for $3.49. There are less-expensive models, too, but be on the lookout for junk.

As soon as you amass a library of any size you'll be needing a carrying case to help you tote your cassettes. There are a number of sizes, styles and types of construction. They range in price from $2.98 to $20 or more and to the untutored eye all look much alike (except for capacity, which tends to increase with the price).

Wood is more durable than cardboard or plastic alone and makes for solid construction. By the same token, heat-sealed plastic bonds better than mere glueing. The combination of heat sealing and stitching makes not only for durability but for good looks as well. There are also alligator leatherette
Fig. 1—AM plug-in tuner. Putting recorder in play mode moves head into tuner and turns on power. Output is coupled inductively to head.

Fig. 2—Alternate ways of powering a recorder. Panasonic converter (left) supplies four DC voltages. Norelco Battery Pak is rechargeable.

Fig. 3—For eight hours of continuous music, Norelco produced this circulator which flips cassette after play and inserts new cassette.

Fig. 4—Maintenance cassettes. Robins (left) demagnetizes heads. Center rig checks speed. Combo tests balance. Fourth cleans heads.

Attache cases of cardboard or wood holding 30 cassettes. The Le-Bo Products wood cassette model sells for $11.95. A cardboard version might retail for about $2 less.

Cassette heads, like the heads on reel recorders, collect oxide. A large enough deposit will interfere with the performance of the machine. Because cassette heads are difficult to get at, accessory manufacturers have come up with an odd assortment of gadgets to do the job. The one which looks easiest to use and is most common is the head-cleaning tape cassette. Inside a standard cassette is a length of abrasive tape. You simply play the cassette as you would ordinarily and the abrasive coating removes the oxide from the heads. They'll do the job all right, but they'll also wear down your heads—cutting their life expectancy by as much as 25 per cent. A better job is done with the cleaners which contain a length of cotton tape.

Before playing the tape, you soak it in a cleaning solution (in Le-Bo's version, the cleaning fluid is squeezed onto the tape during playing from a plastic reservoir inside the cassette). The cotton applies a solvent which loosens the oxide, then wipes both off as it continues to travel past the heads. Of course, a cassette player can be cleaned in the same way and with the same tools as a reel recorder—a cotton-tipped swab and a cleaning solution like denatured alcohol. There are several good commercial cleaners available from Robins, Recoton, Le-Bo, Audiotex and others. If drugstore Q-tips aren't long enough to reach into the heads on your machine, Robins has a set which includes the long-handled variety with a bottle each of head cleaner and tape lubricant. It's priced at $2.25.

Some manufacturers have combined abrasive head-cleaning tapes with test tapes to
form three-in-one cassettes (see Fig. 4). Besides cleaning, these tapes enable you to check balance between stereo channels and alignment of the record/play head. If you want test tapes, they’re available separately. However, it may not do you much good to know that your head is out of alignment if you don’t have the tools or the skill to align it. (See TAKING CARE OF A CASSETTE RECORDER, Sept. 70 El.) Good test cassettes are available from Channel Marketing. They contain a frequency-response test, a test to determine tracking, a program and individual track volume balance check, speaker and program identification and an automatic switching test. To find out if your player is running at the proper speed, there are Robins strobe units for $6.15.

Sooner or later, your unit’s heads will become magnetized, requiring the use of a demagnetizer to reduce noise and restore high-frequency response. There are probes similar to those designed for reel recorders and the easy-to-use cassette types. Le-Bo and CM have DC models which plug into a car’s cigarette lighter for $8.95; or an AC type for $6.95. Both utilize two pole pieces which press against the head and remove residual magnetization. Because it’s so difficult to see what you’re doing, we found the shell types—pole pieces mounted in a cassette—much easier to use. You simply insert the cassette and plug in the AC cord hanging out the bottom and then remove the cassette after a minute or two.

Before we leave the housekeeping area, there’s the matter of keeping your tapes properly labelled and indexed. Robins is one of the first manufacturers to offer replacement labels for cassettes and an intelligent indexing system. If you elect to re-use a cassette, until now you’ve had to scratch out the original label information and try to find room to write in what you’ve just recorded. The Robins labels, at 5¢ each in packages of 20, come in five colors to permit color coding of recorded material. They’re pressure-sensitive and can be pressed into place.

Robins currently offers the only tape splicers for cassettes (Fig. 5) and TS 115 Gibson Girl automatic for $5 and the TS 215 pocket-sized splicing block with 25 pre-cut base, splicing patches and a burnishing roller.

To facilitate splicing and editing, Robins offers a pair of tape winders—tiny reel locks tooled to fit the cassette hubs—which sell for $1.50. They permit rocking the tape back and forth past the heads on certain recorders to find the right spot to edit.

The bulk eraser is as useful to the cassette recordist as it is to his reel recording cousin. It rapidly and thoroughly erases everything on the cassette. Robins has a cassette model, TMC 1, at $20 which seems to work well. Almost as fast, and substantially less expensive ($1.98) is Channel Marketing’s SED Speed Erase, a ferrite bar that fits over the open end of a cassette. Magnesonics has a model which erases the entire cassette without the use of a recorder (see Fig. 6).

You may not need all of these cassette accessories, but the longer you own your recorder or player, the handier you’re likely to find some of them.
Good Reading
By Tim Cartwright

ABC’S OF THERMISTORS. By Rufus P. Turner. Howard W. Sams & Co., Inc., Indianapolis, Ind. 96 pages. $2.95

Does thermistor bring to mind a solid-state device for measuring temperature? That definition short-changes this versatile semiconductor, according to Rufus Turner, and he gives a convincing argument. After explaining the principles of electronic thermometers he describes the applications thermistors have in some unusual instruments, such as the one illustrated below. This is a circuit for a windspeed indicator having no moving parts. Using two thermistors, the blowing wind cools an exposed thermistor. Its resistance, compared to the sheltered thermistor, changes and unbalances a bridge circuit.

Dr. Turner depicts about four dozen different circuits that reveal how thermistors can compress an audio signal, act as a voltage regulator or introduce time delay. This is no cook book of construction projects but the chapter on thermistor fundamentals should furnish the experimenter with enough background to attempt simple projects. The book is the first simple, one-source publication we've seen on these useful devices.

SMALL APPLIANCE REPAIR GUIDE. By Wayne Lemons & Glen Montgomery. Tab Books, Blue Ridge Summit, Pa. 95 cents (paperbound)

“You should be reluctant to clean the inside of any percolator brought in for repair...,” warns this practical guide. This advice is typical of the down-to-earth information which fills this volume. The authors seemingly speak from atop a mountain of broken appliances and have written a fine guide for the self-servicer or beginner interested in a field that's desperately in need of technicians. Everything in the field is described—from why toast won't pop up to steam irons that won't whew and such other 20th Century artifacts as electric blankets, mixers, knives, shavers, deep fryers and hair dryers. There are good tips on the appliance fixer’s recurring nightmare—how does this thing come apart?—and a chapter on making a portable tester that should help diagnose the ills of almost any small appliance. Oh, yes—why shouldn't you clean the inside of a percolator? It changes the taste of the coffee.

OFFICIAL HANDBOOK OF METAL DETECTORS. By Dr. Arnold Kortejarvi. Recreonec Publication, Inc., St. Petersburg Beach, Fla. 165 pages. $3.25

Spanish gold discovered along the Florida coast! Coins worth $2,000 found in two weeks! Frantic search for King David's missing treasure! Amid such breathless reports it's no wonder that an official handbook of metal detectors has reached print. Dr. Kortejarvi, though, is no doctor of English as he surgically slices the language and sounds like he's writing from Frankenstein's castle in Transylvania. An example: “I choose the best way to classify the general designs of metal detectors by the Laws of Physics and the Laws of Electronics.” After the doctor buries his monsters, the book becomes a reasonable primer on metal detectors. With admirable restraint (there are no get-rich-quick promises), he details the limitations of each piece of equipment and relates some practical techniques of small-time treasure hunting such as coin shooting or prospecting for nuggets. Although much of the book consists of instructions provided by various manufacturers, it still might be a worthwhile investment before you spend your money on a metal-detecting instrument.


If you have 20 electric motors in your home operating on six different principles, you had better buy this book because these machines are shaping our destiny. The author has produced a clearly written, up-to-date text on the essentials of electric motors and

(Continued on page 103)
Free-Power Square-Wave Generator for Audio Testing

By HARRY KOLBE THE MOST basic test instruments for audio servicing are an oscilloscope and a signal generator. Making sine-wave tests with them can reveal much about the performance of an amplifier. However, characteristics such as frequency response, phase shift and ringing (oscillation) can't be determined by sine-wave tests. They require a square-wave test signal.

Unfortunately there are audio generators that don't have a square-wave output. And some that do put out a less-than-ideal square wave that will result in incorrect evaluation of an amplifier's performance.

Our Free-Power Square-Wave Generator (a converter, basically) is a simple and inexpensive way to put square waves on your service bench. It can be plugged into the output of any audio sine-wave generator (Fig. 1) whereupon it will convert the sine-wave output into square waves. No modifications need be made to the sine-wave generator.

Unlike many other square-wave converters ours is most unusual in that it doesn't require batteries or a power supply. It gets its power from the sine-wave input signal itself. Part of the input signal is rectified and doubled to power the three-transistor squaring circuitry. (Fig. 2.)

Ideally, the sine-wave generator should have a 1,000-ohm (or lower) output impedance and be able to deliver a 2-V signal under load. But there are exceptions. For example, we used our converter with a sine-wave generator whose output impedance is 1 megohm and whose maximum unloaded output voltage is 7.6 V. When we plugged in the converter, the generator's output voltage dropped to 2.4 V. However, this was sufficient voltage to operate the converter satisfactorily.

The frequency of the square waves will be the same as the frequency of the input sine wave. If the sine-wave input signal contains distortion, this will not appear in the square-wave signal. The converter has a rise time of about 30 nanoseconds. It generates excellent square waves from 10 cps to 500 kc. The photo of the scope trace in Fig. 3 is of a 1-kc square wave.

Construction

The converter can be built on a 3 x 1½-in. piece of perforated board. The pictorial in Fig. 4 shows the location of all parts. Flea clips or brass eyelets are ideal for tie points. The photo below the pictorial shows the construction used by the author. He chose to make a printed-circuit board, which doesn't simplify matters that much because there are so few parts in the project.

Fig. 1—Generator is built in a 3½ x 2¼ x 1½-in. Minibox. On back are chassis-mount banana plugs which fit in jacks on sine-wave generator. Square-wave output at front is available at dual five-way binding posts. Unit is powered by input sine-wave.
PARTS LIST

C1—100 µf, 15-V electrolytic capacitor
C2—30 µf, 12-V electrolytic capacitor
C3—50 µf, 12-V electrolytic capacitor
C4—1,000 µf, 500-V silvered-mica capacitor
C5—500 µf, 15-V electrolytic capacitor
C6—100 µµf, 500-V silvered-mica capacitor
C7—.01 µf, 50-V disc capacitor
D1-D5—1N914 diode
Q1-Q3—2N5179 (RCA) or HEP 56 (Motorola) transistor
Resistors: 1/2 watt, 10%
R1,R5,R6,R7—10,000 ohms
R2,R3—4,700 ohms
R4—1,000 ohms
R8—3,300 ohms
Misc.—Dual five-way binding posts (H.H. Smith 224 BB, Allied 47 A 1328), 3/4 x 2½ x 1¾-in. Minibox, perforated board

At the left side of the U-section of the Minibox install two chassis-mount banana plugs using shoulder washers to insulate them from the box. Mount them on ¾-in. centers to match the output jacks of most audio generators. At the other side of the box, mount two insulated five-way binding posts on ¾-in. centers or install the dual five-way binding post specified in the Parts List. Mount the board in the cabinet using ¼-in. spacers to keep the board away from the cabinet. Then make connections from the board to the input and output connectors.

Square-Wave Testing

Square-wave testing makes it possible to check at the same time the phase, distortion, stability and frequency response characteristics of an audio amplifier. Here are the reasons why.

A square wave consists of a fundamental-frequency sine wave and all of its odd harmonics which are in definite phase and amplitude relation to each other. The square wave is the algebraic sum of the fundamental frequency and an infinite number of its odd harmonics, all sinusoidal in shape and having a common time of origin.

In practice, however, the 30th harmonic is the highest order of sufficient amplitude to be of importance. An amplifier that changes the phase relation or the amplitude of any of the components of a square wave will distort the square wave. Only when the amplifier passes all the frequencies of the square wave without attenuation or phase shift will the...
Free-Power Square-Wave Generator

output be undistorted.

What you do is feed the square wave into an amplifier, then observe it at the amplifier's output on a wide-band scope. The display will reveal the amplifier's shortcoming as shown in the typical patterns at the right. Note how frequency response, phase shift, instability and distortion show up.

Don't expect to see waveforms that look exactly like these. The patterns shown here are theoretically ideal and will differ from those you'll observe because of the response of the scope itself and because of the settings of the scope's controls.

The frequency response limits of an amplifier can be approximated by multiplying and dividing by 30 the fundamental square-wave frequency that is perfectly reproduced. For example, assume a 1,000 cps square wave is perfectly reproduced. This means that the amplifier is capable to flat reproduction of frequencies from about 30 to 30,000 cps.

Here's another thing you can do with square waves. Assume you want to determine the exact flat position of an amplifier's tone controls. Feed a 1,000-cps square wave in the amplifier and simply adjust the controls for best square-wave response. When you move the controls from the flat position, you'll see the square wave's shape change reflecting high- and low-frequency boost and attenuation.

Typical Waveforms

(A) Ideal square-wave response
(B) Poor low-frequency response
(C) Accentuated low-frequency response
(D) Poor high-frequency response
(E) Poor low- and high-frequency response
(F) Leading phase shift at low frequencies
(G) Lagging phase shift at low frequencies
(H) Parasitic oscillation (instability)
The Ham Shack
By Wayne Green
W2NSD/1

As I closed the last Ham Shack, I was preparing to leave on a trip to Jordan. I am pleased to report that the journey was such a success that I accomplished far more than I thought possible.

King Hussein was waiting for the plane at Amman's airport with a royal entourage and ceremonial red carpet. This welcome might have gone to my head had I not learned that the King's sister was a fellow passenger on the plane, a more likely recipient of the cheers of the crowds.

My spirit buoyed immediately as I was given a special palace escort through customs and immigration and whisked to the Jordan Intercontinental Hotel by limousine to stay as the guest of His Majesty.

The day after I arrived I was picked up by His Majesty's private secretary, Patricia Salti, and driven to the palace a few miles outside of town where the King and his family live. This is also where he has established his ham station. The King was waiting for me in front of the palace and welcomed me warmly. We talked for a while about amateur radio and then I got busy operating his station while he observed.

The primary purpose of my trip to Jordan was to help the King handle the hundreds of hams who were trying to make contact with the royal station, JY1. After this initial onslaught the King could operate the station in a more leisurely atmosphere so that the joys of hamming would not be lost to him.

During the two weeks that I was there, I operated the station every day for about five or six hours, working just about every amateur in the world that was seriously trying to get through to JY1. It had been many years since any station had been active from Jordan, so business was brisk. By the end of my stay I was able to call CQ quite a few times before getting a contact, so I suspect that the main reason for my trip was accomplished.

Perhaps the most important benefit of my trip to Jordan was an unexpected and lasting one. His Majesty asked me to prepare a set of amateur radio regulations for Jordan so that ham radio could be established in his country on an organized basis. I prepared these and helped to establish the Royal Jordanian Amateur Radio Society for the administration of licenses. I am still working on a set of exams to be used as qualification for the two grades of license that are available.

His Majesty asked me to arrange for seven complete amateur radio stations to be sent to Jordan. These will be set up in schools, orphanages and remote military bases for the first Jordanians to become licensed amateurs. The King believes that amateur radio is one of the most valuable tools in interesting teenagers in technical careers. At present virtually all teenagers in Jordan aim at being doctors, lawyers or civil servants.

There is no possible way for any country to grow without communications and electronics and it all begins with amateur radio.

New Amateur License Proposed. The 800,000 or so hobbyists now using the 23 CB channels are certainly enough proof that there is a real need for some sort of hobby band. The legitimate users of CB have long been pushed off the band by the multitudes flocking to the 23-channel nightmare.

If we need a hobby band, why not have one? For all the mighty groans about a shortage of frequencies, there are dozens of unoccupied TV channels and a wide assortment of other vacancies here and there throughout the VHF band. One of the most vacant of all, sad to say, is the amateur 220- to 225-mc band.

In giving the matter a lot of thought I considered the problems faced by the FCC in administration of the present CB band, the need for activity on 220, the need for development of inexpensive VHF equipment and the need for more radio amateurs. With these in mind I sat down and worked out a plan which would seem to solve all of the problems.

I have petitioned the FCC to establish a new hobby class of amateur radio license. The examination would require no code and no theory, only a knowledge of the rules and regulations. The license would permit operation with a 100-watt power limit in the 220.5- to 224.5-mc band using narrow-band FM.

[Continued on page 101]
El Kit Report

A New Name in Color TV Kits

Conar Custom 600

One of the important events of the Soaring Sixties was the rapid growth of color TV. Dormant until that fabulous decade began, sales of color TV receivers blossomed at an extraordinary clip. In 1963 the first color TV kit appeared on the market. It was a Heathkit and remained unchallenged (except for new models) until 1969.

Then the Conar Instruments Division of the National Radio Institute (3939 Wisconsin Ave., N.W., Wash., D.C. 20016) announced a color TV kit. The kit, which sells for $366, was originally designed as a training project to be used with NR1's home-study course in color TV servicing. Subsequently a new construction manual was prepared and the set was added to Conar's line of kits.

Its basic design makes it a close kin of those early b&w receivers that had a full set of electronic picture-adjustment controls. That is, there are no preset or locked circuits that require a component change to center the picture or alter its width. All the controls such as vertical and horizontal centering, height, linearity and high voltage are accessible for convenient adjustment. Most are shaft-type controls; the few that need rare or occasional adjustment are screwdriver-adjust controls. To facilitate convergence adjustments color-coded gun-killer switches are provided on the rear chassis apron to eliminate the need to pierce the CRT's leads.

The static and dynamic convergence adjustments are standard: permanent magnets around the neck of the CRT for static adjustments and a movable dynamic-convergence board which is normally mounted inside the cabinet. For convergence the dynamic-convergence board can be attached to the back of the cabinet facing forward so you can observe the effect of adjustments.

A built-in crosshatch/dot-pattern generator precludes the need for an external generator. When the dot-selector switch is flipped, the screen is filled with dots or lines for static and dynamic convergence. The power supply is a transformerless voltage doubler. Tube heaters are connected in series but there is a filament transformer for the CRT. There is no built-in degaussing coil. The cabinet is vinyl-clad steel.

The set has a rectangular tube that provides a viewing area of 180 sq. in. There are 21 tubes, 20 diodes and three transistors. Both front-ends are assembled and pre-aligned: the VHF has two tubes and the UHF is solid state.

The kit is supplied with a 106-pg. con-
struction manual and a 47-pg. manual that covers preliminary set up, sound/alignment, convergence, and color-circuit adjustments. In addition there are sections on theory of operation, servicing, waveforms and instrument alignment. Home alignment will get the kit working, though Conar also gives instructions for a pro-type instrument job if you want to do it.

Included with the construction manual are large pictorial diagrams which you pin up over your work area. Construction starts off with the assembly of six printed-circuit boards. These are identified as IF amplifier (the transformers are pre-aligned) and video detector; sound and AGC; video amplifier, color circuits; horizontal oscillator, vertical oscillator and high-voltage regulator; and convergence.

Following board construction you assemble the main chassis, the high-voltage shield can, then wire the main chassis which includes connections between boards and chassis-mounted components.

Putting it Together. Unfortunately our builder had problems with the construction manual. Time was wasted by having to resolve some ambiguities between the step-by-step instructions and the pictorial diagrams. A call to Conar got him a set of addenda sheets to update the manual (an early one). A single wiring error, however, put a short across the switch and welded the contacts.

Looking into the cabinet prior to installation of main chassis. The dynamic-convergence board is shown in position used for making adjustments.

What happened after the power switch was replaced and power was turned on? No viewable picture. It took some troubleshooting to locate a defective capacitor that caused the focus potentiometer to burn out. After replacing these parts—to and behold, living color!

But our builder was still unable to sit back and enjoy the fruits of some 53 hours of construction time. Next came the Maintenance, Alignment and Troubleshooting Manual. This book covered initial set up, sound alignment, purity adjustments, static and dynamic convergence. Then the builder adjusts the color-oscillator transformer, reactance coil and burst transformer. Finally there were the adjustments to the sound-rejection circuits and color killer. At last, the back went on the cabinet to wrap it all up. It sounds like a lot of work but it took only about three hours. Subsequent convergences after the parts age should take a lot less time.

What’s the picture like? Not bad. Our builder found the color to be generally good. However, Conar supplied him with a larger coupling capacitor to be installed in the video amplifier that corrected a problem of color bleeding. Convergence and purity are satis-

(Continued on page 98)
How to Control Your Recorder and Record from Afar Wirelessly and Learn to Love Buggers

By JOSEPH RITCHIE

FASTEST way to get fed up with making live recordings is to entangle yourself in wires and become distracted by operating the machine’s controls. It happens almost every time you use a recorder to tape a home-movie sound track or to bug a room. If you’ve made such recordings, you know it’s always a nuisance to control a recorder located a distance away.

However, using an FM wireless mike, a portable FM radio and our Controller, you’ll have a wireless tape-recording system that will make those oddball recording jobs easier done than said.

How it Works

The FM wireless mike is a miniature FM broadcast station that transmits up to 200 ft. Tune it in on an FM radio and you get audio at the radio’s earphone jack. The audio is fed via a patch cord to the recorder’s input jack.

But how is the recorder started and stopped? The Controller does that. It receives another signal from the radio, when you turn on the mike, that starts the recorder. When the mike is turned off its carrier disappears and the Controller stops. Thus, you don’t waste tape when there’s nothing to record.

For best results the FM radio should have AFC (automatic frequency control) to prevent drift. AFC will also help correct for the frequency drift of the wireless mike.

Figure 4 shows the typical detector circuit of many transistor FM radios. When a signal is not received there is no voltage across capacitor Cx. When a signal from the mike is received, a DC voltage appears across Cx. It is from 0.2 to 3 VDC or more depending on the radio and the signal strength. The DC voltage goes to the Controller via isolation resistors Rx,Ry and jack J2.

Note that the radio’s audio signal is taken from a tap on the detector-transformer’s secondary. But in some multi-band FM radios the audio signal is taken from a resistor divider network across Cx. In such radios install only Rx, eliminate Ry and connect J2’s frame to the radio’s ground.

Fig. 1—Complete wireless tape-recording system consists of an FM radio, an FM wireless mike, a reel or cassette recorder and our control box at the right.
Fig. 2—Perforated board is 2 1/4 x 3 1/4 in. RY1's coil lugs are at top. Its switch contacts are leads coming from the center of top and bottom.

rather than to the negative end of Cx. In either case make certain Rx connects to the positive end of Cx—the end that faces the diode's (D1) cathode.

Resistors Rx and Ry must be 27,000 ohms. Less resistance will seriously affect the FM detector. A higher resistance will not provide sufficient signal to operate the Controller.

Take a look at the Controller's schematic in Fig. 5. The circuit is a sensitive high-gain DC amplifier with a reed relay (RY1) in the output transistor's (Q2) collector circuit. The DC voltage from the radio at J1 causes RY1 to close. The contacts of RY1 are connected via PL1 to the recorder's remote-control (start/stop) jack. With the recorder's controls preset to the record mode, the recorder will start when RY1's contacts close and will stop when the contacts open.

Construction

The Controller can be built in just about any metal or plastic cabinet. The parts can be mounted on a small piece of perforated board using push-in terminals for tie joints. Layout is not critical. Substitution should
Control Your Recorder

not be made for Q1 because the specified transistor has a very high gain. Using a silicon transistor for Q1 will probably make the unit inoperative. Transistor Q2 can be any high-gain type. Any small relay with a 20-ma coil (300 ohms at 6 VDC) can be used, though the reed relay specified will work even when battery B1 is exhausted to half its normal voltage.

In most transistor FM radios you’ll find it’s often difficult to connect across Cx unless the radio’s circuit board is removed and connection is made to the circuit-board foil. However, if the radio’s parts are end-mounted (as is frequently the case) the resistor between the detector and Cx often has one accessible lead sticking above the board. Resistor Rx or Ry can be soldered to this lead and it won’t matter whether the connection is made to the diode (D1) or Cx side of the resistor as long as the lead from Rx and Ry to the connection is no longer than ¼-in.

Install jack J2 at some convenient place in the side of the radio. If there is no space for J2 and the radio has a jack for an external power supply, remove the connections to the jack and use it for J2.

Checkout

Prepare a short length of shielded cable to connect the radio’s DC-control-voltage jack (J2) to J1. Connect an ohmmeter to PL1. Apply power to the Controller by setting S1 to on and then tune in an FM station. When a station is tuned in, RY1’s contacts should close and the ohmmeter should indicate zero ohms. If RY1 fails to close, make the following check: Temporarily connect a 1.5-V battery to J1 (negative to J1’s frame). If RY1 fails to close, the trouble is in the Controller. If RY1 closes, Rx and/or Ry is improperly installed.

Operation

If the controller checks out, turn on the FM mike and tune in its carrier on the radio. [Continued on page 101]
THE days of the old neon-lamp voltage tester are numbered. It was great for indicating the presence of 90 to 600 V. But in the world of low-voltage solid-state equipment, it doesn't do much for you.

Using one of the newest solid-state devices, a gallium-arsenide light-emitting diode (Monsanto MV50), you can build a voltage tester that glows red when connected to 5 to 400 V, either AC or DC. This makes it versatile enough to be used with both, say, transistor radios and household appliances.

It also indicates the polarity of a DC voltage. When the probe (R1) is positive with respect to the ground clip, diode D2 glows. The brilliance depends on the voltage. If the polarity of the voltage is reversed, D2 doesn't glow.

Take a look at the schematic above. When D2 is forward biased (R1 positive with respect to clip), it glows red. Resistor R1 (10,000 ohms, 1/2 watt) limits D2's current to 40 ma at 400 V. Diode D1 (1N4001) prevents D2 from being destroyed by a reverse-polarity connection in a circuit (R1 negative, clip positive. The maximum reverse voltage of D2 is 3V).

The tester shown in the lead photo above can be built in the clear plastic body of a discarded ball-point pen. Diode D2 is very delicate. We recommend that you bend its leads very carefully and use a low-wattage iron when soldering. It might be helpful to tin D2's leads before soldering to them.

The tester can fulfill most all the functions of the old neon continuity tester. It is especially useful in solid-state projects in which voltages are low. You can use it to check batteries, power supplies, multivibrators, oscillators, SCR and IC circuits.

The MV50 can be purchased from electronic parts distributors that handle Monsanto semiconductors. It is also available for $4.50 (postpaid) from Custom Components, Inc., Box 153, Malverne, N.Y. 11565.

—Charles L. Andrew

November, 1970
“He's a good worker. I'd promote him right now if he had more education in electronics.”

Could they be talking about you?

You'll miss a lot of opportunities if you try to get along in the electronics industry without an advanced education. Many doors will be closed to you, and no amount of hard work will open them.

But you can build a rewarding career if you supplement your experience with specialized knowledge of one of the key areas of electronics. As a specialist, you will enjoy security, excellent pay, and the kind of future you want for yourself and your family.

Going back to school isn't easy for a man with a full-time job and family obligations. But CREI Home Study Programs make it possible for you to get the additional education you need without attending classes. You study at home, at your own pace, on your own schedule. You study with the assurance that what you learn can be applied to the job immediately.

CREI Programs cover all important areas of electronics including communications, radar and sonar, even missile and spacecraft guidance. You're sure to find a program that fits your career objectives.
You're eligible for a CREI Program if you work in electronics and have a high school education. Our FREE book gives complete information. Mail postpaid card for your copy. If card is detached, use coupon at right or write: CREI, Dept. 1711A, 3224 Sixteenth St., N.W., Washington, D.C. 20010.

CREI, Home Study Division
McGraw-Hill Book Company
Dept. 1711A, 3224 Sixteenth Street, N.W.
Washington, D.C. 20010

Please mail me FREE book describing CREI Programs. I am employed in electronics and have a high school education.

NAME

AGE

ADDRESS

CITY

STATE

ZIP

EMPLOYED BY

TYPE OF PRESENT WORK

G.I. BILL

I am interested in

- Electronic Engineering Technology
- Computers
- Space Electronics
- Nuclear Engineering Technology
- Industrial Automation
- NEW! Electronics Systems Engineering

APPROVED FOR TRAINING UNDER NEW G.I. BILL

November, 1970
The Listener
By C. M. Stanbury II

Jamming the U.S.

In a surprise move, the Canadian Minister of Resources has said that Ottawa may begin to jam broadcasts from the United States in an attempt to foster Canadian nationalism.

The Minister, J. J. Greene, declared in a published statement, "We have not gone to the extent of jamming the airwaves along the border but—who knows?—even this may come."

Until recently this statement would have been dismissed as flag waving on the part of the Minister, but an incident in England has caused experienced observers of the radio scene to have second thoughts.

Radio Northsea International is a rock-music pirate station operating in the R. Caroline tradition off the coast of England. Last winter, the station was heard widely in the U.S. on 6210 kc. After interfering with British ship-to-shore transmissions on 1610 kc, the station switched its frequency to 1578. Following this switch to a new frequency the British Ministry of Posts and Communications began to jam the transmissions.

Other than a few instances under martial law in emergencies, this is the first time that jamming has been used by a non-totalitarian country.

Despite a lack of experience in this phase of broadcasting, the British were remarkably well prepared. Every key BBC medium-wave station now is assigned a portable jamming unit in the form of a truck with a telescoping antenna with powers ranging from 1 to 10 kw.

When the Ministry decided to jam RNI, it borrowed one or more of these units from the highly respected BBC. With the BBC's entry into a field generally reserved for countries like the U.S.S.R., it is easily possible that other countries might follow suit, including Canada.

If Mr. Green's comments were intended as a joke, his humor was ill timed for it is clear that a serious threat to listening freedom is developing on an international scale. In response to this threat, the World DX Club has begun a new anti-jamming campaign. The British based club is one of a few with a truly international outlook and has active representatives in many countries, including a spokesman in the United States.

While WDXC's approach to the situation still is undefined, it probably will assume an exploration-and-exposure method. If you are interested in these developments it would be advisable to join WDXC and receive their colorful bulletin, Contact. Another step in the right direction is letting your views be heard. You might contact the North American representative of the club, William Matthews, at Box 15306, Columbus, Ohio 43215.

Canadian DX. Now that U.S. ship-to-shore traffic is switching from medium wave to VHF, DXers should have less interference to contend with in attempting to log some of the more remote Canadian stations. These would include VCK, VCN and VOJH, especially on the key channel of 2182 kc, the distress frequency.

VOJH is at Cornerbrook, Newfoundland, on the Gulf of St. Lawrence's rugged eastern shore, while VCK is on the Gulf's bleak northern coast at Seven Islands, Que. VCN is Grindstone Radio, operating from the even more remote Magdalen Islands.

The Magdalenians are not considered a separate country. However, they present a rarer DX prize than many islands accorded country status. Although VCK and VCN are located in Quebec, most transmissions are made in English rather than French.

On the BCB, a new 50-kw station has come on the air on 540 kc. It is CBSC located at Windsor, Ont., and is the first clear-channel station east of the Mississippi in several years. For listeners in the Mid-West interested in programs in French, this station will be a good bet.

Propagation Forecast. Sunspot activity is still relatively high and, as a result, daytime DX in the 15-, 17- and 21-mc bands will be good to excellent. At night, conditions are expected to be about the same as they were last year at this time, with the 6- and 9-mc bands generally best for DX over all-dark paths.

Noise levels due to thunderstorm activity are at a minimum in the winter months and broadcast-band DX should improve compared to the last few months.
El Kit Report

Blister-Pack Tube Tester

Mercury 990

WHEN a TV set starts acting up, the best plan of attack is to first check the tubes. But it's a waste of time to pull tubes, put them in a bag and head for the supermarket or drugstore tube tester. The efficient approach is to have handy your own tube tester—like the Mercury Model 990. The kit sells for $21.95 ($34.95 assembled) and you can put it together in five hours.

An unusual thing about the 990 is the way it's packaged. As is common in electronic-parts retailing nowadays, the 990 is displayed in a blister package as shown above. Notice that it comes with the tube sockets and slide switches already mounted.

The 990 is equipped with eight sockets for the following tubes: Compactron, Nuvistor, seven pin, octal, 9-10 pin, magnoval, novar and decal. These will cover every tube you'll encounter in modern TV sets.

By means of 12 SPDT (center position open) slide switches, the grids and plate of a tube are connected together for a standard cathode-emission test. The open-circuit position of each switch disconnects any tube element. The meter is in a half-bridge rectifier circuit.

There are three rotary switches. One applies the following filament voltages to the tube: 1.4, 2.5, 5.0, 6.3, 12.6, 25, 50 and 117 V. The second switch connects the filament return pin on the tube. The third selects one of four fixed-resistance loads and one of two test voltages. Unlike some other emission testers that are calibrated with a tube known to be good, the 990 is ready for service after you complete the check-out tests.

Construction was no problem. Wiring is tight between the sockets because of the 900's 6¼ x 7¼ x 3½ in. size. As for performance, it's easy to operate and accurately disclosed good and bad tubes in our junk box. We fault the kit for only one minor omission. The grid/plate clip was missing.

The 990 is a valuable addition to any test bench. It has a tough plastic case that will withstand a lot of knocking around. And by mailing the registration card back to Mercury, you will periodically receive test settings for new tubes.

View of inside. The filament transformer is supplied mounted in the high-impact plastic case.
SHORT-WAVE LISTENING


HALICRAFTERS S-388 receiver. Will trade for ham or CB transceiver. Terry Bigler, 71835 Siesta, 29 Palms, Calif. 92277.

LAFAYETTE 271 L three-band receiver. Will swap for best offer. George Lammers, P.O. Box 321, Livingston, Ala. 35470.

PORTO 2000 receiver covering AM-FM-SW. Would like a trans for an electric guitar or VOM. Leonard Deiterman, Ward, S.D. 57704.


HEATHKIT GR-64 short-wave receiver. Will trade for CB equipment. Tom Harris, 13039 Helen St., Southgate, Mich.

HALICRAFTERS SX-24 receiver. Will swap for Don Britton construction plans and courses. Joe Wegner, P.O. Box 262, Glendale, Calif. 91209.

KNIGHT Star Roamer and homemade antenna tuner. Will swap for best offer. Brian Reynard, 1609 Tropical Dr., Lake Worth, Fla. 33460.

SILVERTONE 4586 floor radio with BC6 and 1B-5A. Will trade for best offer. Eddie Geiger, 4425 Landon Dr., Knoxville, Tenn. 37921.


ONE-TUBE short-wave receiver. Swap for 100-mw CB base station. M. Dillon, 243 Eureka St., Petrolia, Ontario, Canada.

KNIGHT Star Roamer receiver in good condition. Want ham accessories. Rich Leitmann, 1847 Ludington Ave., Wauwatosa, Wis. 53226.

HAI LIFRCRAFTERS S-120 short-wave receiver. Will swap for Heath HR-10B ham receiver. Tim Dietz, 74C Ludlow St., Lawrenceburg, Ind. 47025.

ANTEK ELECTRONICS

PHILCO 1933 table radio and both 1936 radio. Will swap for a pre-1948 TV. Donny Simonian, 6222 East Townsend, Fresno, Calif. 93727.


PHILCO 1920 radio. Want complete ham set in working order. Jim Sullivan, RD 1, Alvord, Iowa 51230.


ATWATER KENT model 55 radio in perfect condition. Radio has four-track tape recorders. Ronald Halchock, 2707 Garden View Dr., Jefferson City, Mo. 601.

RCA Model R52 console receiver in good condition. Will trade for CB rig or test equipment. Clarence Gauthier, 86 Charlton St., Oxford, Mass. 01540.


CITIZENS BAND

LAFAYETTE HA-300 2-watt, 2-channel, walkie-talkie with AC adaptor and channel 11 crystal. Will swap for a general-coverege receiver. Maynard Smith, 650 Bryant St., East Meadow, N.Y. 11554.


MIDLAND 13-724 2-watt, 3-channel walkie-talkie. Will make a deal for a new EICO SWR meter. Pete Wilhelmi, 1904 South Robert St., West St. Paul, Minn. 55118.

CB OUTFIT complete with base and mobile stations. Will swap for stereo cassette recorder. W. B. Gibson, Box 284, Fairborn, Ohio 45324.

AMPHENOL 675 transceiver with power supply for base station use. Will trade for an oscilloscope or best offer. Bob Perdue, 778 Newport, Detroit, Mich. 48215.


SONAR FS-23 covering 23 channels. Operates as base or mobile. Will swap for an AM power modulator. Ronald H. Bouds, RD 1, Box 183, Snow Hill, Md. 21833.


AUDIO AND HI-FI

REK-O-KUT turntable, SW receiver, and CB rig. Will trade for TV camera or test equipment. Jack Rosenbach, 1001 West 79th Pl., Denver, Colo. 80221.


PENTRON Stereo-Magic recorder, two or four track. Will trade for Touch-Tone telephone equipment. Richard M. Jacobs, 4941 Tracy, Kansas City, Mo. 64110.


VOICE OF MUSIC model 722 four-track stereo tape recorder. Want in trade DX-60B and HR-10B or best Xmr. Rcvr. combo. Thomas Ziko, 350 Rear Preble St., South Portland, Me. 04106.

OTHER EQUIPMENT

BLACK LIGHT. Will swap for test equipment or best offer. Bob Rogers, 7701 5th Ave. So., Birmingham, Ala. 35206.


PORTABLE and table-model AM radios. Will swap for VTVM or VOM. Bruce Friedman, 21 Stuyvesant Ave. N.Y., N.Y. 10009.

EICO 400 oscilloscope and Eico 324 RF signal generator. Will swap for best offer. Alan Mark, P.O. Box 372, Pembroke, Mass. 02359.

NATIONAL RADIO Institute TRF signal tracer and RCA Dynamic Transistor Demonstrator. Will trade for TV or auto electronics equipment. Frank Hareford, 1416 21 St. N.W., Washington, D.C. 20036.

[Continued on page 103]
WHEN testing tubes, be sure to look for more than one listing in the tester manual. For instance twin triodes will have two separate listings. A four-section tube might have four separate listings. If any one of the sections should be bad, the tube must be discarded.

When replacing a bad component on a printed-circuit board (sketch at left), you have to cut the leads on the old part and solder the new component to the old leads. Use a heat sink between the board and the soldering point so that the excess heat is drained away. This prevents the free lead soldered to the board from coming loose.

Arriving home from vacation and about to watch a color TV that hasn't been turned on for a few weeks? You had better dry out any moisture that might have accumulated during its inactivity. This is easily accomplished by placing a 60-watt bulb inside the set and leaving the light on for a few hours. Then it's safe to turn the set on.

If you begin losing high-frequency response on your tape machine, it's usually because the tape is not snug up against the head. It might appear snug but some of the tape's oxide coating has formed a layer on the head over a period of time. The cure is easy, if you swab down the head with a cotton ball moistened with head cleaner.

Lots of electric appliances have leather-covered cabinets. These covers can get annoying creases when something heavy is left on top or against them for a while. To get rid of these creases, either iron the cover with a steam iron or put a damp cloth over the crease and rub with a hot soldering iron. Be careful with plastic covers.

The new instant-on type tube TV's have been found to have a new variation on an old trouble. The symptom, you can't turn the TV off except by pulling the plug out of the wall. Your first reaction might be to think your set has a shorted on-off switch. Wrong again, Watson. The diode across the on-off switch that permits heater operation while keeping the B+ off has shorted. Since it's across the on-off switch, the TV stays on. You can remove the diode which will restore the on-off switch but removes the instant-on feature or you can replace the diode which will restore the set to the correct working condition.

Many products advertised in this issue offer you further information direct from the manufacturer. At the bottom of many ads will be a "Circle No." line. This means that the advertiser offers you further product information, free, right to your mailbox. Look through the advertising, and turn to page 11. Circle the advertisers' number, complete the coupon, and we will take care of the rest.
The Long Nights of Uncle Tom

Continued from page 62

It it because he's tired?
HE IS NERVOUS
Can Tommy talk to you later?
DON'T KNOW

Tom returns.
Bill, I'm back and relaxed. Can we talk now?
BELIEVE
Please explain reincarnation.
[No reply.]

Judy and Loretta take over the board.
Bill, are you still there?
HE DOES NOT HAVE IT
What?
WHAT IT TEAKS HI BEAUTIFUL
Why can't you talk to Tommy now?

I DON'T KNOW CHICKS ARE GOOD I HAVE
YET HAD SO MUCH FUN IN A LONG TIME
Do what method do you receive us?
I DON'T KNOW I THINK HERE YOUR
THOUGHTS BEFORE ME HOW
We can't make that our.
HOW DID YOU GET THROUGH
How do you know when we want you?
DO YOU KNOW ME
Explain because we still don't understand.
I DONT EATHER
Do you know how we are communicating with
you?
I FEEL YOUR THOUGHTS

Back to the spy business.
Is the CIA setting up a station on Corn Island?
BUYING ANTENA IN CHICGO
What will the call sign or identification be?
NONE WILL THINK IT IS ON BOAT

The story takes form.
Will it be a CIA station?
(I WILL USE IT TIMES BRIZALONS
What is the motivation of the station?
MAYDAY TO PEOPLE
Are they going to warn the people?
YES AND KEEP CANAL IF THEY CAN
Will Castro try to get canal by an invasion?
GET PEOPLE WORKED UP
Why does he want the canal?
STOP AMERICAN SHIPPING TO EAST
FROM EAST
Why is Brazil so interested in the canal?
COFFEE WE BUY HER GOODS AND SUGER
Why on Corn Island?
IT IS OWNED BY HONDURUS WE HAVE
LETED BARIZAL RENT FROM US
NOBODY KNOWS IT USA

(Bill seemingly confuses Honduras and
Nicaragua, which owns the Corn Islands.)

If I can get this story in print will I have a scoop?
YOU WILL GET A VISIT
The FBI will visit me?
MORE THEM
Who else will visit me?
CIA
What will they do?
FRIEND IN CIA WILL CALL LAUGH
You mean the CIA will deny the story?
YES
Are there other existence planes higher or lower
than where you are?
JETS AND PROPS
(When there are two meanings to a word
Bill often assumes the wrong one.)

No, I mean spiritual planes. From where you are
now, do you move on further?

I CAN'T SEE THE REASON FOR GOING
ANYPLACE
Do you understand reincarnation?
I DONT UNDERSTAND ME
Isn't it, you tell us anything?
SPARK IS LIFE IT DOES NOT DIE
The spark of life cannot die, right?
ME
That's what you are—the spark of life?
THINK SO WHAT I AM YOU WANT TO
KNOW I AM ME THEI CRY I LAUGH
You have the same emotions now that you al-
"ways had?
SAME ANIMAL GONE
if you're good on earth or bad does it make any
difference afterwards?
GOOD YOU CAN LIVE WITH YOURSELF
Suppose you are evil?
YOU CANNOT LIVE WITH SELF
Do you ever rest?
NONE ED ANIMAL GONE
What happens to the spark in a pet when it dies?
NEVER THOUGHT ABOUT IT WILL HAVE
ASK
We will say goodbye for now, Bill.
(Q 10-2

Wednesday, first session. Enter a lady poet
with a sense of humor.
Bill, are you there?
WE GOT SE YOUR
Who is this?
JANE
Do you have a message for us?
SWACET
Replicate, please.
VBF E2 MUST POET COME T
Are you a poet? 
NICE TRY BUT RIGHT
When did you write poetry?
IAR
Is that when you lived?
DIE
Were any poems published?
JUST TIMMHIPEUT
Any short poems you can tell us?
MAID FROM ULSTER
Were you from Ulster, England?
YES
What was your last name?
HARDIMS
Hardinc?
HARDY
Hardy?
YES
What year were you born?
1726 MERGRATE
Margate?
YES
Were you married?
NO
How did you die?
PLAGE
Died of the plague? Did many die with you?
SOME
Have you ever contacted anyone else?
YES
Many times?
SOME
Do you know Ross?
TOSS ROSS
Ross, CROSS
Not Cross, Ross, TOSS
Are you having fun with me by making rhymes?
YES
You aren't going to give me any information,
are you?

[Continued on page 98]
NOW! THIS $99.95 COMPLETE 8-TRACK STEREO TAPE CARTRIDGE SYSTEM

for only $29.95 plus mailing and handling

when you join the Columbia Stereo Tape Cartridge Service by buying three cartridges now, and agreeing to buy only twelve additional cartridges during the coming two years, from the more than 1,000 to be offered

The richness of full stereo sound with the convenience of 8-track cartridges!
Here's everything you need to enjoy the new world of 8-track cartridges! Precision-engineered to high Columbia standards, the System with its solid state design and rich walnut-veneer finish includes a Player with Program Index to control 4 stereo channels (8 tracks) of music that play automatically or can be switched from channel to channel with the touch of a finger (Cartridges, never need rewinding or threading). The Amplifier has right and left speaker volume Controls, plus Tone Controls to adjust bass and treble balance. The Twin Speaker Enclosures have sensitive yet heavy-duty speakers for maximum fidelity. From Japan. Player is 8 1/2" W x 13 1/2" L, Amplifier is 6 1/2" W x 3 3/4" H x 8 1/2" D. Speakers are 7 1/4" W x 9 1/2" H x 4 1/4" D.}

Our regular offered price for this System is $99.95 — yet now you may take the System for only $29.95 when you join the Columbia Stereo Tape Cartridge Service and buy three cartridges of your choice at the regular Service price of $36.98 each.

You only obligation as a member is to purchase twelve additional cartridges during the next two years. Music you'd probably buy anyway! As a member you will receive, every four weeks, a copy of the Service's buying guide. Each issue contains scores of different cartridges to choose from — the best-sellers from over 50 different labels! If you want only the regular selection of your main musical interest, you need do nothing — it will be shipped to you automatically. Or you may order any of the other cartridges offered from any field of music... or take no cartridge at all... just by returning the convenient selection card by the date specified. What's more, from time to time the Service will offer some special cartridges which may reject by return the special dated form provided, or accept by doing nothing.

Your Own Charge Account! Upon enrollment we will open a charge account in your name. You pay for your cartridges only after you've received them. They will be mailed and billed to you at the regular Service price of $6.95 (all special cartridges somewhat higher), plus a mailing and handling charge.

Free Cartridges! You'll get an additional cartridge of your choice FREE for every two cartridges you buy, once you've completed your enrollment agreement. That's like getting a 33 1/3% discount on all the 8-track cartridges you want, for as long as you want!

MAIL COUPON TODAY

COLUMBIA STEREO TAPE CARTRIDGE SERVICE
Terre Haute, Indiana 47802

Please accept me as a member, and send me the Columbia 8-Track Cartridge System described here. I am enrolling now check or money order for $29.95. Complete satisfaction is guaranteed or your money will be refunded in full. Also send me these three cartridges, billing me $6.95 each, plus mailing and handling for the System and cartridges. Fill in numbers.

My main musical interest is (check one box only):

[ ] Easy Listening [ ] Young Sounds [ ] Country

As a member of the Service, my only obligation is to purchase as few as twelve additional cartridges during the coming two years. I may choose selection from all fields of music at the regular Service price under the terms outlined in this advertisement. I may cancel my membership at any time thereafter. If I continue I am to receive an 8-track cartridge of my choice FREE for every two additional selections purchased. Complete satisfaction is guaranteed or my money will be refunded in full.

Bill: [ ] M. [ ] F. (Please Print)
Initial

Address

City State Zip...

If you wish to charge the cost of the System and your first three cartridges, plus mailing and handling, to your credit card, check one and fill in your account number below.

[ ] Uni-Card [ ] American Express [ ] Master Charge [ ] Diners Club [ ] BankAmerica[ ] Midwest Bank Card

Account Number: Expiration Date: A41-5/55

Signature: A41-6/65

© 1970 CBS Direct Marketing Services SC-463/779

November, 1979
The Long Nights of Uncle Tom

Continued from page 96

EACH PERSON MUST
Do you have any messages?
BILL RISHTHRWIAN DEED GIVE TO ME
Repeat that please
ME HE CE BE SE WE PE UE WE TE GE KE
Are you joking with rhymes again?
YES
Have you been told that you have a good sense
of humor?
HIBOTUPUT SHE KING ED
Who was the King of England when you were
there?
FRENCH
You were French? I thought you were English.
QUEEN
Jane rewrites history.
Who was the Queen?
S ANNE.
Wasn’t King George on the throne in those years?
GEORGE SON ARE FRENCH
When you were in England did you ever see
royalty?
A CARRIAGE DROVE BY
Must have been exciting
BEST
How old were you?
CHILD
How did you know we were here? We called Bill.
BILL SAID TO WAIT
Do you know my father?
BET HIM YOU WOULD TALK
About him?
BILL SAID ONLY HIM
You bet Bill that I would talk to you? He said
I wouldn’t?
YES
Can I call you if Bill isn’t around?
C I AN RYTHME
I wrote some poetry once.
TIME DIME FINE WINE
Is pime OK? Does it fit there?
KIND
You like to make rhymes?
I CAN POET
Cheerio, hope we contact you again soon
GOD BLESS
Wednesday, second session.
Bill, are you there?
I AM HERE I WAS TRYING TO FIND
ABOUT ANIMALS THE SPARK FROM THE
DOG
Any luck?
HIDE ICNZEW WE NOT FIND TODAY DEAP
MCIDEHCKAHLAF
Are you going to keep trying?
YES GIVE ME TIME
Bill’s explanation.
Corn Island doesn’t belong to Honduras. It is
Nicaragua.
I KNOW IT AS HOUNDRES
The flying-saucer mystery is solved at last.
What about flying saucers?
FUNNY
They are a joke?
YES
What are people seeing and photographing?
WHAT THEY MAY WANT TO
They aren’t anything at all?
IF THEY ANYTHING IT FROM HERE
You mean God sent them?
NO
They are from earth?
EARTH

Bill once asked Uncle Tom to publish a
story with his by-line. So...

THE CORN ISLAND AFFAIR
By William Wheton

A new radio station will be set up late this year on
Little Corn Island in the Caribbean. It will be owned
and staffed by Brasilians. The Corn Islands, presently
under lease by the U.S. from Honduras (sometimes known
as Nicaragua), have been rented quietly to Brazil for the
purpose.
The station will be commercial in nature (a soft-drink
company is buying time through an office in Buenos
Aires), though CIA agents will work there and CIA pro-
grams will be fitted into the programming.
The station is being established to send out what might
be considered Mayday calls to the people of Central
America because Cuba’s Fidel Castro will move at the
beginning of 1971 to create disturbances in Panama. This
will be done to rid the Panama Canal of American
control so Cuba can control it. The idea was presented
to Castro by China, a nation which has offered Castro
food aid in exchange for cooperation.
The plan, if successful, would jam American shipping
from both coasts and nearly destroy Brazil’s coffee exports
to the Pacific.
A large number of engineers is involved in the radio
project. The 100,000-watt transmitter is being built in
Maryland. A high-gain antenna is coming from Chicago...

Color TV Kit

Continued from page 83

factory as evidenced by the absence of color
tint in a b&w picture.
Although the set does not have AFT (au-
tomatic fine tuning) there is no difficulty in
tuning a picture. Compared to other nearby
color sets with comparable antennas, the Co-
lar produces a picture free of snow and
noise.
GIANT TOOL & HARDWARE SALE

You Can Have Access To $1,000,000 Worth of Tools, Appliances and Accessories — All at Bargain Prices.

Over 12,000 items — in this giant 188 page CATALOG THAT OFFERS YOU UP TO 50% OFF the retail price. If you're a serious minded craftsman or mechanic, or an owner of a car or boat or home, then at one time or another you've used tools, and didn't have the right ones. Well, now you can be sure to have the right tools at prices you can afford.

Save Hundreds of Dollars a Year

Thanks to Hamilton House's arrangement with U.S. General Supply Corp. we can offer you an opportunity to have available, as close as your mailbox, an inventory of brand-name tools and accessories in excess of one million dollars that you can draw against as you wish at bargain prices of up to 50% off.

Over 12,000 Items — Including Name Brands

This giant 188 page wholesale catalog not only has everything you can think of in tools, appliances and auto accessories but lots of things you can't think of either. Interested in Routers? — just turn to page 43. How about Micrometers? — check page 97; automobile tires? — sure, on page 186; did you say lawn mowers?— try page 130, and what about three full pages on binoculars and telescopes, two pages on Smith-Corona typewriters and adding machines, radios, wrist watches, tennis rackets, and so much, much more. Please don't forget augers, blades, brushes, burrs, chisels, drills, fans, flashlights, hacksaws, hammers, lathes, padlocks, planes and the thousands of others staples that make this catalog a BIBLE in the field. And it's all there, right at your fingertips, and all at bargain prices.

Actually Start Your Own Part-time Business

Many customers have actually started their own business with this hardware store-at-home catalog. Its 188 pages are so crammed with fully-illustrated merchandise that any friend, neighbor or relative who sees it is bound to want something from it. And as only the retail prices are listed, the confidential low costs, which are concealed in a code known only to you, offer you an opportunity to actually earn money. Once you start, you'll be amazed how easy it is to sell, because these amazing values actually sell themselves. And, because U.S. General Supply keeps all the merchandise on hand in their huge warehouse, most orders are shipped out the day they're received.

$1 Gets You Started

At the top of this page is a coupon. Just cut it out. add a dollar bill or check or money order and mail it today. You'll get the biggest value a dollar ever bought. This giant wholesale catalog is guaranteed to save you money and even make you money. But, we're going to go one better. We're going to guarantee that you're going to get your dollar back, because with your catalog, you'll receive a certificate worth $1 which you can apply against your first purchase. And, if that's not fair enough, if for any reason you're not 100% satisfied with your catalog, then we'll refund your one buck with no questions asked.

No Risk—Money Back Guarantee

Hamilton House Dept. L-A11
Cos Cob, Conn. 06807

I enclose $1. Please send me my giant new fully illustrated 188 page wholesale catalog of over 12,000 items including the best brand name tools. I understand that with my catalog I will receive a certificate worth $1 on my first purchase or I will be refunded my $1 if I am not 100% satisfied.

Name ____________________________
Address __________________________
City & State __________ Zip ________

Partial List of Contents

- Drills and Sanders
- Lancaster Chain Saws
- Portable Power Saws
- Drill Presses
- Eelt-Disc Sander
- Westinghouse Power Motors
- Vises with Steel Screws and Guides
- Hoppy Split Image Transit
- Jet Fuel Igniters
- Prism Binoculars and Telescopes

- Champion Spark Plugs
- Arc Welders
- Bernz-O-Matic Torches
- Paint Sprayers
- Smith-Corona Typewriters and Adding Machines
- Tractors—Sprinkler Heads—Lawn Mowers
- Scout Knives—Tarpaulins
- Waltham Watches
- Motorola and Webcor Tape Recorders & Stereos

November, 1970
If you picked more than five of the dozen subjects above, you should be reading TRUE Magazine.

Each month, TRUE, For Today’s Man, combines all your interests into a full-sized package of personal reading pleasure. And now, to make sure you don’t miss a single issue and to save you real money—you can subscribe to a full eleven (11) issues of TRUE—not at the newsstand price of $6.60—or the regular 11-issue subscription price of $5.50—but at the special price of only $3.00! AND if you send remittance with your order, thus saving us billing expense, we will send you one extra issue free—making twelve (12) in all!

ACT NOW! Just complete the coupon below and mail it today. This special offer is for new subscribers only.

Send your order to:
TRUE
FOR TODAY’S MAN
DEPT. E1-12
Fawcett Building
Greenwich, Connecticut 06830

Check proper box
☐ Bill me at $3.00 for 11 issues.
☐ Send me 12 issues—my payment is enclosed

Please enter a TRUE subscription for:

Name ____________________________
Street ___________________________
City __________ State ______ Zip ____

Continued from page 46

Bugging the Fuzz

receivers. If you want to try some DX from the next town the antenna will probably need improvement. Manufacturers of ham, CB and other two way antennas offer a line of monitor models. They are well suited for outdoor mounting, high and in the clear, to intercept stronger signals from distant stations. An example is the GP-1 ground plane by Newtronics that covers 25-50 mc at a price of $11.95. A special feature of this and other monitor antennas is a cutting chart which enables you to adjust elements to an exact resonant frequency. Or, you can simply cut the antenna to the middle of the band.

Now that you have all the equipment, you might be somewhat dismayed at what you hear. Policemen don’t have very much time to gab, so each department employs a system of codes similar to those in the chart.

In the secrecy department there are a couple of other matters. It is against the law to repeat what you hear in these transmissions, or to use them for purposes of profit. There are many states that have laws prohibiting the mobile use of police receivers. Check with your city or town police before mounting your equipment under the dashboard.—Len Buckwalter, Tom Kneitel.

A Letter From Georgetown

Continued from page 22

unmercifully—by Frank Roulstone, among others. Often the 007 chaps would arrive in heavy trench coats and then keep them on even in the stifling heat of Georgetown’s afternoons.

“Going south?” Frank used to ask them “Yep.”
“Tonic Nicaragua”
“Nope”
“Or, to Swan, maybe?”
“Yep”

It all seemed to be part of a strange code by which CIA agents, like George Washington or Boy Scouts, do not tell lies, but they aren’t given to volunteering the truth, either. You might check us out on this theory if you’ve a mind to. Like the next time you run into a CIA operative just ask him straight out: “Hey, how’s it going with that new station of yours on Little Corn Island?”

—Bob Beason
How To Control Your Recorder

Continued from page 86

Then connect a patch cord between the radio’s earphone jack and the recorder’s mike jack. Talk into the mike and adjust the recorder’s gain control for proper level.

If the radio is equipped with AFC, set the AFC switch to on. Then plug PL1 in the recorder’s remote-control jack. For proper operation it is very important that the mike’s output frequency be set to an absolutely dead spot on the dial—generally around 48 mc. If there’s even the slightest trace of a station in the background, the Controller will not stop the recorder when the mike is turned off.

The Ham Shack

Continued from page 81

The use of FM would help free us from the terrible mess that is made by all those AM carriers on 27 mc and would greatly reduce interference problems. While the 200-mc band does not provide the skip conditions experienced on 27 mc, the 100-watt power limit will permit ground-wave coverage far above that experienced on 27 mc. More important will be the use of repeaters, the development that has had such a tremendous impact on two-meter communications.

The opening of a hobby-class band would quickly encourage manufacturers to produce reasonably priced equipment for the development of this band—equipment which would also benefit those higher-class licensed amateurs interested in using the two 500-kc segments of the band on each end of the hobby band.

Television interference should be at a minimum with these allocations because they are above TV Channel 13.

Special call letters have been requested for this new license, starting with NA1AAA, a series which would mathematically permit the licensing of over 4,500,000 operators. This would allow the holder to keep his suffix letters when the class is raised. turning a NC2BDF into a WB2BDF, for example.

The initial response to the proposal, except from the ARRL, has been quite enthusiastic. It would seem to answer an awful lot of problems and cause a minimum of difficulties. How does it strike you?

November, 1970

now...a better way to drive and adjust hex socket screws

...IN PRECISION WORK

With the tools in this new, compact convertible screwdriver set, you can turn all types of hex socket screws...in all types of locations...faster, easier than with conventional keys.

Handy midgets are ideal for such delicate, precision work as assembly and servicing of instruments and controls. Remarkable “piggyback” torque amplifier handle adds grip, reach, and power needed for other applications, lets you do more jobs with fewer tools.

PS-89 SET
8 midgets (hex size .028” thru ½”) plus hollow, “piggyback” handle. Slim, trim, see-thru plastic case fits pocket or tool box, doubles as bench stand.

REQUEST COMPLETE HAND TOOL CATALOG which includes information on other Xcelite Compact Sets, too—slot tip/Phillips/Scrulox® screwdrivers, nutdrivers, and combinations.

Nationwide availability through local distributor

XCELITE®

XCELITE, INC., 16 Bank St., Orchard Park, N. Y. 14127
Send complete tool catalog, which includes information on all Xcelite Compact Sets.

name ____________________________
address ____________________________
city ____________________________ state & zip

In Canada contact Charles W. Pointon, Ltd.
CIRCLE NUMBER 13 ON PAGE 11
"... Look, Marconi, I don't care about any test you're going to take. Just knock it off!

"Our code oscillator is out of order so I'm going to tap out your code test on the table with my pencil..."

"I just got a bribe offer at 3 wpm."

"Honey, it's me. Listen, look in my code test book and see if 'P' is di-dah-dah-dit or dah-di-dah-dah...

"... Mr. Harris, you shouldn't take it like this. A little more code practice and I'm sure you'll pass the test..."
bolsters the book with many practical considerations in their design and application. Mr. Lloyd, incidentally, punctuates his otherwise sober work with some outrageously funny asides. Best example: In 1889 a controversy raged over whether to produce AC or DC electrical power. The group against AC called alternating current deadly and a newspaper illustration of the day showed a man sitting in an electric chair, the sheriff about to throw the switch. The article explained that hanging by rope was sickening, inhumane and uncertain. But the man in the picture needn’t fear any bungling because he will be executed by Westinghouse alternating current.

Mr. Lloyd’s comments: “There is no evidence that the well-known slogan, ‘You can be sure if it’s Westinghouse,’ originated at this time.”

Swap Shop

Continued from page 94

FLOURESCENT X-ray negative illuminator and two 16-mm sound movie projectors. Want 8-mm movie equipment in trade. Jeff Goodman, 23 Pioneeer Blvd., Huntington Sta., N.Y. 11746.


HEATHKIT oscilloscope, Model O-12 with 5-in. CRT. Will swap for a Hallicratters communications receiver. Robert Roy, 151 Ray St., Manchester, N.H. 03104.

POLAROID Land camera with leather carrying case. Will swap for two Heathkit AS-13 speakers or equivalent. Steve Lympany, 9 Buena Vista Dr., Delmont, Pa. 15626.

TRANSIENT DETECTOR, Model 2601A manufactured by Huggins Labs. Will trade for best offer. Dean Williams, 4814 Broadmeadow Ct., Huntsville, Ala. 35810.

LIONEL 027 gauge model trains. Make swap offer for hi-fi equipment. Ralph Archer, 1620 Pilgrim Ave., Bronx, N.Y.


ELECTRONICS books and information. Want in return CB mobile antenna or ham receiver. Gary Castellini, 3567 Lincoln Ave., Wineland, N.J. 08630.

SERVO-MOTOR in good shape for special applications. Want high quality panel meter or best offer. Robert Liebman, 156-11 Aguilar Ave., Flushing, N.Y. 11367.


SNAKE DRUM and cymbal. Swap for keyer, phone patch or what have you. Rick Miller, R.R. 3, Sumner, Iowa 50674.

ASSORTED TUBES (oldies like 39/44’s and others). Trade for BC-454 or BC-455 surplus receiver, with or without power supply. Larry Gravett, 434 Ednor Rd., Silver Springs, Md. 20900.

RF PLASMA TORCH with power supply. Want sniperscope or snooperscope, or what have you. Edward Miller, Jr., 12010 Telegraph, S. Rockwood, Mich. 48179.

CIRCLE NUMBER 9 ON PAGE 11

FOR SPEEDY SERVICE

1102171 647 98 24 0664
T M BROWN
5936 23rd PARKWAY
WASHINGTON, D. C. 20031

WE’RE LOST WITHOUT THIS LABEL

Well, not really lost—but we can do things faster for you if you send along the ADDRESS LABEL from your magazine any time you write to us about your subscription.

CHANGE OF ADDRESS

If you’re moving, please let us know six weeks before changing your address. Better still, attach the magazine address label to this form, and print your new address here:

NAME: ____________________________________________

ADDRESS: _________________________________________

CITY: ___________________________ STATE: ______ ZIP: ________
COLOR CONVERTER for Black and White Television. New Patented System. An Ideal Do-It-Yourself Electronic Kit, for Hobbyists and Experimenters. Write for Free Brochure, B.H. Electronics Corp., P.O. Box 2449, Main Office, Miami, Fla. 33101.


* * * INVENTIONS & INVENTORS


* * * LEAD MUSIC
LEAD GUITAR Course, Diagrams, Lead Chords, Improving, etc., $1.00, 18 Redcoat, Lexington, Mass. 02173.


POEMS AND songs wanted by America's most popular studio, Tin Pan Alley, Broadway Productions Division EL, Lake Grove, New York 11755.

* * * ROCKETS

* * * PERSONAL
AMAZING! 500 DeLUXE Gold Striped Name, Address Labels, $1.00 postpaid. Gift House, 5702 South Old Mill, El-S11, No. 55, Littleton, Colorado 80120.

AERIAL PRODUCTS OFFERS Best Places to Eat and Stay. Scenic Routes, Parks, Historic Sites, 170,000 Word Book, Only $1.50, The Gift Gallery, Dept. 4E, P.O. Box 38143, Dallas, Texas.

* * * MISCELLANEOUS
OVER 2,000,000 BACK Issue Magazines! Send Needs. No Catalog, Midtown, Box 917-EI, Maywood, N. J. 07607.


PROTECT YOUR Checks! Roll amazing Check Protector over amount and paper instantly perforated, preventing change. Fits pocket or purse, $1.25 postpaid. Ember Enterprises, Box E1-11, 10530 Encino Ave., San Fernando Valley, Calif.

WHOLESALE BOOK Directory—books galore at unbelievable prices—hobbies, novels, dictionaries, encyclopedias, etc. Write B. England, Box 33-Elk Drive, Fair Rockaway, N. Y. 11641.


TO: ELECTRONICS ILLUSTRATED • 67 W. 44th St., New York, N. Y. 10036 • Att: Classified Advertising Dept. Gentlemen: Here's our copy for the Classified Section of ELECTRONICS ILLUSTRATED. Remittance of $ is enclosed to cover insertion(s) in the issue(s)

|   |   | 3 | 4 | 5
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
</tr>
</tbody>
</table>

YOUR NAME __________________________ PHONE __________________________

FIRM ________________________________ ADDRESS __________________________

CITY ______________________ STATE __________ ZIP __________

DATE ________________________________ YOUR SIGNATURE __________________________

(PLEASE PRINT OR TYPE COPY • FOR ADDITIONAL WORDS ATTACH SEPARATE SHEET)

November, 1970
BUILD 20 RADIO and Electronics Circuits

PROGRESSIVE "Edu-Kit" HOME RADIO COURSE

Now Includes

12 RECEIVERS
3 TRANSMITTERS
SQ. WAVE GENERATOR
SIGNAL TRACER
AMPLIFIER
SIGNAL INJECTOR
CODE OSCILLATOR

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

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods in training. You will learn theory, construction, servicing and use of your own Radio. You will learn to use hand tools, and learn to use standard type of punched metal chassis as well as the latest development of Printed Circuit chassis. You will learn the basic circuits of your model and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, Radio, Code Oscillator. You will learn and practice troubleshooting, using the Progressive Signal Trainer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

The "Edu-Kit" is a product of many years of teaching and engineering experience. The "Edu-Kit" will provide both self-education in Electronics and Radio, worth many times the few dollars you pay. The Signal Trainer alone is worth more than the price of the Kit.

THE KIT FOR EVERYONE

You do not need the largest background in radio or science. Whether you are interested in radio because you want an interesting hobby, or because you want to have a radio, or because you have been a "radio bug" for years, the "Edu-Kit" is a worthwhile investment. Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries. The "Edu-Kit" has been carefully designed, easy to learn, easy to use. The "Edu-Kit" allows you to teach yourself at your own pace, at your own speed, at your own time. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study, practice, trouble-shooting—all in a closely integrated program designed to provide an easy, thorough, and interesting background in radio. You begin by examining the various radio parts of the "Edu-Kit." You then learn the function of these parts by building a simple radio. With this first set you will be learning to listen to regular broadcast stations, learn theory, practice assembly, and trouble-shoot the kit. You will then move on to advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself with more advanced model radios which require different work like a professional radio. The "Edu-Kit" contains no printed text that you must read, but includes in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Injector, Code Oscillator and Signal Injector, or a Printed Circuit "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring, soldering, etc. All the construction known as "Printed Circuit." These circuits operate on your regular AC or DC house current.

THE "Edu-KIT" IS COMPLETE

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

In addition you receive Printed Circuit materials, including Printed Circuit Chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Trainer and the Progressive Signal Injector, a High Fidelity Receiver, and a Quiz Book. You receive the Educational Research in Radio-Television, Free Consultant Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instruction, and a complete program to keep your radios in working order.


UNCONDITIONAL MONEY-BACK GUARANTEE

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

1. Deluxe Model $31.95
2. New Expanded Model $34.95 (Same as Deluxe Model plus Television Course).

Check one box to indicate manner of payment
☐ Send me FREE additional information describing "Edu-Kit."

Name
Address
City & State Zip.

PROGRESSIVE "Edu-Kits" Inc.
1189 Broadway, Dept. 610-AE, Hewlett, N. Y. 11557

CIRCLE NUMBER 10 ON PAGE 11

Electronics Illustrated
Electronics is opportunity, action and NTS!

ALL NEW KITS...ALL NEW COURSES, WITH NTS PROJECT-METHOD TRAINING! MORE BIG KITS THAN EVER OFFERED FOR TRAINING ANYWHERE!

A 295 sq. in. picture COLOR TV, a desk-top computer trainer, oscilloscope solid-state radios, integrated circuits, too! All part of NTS Project Method: The sure-fire system that builds everything you need to know around practical kit projects. And NTS gives you professional "test-center" equipment, including signal generator FET-VOM, and tube checker for your troubleshooting and servicing work. NTS shows you how to use them early in your training. You earn money repairing TV sets and electronic equipment even before you've completed the course. Brand new Color Catalog describes in detail all the exciting equipment that comes with each course.

CLASSROOM TRAINING AT LOS ANGELES:
You can train at our resident school in Los Angeles. NTS occupies a city block with over a million dollars in facilities devoted to technical training. Check special box in coupon.

HIGH SCHOOL AT HOME:
NTS offers accredited high school programs. Take only the subjects you need. Study at your own pace. Everything included at a low tuition. Check special box in coupon for free catalog.

APPROVED FOR VETERANS

ACT NOW! DON'T DELAY! 10 TRAINING PROGRAMS TO INSURE YOUR FUTURE

Please rush new Color Catalog and Sample Lesson plus information on course checked below. No obligations. No salesman will call.

- MASTER COURSE IN COLOR TV SERVICING
- MASTER COURSE IN COLOR TV SERVICING
- MASTER COURSE IN TV & RADIO SERVICING
- PRACTICAL TV & RADIO SERVICING
- MASTER COURSE IN ELECTRONIC COMMUNICATIONS
- FCC LICENSE COURSE
- MASTER COURSE IN ELECTRONICS TECHNOLOGY
- INDUSTRIAL AND AUTOMATION ELECTRONICS
- COMPUTER ELECTRONICS
- BASIC ELECTRONICS
- High School at Home
- Major Appliances Servicing Course

Name ___________________________ Age ______
Address __________________________
City ___________________ State ______

Please fill in Zip Code for fast service

☑ Check if interested in Veteran Training under new G.I. Bill
☑ Check here if interested ONLY in Classroom training in Los Angeles
National Technical Schools makes it easier to double your income. All you need is your own ambition. The NTS Project Method simplifies your training... makes it easy for you to enter Electronics... a whole new world of opportunity. You can have a solid career and probably double your present earnings. Start moving up today. In Color TV. Or in computer and industrial electronics. Or in communications and aerospace. It's easier than you think.

**NTS will show you how!**