Build our Sound-off, Short-out BURGLAR ALARM
Bong goes the gong, dead goes the engine, away goes the thief!

Foil thieves not one, but two ways—see page 33

- BUILD NO-TICKET HAM RADIO RIG
- SELF-CALIBRATING CB MOD CHECKER
- 10-BUCK BOOSTER FOR REAL BCB DX

THE AMAZING POOLROOM IN THE SKY

21 SECOND TV CURE-ALL

U.S. AM STATIONS
WORLDWIDE SW
POLICE/EMERGENCY
Eico Makes It Possible
Uncompromising engineering—for value does it!
You save up to 50% with Eico Kits and Wired Equipment.

Eicocraft
The newest excitement in kits.
100% solid state and professional signal.
Fun to build and use. Expandable, intercompatible. Great "jiffy" projects and an introduction to electronics. No technical experience required. Five 1/2 parts, predrilled etched printed circuit board, step by step in instructions.

NEW


NEW

EC 200 Audio Power Amplifier $39.95, EC 201 20-Watt Solid State Amplifier $39.95, EC 203 FM Transmitter $49.95, EC 204 FM Transmitter $59.95, EC 205 FM Transmitter $69.95.

NEW

EC 300 Tunable FM Radio $19.95, EC 301 FM Radio $29.95, EC 302 FM Radio $39.95, EC 303 FM Radio $49.95, EC 304 FM Radio $59.95, EC 305 FM Radio $69.95.

NEW


NEW


NEW


NEW


NEW


NEW


NEW


NEW


NEW


NEW


NEW


NEW


Color n' Sound
Add a new dimension to your music system. Introducing the first inexpensive solid-state electronic system which provides true synchronization of color with sound. Watch the music you love spring to life as a vibrant, ever shifting interplay of colors.

Simply connect to speaker leads of your Hi-Fi system (or radio). Kit can be assembled in several hours—no technical knowledge or experience necessary. Kit $49.95, Wired $79.95.

Automotive
EICO 888—Car/Boat Engine Analyzer. For all 6V/12V systems, 4, 6, 8-cyl. engines.

Now you can keep your car or boat engine in tip-top shape with this solid-state, portable, self-powered universal engine analyzer. Completely tests your total ignition-electrical system. Complete with a Tune-up & Trouble-shooting Manual. Model 838: $49.95, Wired $69.95 wired.

Test Equipment
100 best buys to choose from.

"The Professionals"—laboratory precision at lowest cost.

Model 232 Peak-to-Peak VTVM. A must for color or B&W TV and industrial use. 7 non-slip ranges on all 4 functions. With exclusive Uni-Probe. $34.95 kit, $49.95 wired.

FREE 1969 CATALOG
EICO Electronic Instrument Co., Inc.
51 Malta St., Brooklyn, N.Y. 11207
[ ] Send me FREE catalog describing the full EICO line of 700 best buys and name of nearest dealer...

Name
Address
City
State
Zip
Without NTS training you've only scratched the surface in electronics...

NTS digs deep into electronics. Proof? Look at the close-up at the left. It's the first transistorized digital computer-trainer ever offered by a home study school.

Fascinating to assemble, the NTS Compu-Trainer® introduces you to the exciting world of computer electronics. Its design includes advanced solid-state NOR circuitry, flip-flops, astable multivibrators and reset circuits. Plus two zener and transistorized voltage-regulated power supplies. The NTS Compu-Trainer can perform 50,000 operations per second, and is only one of many ultra-advanced kits we offer to give you incomparable, in-depth career training.

NTS... THE FIRST HOME STUDY SCHOOL TO OFFER LIVE EXPERIMENTS WITH INTEGRATED CIRCUIT KITS

With NTS Project-Method Home Training, you build a computer sub-system using the new, revolutionary integrated circuits. Each one, smaller than a dime, contains the equivalent of 15 resistors and 27 transistors.

With Project-Method, kits are carefully integrated with lesson material. All our kits are real equipment—not school-designed versions for training only. Project-Method was developed in our giant resident school...and proven effective for thousands of men like yourself. It's the practical-experience approach to learning. Gets you going in a hurry!

COMMUNICATIONS

This Transceiver is included in Communications courses. It's yours to build...to easily prepare for F.C.C. License exam...To become a fully-trained man in communications.

25" COLOR TV

Included in Color TV servicing courses. Building this advanced receiver gets you deep into color circuitry—advances you into this profitable field of servicing—the easy way. Color is the future of television, and your future, too!

GET THE FACTS! SEE ALL NEW KITS AND COURSES OFFERED IN THE NEW NTS COLOR CATALOG. SEND THE CARD TODAY! No obligation. No salesman will call.

Classroom Training At Los Angeles. You can take classroom training at Los Angeles. NTS occupies a city block with over a million dollars in facilities devoted exclusively to technical training. Check box on coupon.

INDUSTRIAL & COMPUTER ELECTRONICS

New ideas, new inventions, are opening whole new fields of opportunity. Electronic control systems, computers, are being applied to great numbers of manufacturing processes every day. We train you for this new field, fast! With advanced control systems, devices, a new 5" oscilloscope, and the NTS Compu-Trainer. Modern, quick and easy training prepares you to enter this brand-new world like a pro.

NATIONAL TECHNICAL SCHOOLS

WORLD-WIDE TRAINING SINCE 1905

4000 So. Figueroa Street  Los Angeles, Calif. 90037

APPROVED FOR VETERANS

Accredited member:
National Home Study Council
National Association of Trade and Technical Schools.

February-March, 1969
Radio-TV EXPERIMENTER

February/March 1969

• CABLE TV'S PICTURE IS CLEAR
  The CATV Caper—ghost, you die!

• SPECIAL CONSTRUCTION PROJECT
  Autoguard—car burglar alarm with protection plus

• SCIENCE SPECIALS
  21-Second TV Cure-All
  Electromagnetic Pulse Pickup—2 to 100,000 rpm!
  The Amazing Poolroom in the Sky—proton pool pays off

• CONSTRUCTION PROJECTS FOR HOME AND SHACK
  Mini-Mod—every CBer needs one
  No-Ticket Rig—great starter station
  BCB Booster
  Rapid-Pulse Calibrator—for real scope power
  Autodim—like front-row center at the theater

• ELECTRONICS FEATURES
  It’s Sex that Makes Them Different—cartoon page
  Radio, Grandpappy Style
  Need Service Info? Try Microfilm!
  Reel Gone Fishing—no strings attached!
  The Temptress, the Towers, and the Gold
  Two-Band Tuner in a One-Band Case

• LAB CHECKS
  Allied 1150 Portable Cassette Recorder
  Dynaco PAT-4 Stereo Preamp and 120 Power Amplifier
  Injectorall 500 Printed Circuit Kit

• COMMUNICATIONS: CB / HAM / SWL
  CB Rigs & Rigmarole—what’s new
  Propagation Forecast
  Ham Traffic—what price ham radio?

• NEW THIS ISSUE
  Stamp Shack—for those stuck on stickums
  Emergency Radio Services—Chicago area

• REGULAR DEPARTMENTS
  Positive Feedback—editorial chit-chat
  Bookmark—by Bookworm
  New Products—goodies and gadgets
  Ask Me Another
  Literature Library


Cover drawing
by Joe Rak
Success in Electronics Comes as Naturally as 1–2–3 through Education

There they are — three big steps — three deliberate steps which lead directly to success in electronics. Your future is shaped by the moves you make — by the steps you take. Begin now with Step ≠ 1.

STEP ≠ 1 is a simple request for full information on the Grantham Associate Degree Program in Electronics. You take this step by filling out and mailing the coupon. We mail our catalog to you; we do not send a salesman.

STEP ≠ 2 is earning your FCC first class radiotelephone LICENSE and radar endorsement. You complete this step in the first two semesters of the Grantham educational program (by correspondence or in residence). Train with the school which gives associate-degree credits for your license training, offering you the opportunity to advance beyond the FCC license level to a college degree in electronics.

STEP ≠ 3 is earning your ASEE DEGREE. This degree is conferred when you have earned credit for all six semesters of the Grantham curriculum.

The Grantham Associate Degree Program offers in-depth technical education, and prepares you for employment as an engineering technician—a big step above an ordinary technician. (Most of our students are already technicians when they begin the course.) Engineering technicians usually work directly with scientists and engineers, analyzing and solving engineering problems. You can make more money as an engineering technician!

Accreditation, and G.I. Bill Approval

Grantham School of Electronics is accredited by the Accrediting Commission of the National Home Study Council, and is approved for both correspondence and resident training under the G.I. Bill. Just mail the coupon, or write or telephone us for full information without obligation.

Grantham School of Electronics
1505 N. Western Ave., Hollywood, Calif. 90027
818 18th Street, N.W., Washington, D.C. 20006
Telephone: (213) 469-7878
Telephone: (202) 298-7460

Grantham School of Electronics has conferred on
John Doe the degree of
Associate in Science in Electronics Engineering

FEBRUARY-MARCH, 1969
LEARN ELECTRONIC THEORY

BY BUILDING THESE STEP-BY-STEP KITS

Embark now on an exciting step-by-step journey toward the assembly of a highly professional eight-transistor or five-tube radio. Enjoy the personal pride and accomplishment of assembling your own radio... and learning a great deal about basic electronics and radio theory. Graymark, leader in kits for instructional classroom use, here offers two of these radio kits to the public. Each comes complete with all parts and fully illustrated/easy-to-follow instruction manual. All parts are fully warranted. Send coupon below for fully illustrated color brochure.

"COMACHO" EIGHT-TRANSISTOR RADIO. Kit provides basics of superheterodyne transistor theory operation. Builds into an attractive printed circuit board radio, mounted in plastic case. Compares favorably with more expensive units. Earphone included. $19.95 each.

"SCALLON" FIVE-TUBE RADIO. Easy-to-understand kit approach to superheterodyne circuitry. Assembles into a distinctive table-type radio. Tubes, contemporary walnut cabinet included. $21.95 each.

Send order today to:

Graymark ENTERPRISES, INC.
P.O. Box 54343 • Ter. Annex, • Dept. 104
Los Angeles • Calif. 90054

Send Kits Checked
□ COMACHO ($19.95 ea.) □ SCALLON ($21.95 ea.)

□ Send Postpaid. Enclosed find check/money order for full amount. (Calif. Res. add 5% total purchase)
□ Send C.O.D. I will pay full amount, plus postage.
□ Send illustrated color brochure.

Name ________________________________
Address ________________________________
City & State Zip __________________

Radio-TV EXPERIMENTER

Feb./Mar. 1969 Vol. 26/No. 1
Dedicated to America's Electronics Hobbyists

Editor-in-Chief
JULIAN M. SIENKIEWICZ
WA2CQL, KMD4313

Managing Editor
RICHARD A. FLANAGAN
KQD2566

Technical Editor
CLIFFORD L. FORBES
KBQ8535

Art Editor
JIM MEDLER

News Editor
HELEN PARKER
KQD7967

Art Director
ANTHONY MACCARRONE
Graymark ENTERPRISES, INC.

Cover Art Director
IRVING BERNSTEIN
Associate Art Director
JOHN YUSKO
Art Associate
JACK GOLDEN
Advertising Director
JIM CAPPELLO
Production Director
CARL BARTEE
Production Assistant
Marilyn VARGAS
Instrument Division Manager
WILFRED M. BROWN

President and Publisher
B. G. DAVIS

Executive Vice-President and Assistant Publisher
JOEL DAVIS

Vice-Preside and Editorial Director
HERB LEAVY, KAD4529

Vice-Preside and Production Director
LEONARD F. PINTO

Vice-Preside and Treasurer
VICTOR C. STABLE, KBO381


EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of manuscripts, art work, or photographs. All contributions should be addressed to the Editor, RADIO-TV EXPERIMENTER, 229 Park Avenue South, New York, N.Y. 10003.

MAIL ORDER SHOPPING MART UNUSUAL VALUES

A selection of products available by mail for readers of Radio-TV Experimenter
All merchandise sold on a money-back guarantee. Order Direct by Stock No. Send check or M.O.

SEE MUSIC IN DAZZLING ACTION


dramatic breakthrough in audio-visual enjoyment

Actually see favorite musical selections translated into fantastic patterns of beautiful color - each individual note creating its own unique twisting, radiating shape... each strain dancing and prancing, whirling and swirling in perfect time with the music. Easily attached to stereo, radio, tape recorder. Send 25c in coin for 16-page booklet. S9066HP No.85,181HP No.71,004HP No.71,103HP No.71,008HP

NEW! PROJECTION KALEIDOSCOPE

At last - a low-cost unit complete with 24-diam. liquid wheel. Projects infinite variety of brilliant color patterns which do not repeat. Mobility designed wheel. 16 projection lens and Edmund Visual Special Effects program. Please it all possible. Easily operated. Large screen image at short projection distance; perfect for home ground. Troubleless light source. Send 5c in coin for 16-page booklet. S904HP

LONG-WAVE BLACK LIGHT FIXTURE

Extremely versatile, completely-designed long-wave (200-365 angstrom) black-light (ultraviolet) fixture. Has 6 volt, 110 volt or built-in filtration harness. Short wave ultraviolet rays, 253.7 A, are emitted from six highpowered lamp elements. Also perfect for home and commercial uses. Includes built-in reflector, push-pull switch, connecting plug, Mount vert., horiz., or on corner. 11/4" W., 11/2" H. Stock No. 70,134HP $8.95 Ppd. Stock No. 70,124HP (Replacement Bulb) $3.25 Pdpd.

NEW! LOW-COST COLOR ORGAN

Create tremendous variety of unusual and beautiful effects. Simply plug into 220 volt outlets. Sets of colored lights and place near audio sources. Hues picked up by interior "continuous" detector mechanism which colored light goes on intensity determines intensity. Summing up variety of commercial, display and home use-control lighting in pools and fountains, window and holiday decorations. See Color Organ Booklet. S903HP Stock No. 1900HP $39.95 Ppd. Stock No. 71,103HP- 1 lb. 11 oz. $195.00 Ppd.

Gigi FREE CATALOG

148 PAGES! MORE THAN 4,000 UNUSUAL BARGAINS!

Completely new. Packed with huge selection of lenses, prisms, optical instruments, parts and accessories, 100's of charts, illustrations. Many hard-to-get surplus bargains. Enormous variety of telescopes, microscopes, binoculars, magnets, photo components, etc. For hobbyists, experimenters, workshops, factories. Shop by mail. No salesman will call. Simply check coupon or write for Catalog "HP" to Edmund Scientific Co., 300 Edscoop Bldg., Barrington, New Jersey 07007.

ORDER BY STOCK NUMBER • SEND CHECK OR MONEY, ORDER • MONEY-BACK GUARANTEE

EDMUND SCIENTIFIC CO. 300 EDSCP CORP BUILDING BARRINGTON, NEW JERSEY 07007

FEBRUARY-MARCH, 1969
What may look like a mod spider made of plastic and metal bits is actually GE’s new monolithic integrated circuit. It’s a five-watt IC chip, and that’s 5 watts rms, folks! Designated the PA246, the IC power amplifier is designed for consumer and industrial systems requiring up to five watts of audio power output into a 16-ohm load. Introduction of this integrated circuit makes GE’s Semiconductor Products Department the first to offer a complete line of monolithic integrated circuit audio amplifiers. (In addition to the PA246, GE manufactures a one-watt audio IC—type PA234—and a two-watt audio IC—PA237).

To supply that five watts of audio, GE engineers developed an improved heat dissipation package design based on a modification of the plastic dual-in-line package (DIP). This new package provides lower thermal resistance from the IC chip to an attached heat sink.

The IC amplifier plastic package contains two heat sink tabs and eight leads in a staggered arrangement. The two tabs extend from each side of the package, along with the leads, and are made of copper for good heat transfer. The tabs can be readily attached to an external heat sink during the flow solder run of the printed circuit board used for mounting. Experimenters can solder copper sheets about 1/2-in. square to each tab when the ICs push the full five watts.

The new IC device will operate from a wide range of power supply voltages up to 37 volts. Frequency response extends from 30 Hz to 100 kHz; noise output is typically –70 dB, relative to five watts. At the full power output of five watts, input sensitivity is 180 mV and output harmonic distortion is under 1% at 1 kHz.

The really big news is price. One GE PA246 IC costs only $3.84. At this writing we know of one source that has units for sale. If you want one to ten PC246s, send $3.84 per IC plus 75¢ to cover shipping and handling costs to Electronics Hobby Shop, Box 124, Springfield Gardens, N.Y. 11413. ICs are shipped with complete specs and diagrams.

Tuff to Believe Dept. One of our readers, John N. Ramsey of West Hartford, Conn., reports on a letter he received from the FCC. The message was in answer to a question he asked. “What should I do if I hear a distress call on my shortwave receiver?”

Reader Ramsey quotes the FCC’s answer, “. . . If you should hear a distress signal that is not answered in 30 minutes, you should report the matter to the nearest FCC office giving all details of the message including call letters and the frequency on which the message was sent . . .”

So don’t worry, folks. If you ever have to call for help on the old wireless, don’t let no answer upset you. Some shortwave listener will report your trouble to the FCC in 30 minutes. Help will be on the way. This is a comforting thought for those who with only 25 minutes of fuel left are searching for an airport in a fog; or someone about to jump into shark-infested waters as his cabin cruiser burns to the water line; or—oh, you think of a situation! Old Funny Crazy Chaos has chalked up another boo-boo!

Hey, We Did It Again! If you haven’t seen it yet, then go back to your favorite newsstand and look for our latest issue of Electronics Hobbyist. The Editors of Radio-TV Experimenter and Elementary Electronics packed the issue with the best construction projects that can be mastered. Projects were selected to cover two types of builders—those who like to finish the job in one evening and those who don’t mind tinkering in the shop on weekends. And it makes no matter what your specialty is—SWL, amateur radio, audio, test gear, or projects just for fun—Electronics Hobbyist has the project you want packed between its covers.

So why don’t you pick up a copy today. If you’re snowed in, let the mail man do the toting for you. Just send $1.25 (that includes postage and handling) to Electronics Hobbyist, Spring/Summer 1969 Edition, 229 Park Ave. S., New York, N.Y. 10003.

Here are three views of GE’s new PA246 IC power amplifier that’ll knock out 5 watts rms continuously—a big breakthrough for hobbyists.
Here's a new, complete ICS course in TV Servicing that costs less than $100.

With the first two texts, you can repair 70 percent of all TV troubles.

You need no previous experience to take this complete, practical course in TV Repairing.
You don't even have to know a vacuum tube from a resistor. Yet in a matter of months, you can be doing troubleshooting on color sets!
Course consists of 6 texts to bring you along quickly and easily. 936 pages of concise, easy-to-follow instruction, plus 329 detailed illustrations. You also receive a dictionary of TV terms geared directly to course material so you'll understand even the most technical terms.
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.
Quizzes are spotted throughout the texts so you can check your progress. At the end of the course, you take a final examination. Then you get the coveted ICS® diploma, plus membership in the ICS TV Repairman Association.
By the time you've finished the course, you should be able to handle tough, multiple TV problems, on color sets as well as black and white.
This new TV Servicing and Repair Course has been approved by National Electronic Associations for use in their Apprenticeship program. Because of its completeness, practicality and price, it is the talk of the industry. The cost is less than $100—just slightly over 1/2 the price of any comparable course on the market today.
Remember, the sooner you get started on your course, the sooner you'll be turning your spare time into real money. Fill out the coupon and mail today. We'll rush you complete information at no obligation to you.
The HEATHKIT "Boonie-Bike"... The All-Season Trail Bike

Introducing the new Heathkit GT-18 Trail Bike... it lets you go places other people can't... remote backwoods and forest areas... rugged mountain regions... isolated lakes & streams... rough country roads and long forgotten paths... even in the snow... places inaccessible by usual means. With the GT-18 you no longer have to depend on paved or dirt roads, or even trails. The GT-18 is only 24½" wide — if there's room to walk, you can ride with this one. But don't let the small size give you the wrong impression. The GT-18 is full of surprises. It's larger and husker than a mini-bike, smaller, lighter and substantially more powerful than a motorcycle-type trail bike... and it has the agility, stability, traction and sheer guts of a mountain goat. Here's why: Pre-mounted on the welded ⅜" tubular steel frame is the easy-starting Briggs & Stratton 5 horsepower, 4 cycle engine, and it gets the 116 pound GT-18 extraordinary power. Performance? You can't touch it for any price. The behemoth front end is big by trail bike standards (5.30 x 4.50"), but the tubeless rear tire is nothing short of huge — 18 x 8.50"! And that's what's behind the amazing all-surface performance... that 8½" tread coupled with the 5 horsepower, 4 cycle engine and 5 horse engine will power you thru mud, sand, snow, gravel, tall weeds and even underbrush... up steep hills & rock; paths that would put other bikes totally out of it. And when the going gets rough, just slam on the optional ski accessory (GTA-18-1 at $16.95). Heath's unique "grip-lock" mounting eliminates any need for tools too!

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

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

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

HEATHKIT TA-38 Solid-State Bass Amplifier

The new Heathkit TA-38 is the hottest performing bass amp on the market, with quite a few reasons. First, there's all-solid-state circuitry for reliability. Then there's the tremendous power — the TA-38 puts out 120 watts of EIA music power, 240 watts peak, or 110 watts continuous. Extremely low harmonic & IM distortion too. Many amps suffer from "blow-out" problems, but not the new TA-38 — YOU CAN'T BLOW IT... it boasts two 12" heavy-duty special design speakers with giant 3 pound 6 ounce magnet assemblies mounted in a completely sealed, heavily damped ½" pressed wood cabinet — those speakers will take every watt the amp will put out, and still not blow. Sound? The TA-38 is tailored to reproduce the full range of bass frequencies delivered by bass guitars and its sound with combo organs and other instruments is remarkable. Easy 15 hour assembly to the wildest bass amp on the market. Order one now and surprise the guys with the high-priced gear. 130 lbs.

HEATHKIT SB-310 Professional SW Receiver

The finest shortwave receiver you can buy. Covers six shortwave broadcast bands (99, 41, 31, 25, 19 & 16 meters), 30, 40 & 20 meter amateur bands and 11 meter CB. And the new optional SBA-310-3 kit converts the 11 meter band to 15 meters for additional amateur coverage. Has many of the same features that have made Heathkit amateur gear the world's best selling... pre-built & pre-aligned Linear Master Oscillator... crystal-controlled "front end" for same-rate tuning on all bands... linear tuning with 1 KHz dial calibrations... separate RF and AF gain controls... 5 KHz crystal filter included for clear AM, CW & SSB reception... switch-selected upper and lower sideband coverage... built-in 100 KHz calibrator... headphones jack... calibrated "S" meter... famous Heathkit SB-Series styling and much more. For the finest shortwave listening, order your SB-310 today. 24 lbs. SBA-310-3, 15 Meter Conversion Kit, $1fb, $59.95.
HEATHKIT AD-27 FM Stereo Compact

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

HEATHKIT AD-17 Stereo Compact

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

HEATHKIT AS-18 Miniature Speaker System

Miniature in size, but not in performance. This new Heathkit acoustic suspension system features two Electro-Voice® speakers — a 6" woofer and a 2½" tweeter for 60 Hz to 20 kHz response. Handles 25 watts of program material. Adjustable high frequency balance control lets you adjust the sound to what you like. The 8½" H x 15¼" W x 6½" D walnut cabinet is protected by clear vinyl for lasting good looks. Pick a pair of these performers for stereo compacts. 16 lbs.

HEATHKIT MI-18 Solid-State Tachometer

The new Heathkit MI-18 has advanced performance features like unique inductive pickup for connection to any spark-type engine and any ignition system, 0-6000 & 0-9000 RPM ranges, temperature compensated ±½ accuracy, stainless steel hardware, splashproof black & chrome case. Pick the MI-18-1 for panel mounting, or the MI-18-2 with case and hardware. Send for yours now. 4 lbs.

HEATHKIT GR-17 Solid-State AM-FM Portable

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

HEATHKIT GD-325C Low Cost Solid-State Organ

Put the sound of live music in your home now with this low cost, all solid-state Heathkit/Thomas Organ. It features all genuine Thomas factory-fabricated parts and 5-year warranty on the plug-in tone generators. True organ voices . . . variable repeat percussion . . . 13 note heel and toe bass pedals from C1 to C2 range. . . . two overhanging 37-note keyboards, range C2 thru C1; each . . . Color-Glo keylights . . . 75 watt peak music power amplifier . . . 12" speaker . . . vibrato . . . manual balance control. Thousands of people have already experienced the thrill and unique personal satisfaction of building this sophisticated, beautiful sounding musical instrument, and you can too. It takes no special skills or knowledge — the famous Heathkit manual with its easy to follow instructions and giant fold-out pictorials make the 50 hour assembly enjoyably simple. Comes with finished walnut cabinet and bench plus 40-lesson self-teach course. Put the sound of music in your home this Christmas with the GD-325C from Heathkit. 172 lbs.
Heathkit Christmas Gifts

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

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

New GR-681 Deluxe Color TV $499.95
With Automatic Fine Tuning

The new Heathkit GR-681 is the most advanced color TV on the market. A strong claim, but easy to prove. Compare the "681" against every other TV — there isn't one available for any price that has all these features. Automatic Fine Tuning on all 83 channels... just push a button and the factory assembled solid-state circuit takes over to automatically tune the best color picture in the industry. Push another front-panel button and the VHF channel selector rotates until you reach the desired station, automatically. Built-in cable-type remote control that allows you to turn the "681" on and off and change VHF channels without moving from your chair. Or add the optional GRA-681-6 Wireless Remote Control described below. A bridge-type low voltage power supply for superior regulation; high & low AC taps are provided to insure that the picture transmitted exactly fits the "681" screen. Automatic deausing, 2-speed transistor UHF tuner, hi-fi sound output, two VHF antenna inputs... plus the built-in self-servicing aids that are standard on all Heathkit color TV's but can't be bought on any other set for any price... plus all the features of the famous "295" below. Compare the "681" against the others. GRA-227-8, Mediterranean cabinet shown $119.50
Other cabinets from $62.95

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

Big, Bold, Beautiful... and packed with features. Top quality American brand color tube — with 293 sq. in. viewing area... new improved phosphors and low voltage supply with boosted B+ for brighter, livelier color... automatic deausing... exclusive Heath Magna-Shield... Automatic Color Control & Automatic Gain Control for color purity, and flutter-free pictures under all conditions... preassembled IF strip with 3 stages instead of the usual two... deluxe VHF tuner with "memory" fine tuning... three-way installation — wall, custom or any of the beautiful Heath factory assembled cabinets. Add to that the unique Heathkit self-servicing features like the built-in dot generator and full color photos in the comprehensive manual that let you set-up, converge and maintain the best color picture at all times, and can save you up to $200 over life of set in service calls. GRA-295-1, Walnut cabinet shown $62.95
Other cabinets from $99.95

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

Has same high performance features and built-in servicing facilities as the GR-295, except for 227 sq. inch viewing area. Feature for feature the Heathkit "227" is your best buy in deluxe color TV viewing... tubes alone list for over $245. For extra savings, extra beauty and convenience, add the table model cabinet and mobile cart. GRS-180-5, table model cabinet and cart $39.95
Other cabinets from $24.95

Now, Wireless Remote Control For Heathkit Color TV's

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

kit GRA-681-8, 7 lbs., for Heathkit GR-681 Color TV's $59.95
kit GRA-227-8, 9 lbs., for Heathkit GR-227 and GR-25 Color TV's $59.95
kit GRA-227-8, 9lbs., for Heathkit GR-227 and GR-180 Color TV's $68.95
HEATHKIT AR-15 Deluxe Solid-State Receiver

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

HEATHKIT AJ-15 Deluxe Stereo FM Tuner

The remarkable solid-state FM stereo tuner section from the famous Heathkit AR-15. If you already own a fine stereo amplifier, the AJ-15 is the stereo FM tuner for you. It has the exclusive Heathkit FET FM tuner with two FET RF amplifiers and an FET mixer for 1.5 uV sensitivity and excellent cross modulation. The tuner section is completely factory assembled and aligned for easier construction too. Other features include the exclusive Heathkit Crystal filters in the IF section for perfect band gap shape, noise operated squelch, stereo threshold control, "Black Magic" panel lights and more. Put the world's best FM stereo tuner in your system now... the AJ-15. 18 lbs. Optional walnut cabinet: AE-18, 8 lbs... $19.95

HEATHKIT AA-15 Deluxe Stereo Amplifier

The powerful solid-state amplifier section from the famous Heathkit AR-15. If you already have a fine stereo tuner, the AA-15 is the perfect mate for it. It delivers 150 watts of music power. 75 watts per channel... virtually flat response from 8 Hz to 40 kHz... less than 0.5% Harmonic & IM distortion at full output... individual input level controls... two front panel stereo headphone jacks... a tone-flat switch that bypasses the wide-range tone controls... loudness switch... all circuit protection that makes the power amplifier circuits virtually short-circuit proof and "Black Magic" panel lighting. Put the world's best stereo amplifier in your system now... the AA-15. 26 lbs. Optional walnut cabinet: AE-18, 8 lbs... $19.95

HEATHKIT AS-48 High Efficiency System

Our finest Heathkit System... the new AS-48 with famous JBL speakers. The specially constructed 14" woofer employs a 4" voice coil, 11 1/2 pounds of magnet assembly and an inert, self-damping material to deliver clean, full-bodied bass down to 40 Hz. Crisp, open highs, up to 20 kHz come from the 2" direct radiator. LC-type crossover. The three position HF level control gives balance as you like it. All components are front mounted in the beautiful one-piece assembled finish cabinet for easy construction. For very high performance stereo, order two of these amazing bookshelf systems today. 43 lbs.

HEATHKIT AS-38 Bookshelf System

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

NEW

FREE 1969 CATALOG!

Now with more kits, more color pictures, more组装! Fully describes how to put together over 300 kits for stereo, hi-fi, color TV, electronic organs, electric guitar & amplifier, amplifiers, radio, marine, educational CB, home hobby, too. Free coupon with every Heathkit Catalog. Benton Harbor, Michigan 49022.
Fill in coupon for a FREE One Year Subscription to OLSON ELECTRONICS' Fantastic Value Packed Catalog—Unheard of LOW, LOW PRICES on Brand Name Speakers, Changers, Tubes, Tools, Stereo Amps, Tuners, CB, and other Values. Credit plan available.

NAME ________________________________
ADDRESS ________________________________
CITY __________________________ STATE __________
GIVE ZIP CODE __________________

If you have a friend interested in electronics send his name and address for a FREE subscription also.

OLSON ELECTRONICS
328 S. Forge Street Akron, Ohio 44308

FREE

McGEE'S CATALOG
1001 BARGAINS IN SPEAKERS—PARTS—TUBES—HIGH FIDELITY COMPONENTS—RECORD CHANGERS—TAPE RECORDERS—KITS—EVERYTHING IN ELECTRONICS

McGEE RADIO CO.,
1901 McGee St. (RTE) Kansas City, Missouri 64108

NOW FOR 1969
SEN'T FREE

Czechoslovakia's postal administration just issued a pair of stamps that would gladden the hearts of American broadcasters. The one commemorates the 45th anniversary of public radio; the other ballyhoos the importance of the national TV industry. They're intended to encourage domestic pur-
The New 1968 Improved Model 257 A REVOLUTIONARY NEW TUBE TESTING OUTFIT

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

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

COMPLETE WITH ALL ADAPTERS AND ACCESSORIES, NO "EXTRAS"

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

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...

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

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.

$4750

SEND NO MONEY WITH ORDER PAY POSTMAN NOTHING ON DELIVERY

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

ACCURATE INSTRUMENT CO., INC.
Dept. 689 2435 White Plains Road, Bronx, N. Y. 10467

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

Name:
Address:
City:
State:
Date:

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

February-March, 1969
one that depicts Cabot Tower, on a high hill above St. Johns, and from which Marconi sent his first signals to ships far out on the Atlantic.

Television is something else, for the tube didn't get into wide use until after World War II. The first one was turned out by Switzerland, in 1952, as one of four special designs to mark the centenary of the first Telecommunications Union. That organization was established in 1852, to formulate national and European regulations for the use of the telegraph as a public communications medium.

As the telephone, then radio and finally, TV were developed, and their use assumed by governments, these media's control were added to the union's jobs.

Switzerland's quartet of seventeen years ago are completely symbolic in design. Telegraphy is represented by a cross of dots and dashes stretching across the skies and one of the universe's galaxies; telephony, by a pole; radio by an antenna and radio waves; and TV by zig-zag waves emanating from an "eye" such as CBS has been using as its trademark.

The first really realistic TV publicity stamp is the product of the Italian Postal Administration. On Feb. 25, 1954, when the government opened its first national TV network, it issued 25 and 60 lire stickers, each of which depicts a TV antenna along with an actual receiving set on whose screen a map of Italy and its off-shore islands can be clearly seen.

A little more than a year later, on April 16, 1955, France joined the TV stamp parade. Its contribution consists of a 15-franc adhesive which features the Eiffel Tower, on top of which the French government's Parisian TV transmitting facilities had just then been installed. Circular waves emanate from it as rooftops in the foreground all have TV antennae to make the design as cluttered as the gay city's skyline.

Luxembourg was another European nation that marked the inauguration of TV, when on Sept. 1, 1955, it issued a stamp depicting Cabot Tower, on a high hill above St. Johns, and from which Marconi sent his first signals to ships far out on the Atlantic.

Television is something else, for the tube didn't get into wide use until after World War II. The first one was turned out by Switzerland, in 1952, as one of four special designs to mark the centenary of the first

Telecommunications Union. That organization was established in 1852, to formulate national and European regulations for the use of the telegraph as a public communications medium.

As the telephone, then radio and finally, TV were developed, and their use assumed by governments, these media's control were added to the union's jobs.

Switzerland's quartet of seventeen years ago are completely symbolic in design. Telegraphy is represented by a cross of dots and dashes stretching across the skies and one of the universe's galaxies; telephony, by a pole; radio by an antenna and radio waves; and TV by zig-zag waves emanating from an "eye" such as CBS has been using as its trademark.

The first really realistic TV publicity stamp is the product of the Italian Postal Administration. On Feb. 25, 1954, when the government opened its first national TV

network, it issued 25 and 60 lire stickers, each of which depicts a TV antenna along with an actual receiving set on whose screen a map of Italy and its off-shore islands can be clearly seen.

A little more than a year later, on April 16, 1955, France joined the TV stamp parade. Its contribution consists of a 15-franc adhesive which features the Eiffel Tower, on top of which the French government's Parisian TV transmitting facilities had just then been installed. Circular waves emanate from it as rooftops in the foreground all have TV antennae to make the design as cluttered as the gay city's skyline.

![Stamp Illustration](image-url)

**A word about our columnist...**

**Ernest A. Kehr**

Author of articles published in newspapers and magazines throughout the world and numerous books, including "Romance of Stamp Collecting" which has sold more copies and been in print longer than any other stamp book written; conducted courses in philately for City College of New York and Philatelic Foundation for over 20 years. Won Gainza Paz gold medal as "most distinguished philatelic writer" at international competition in Buenos Aires in which some 2,500 entries were judged. Member of jury at more than 30 international stamp exhibitions; founder and executive chairman of Philatelic Press Club; knighted by Queen Juliana, Grand Duchess Charlotte, Popes Pius XII and John XXIII; recipient of Grand Cross, Order of Merit by President Theodore Heuss (Germany) and made member of Honor of Ibero-American Academy of History, all for developing better understanding among people through philately and education. Advisor to many famous personalities including the late President F. D. Roosevelt, Cardinal Spellman, President Magsaysay; Gen. Mark Clark, Lauritz Melchior, etc.
showing its Dudelange transmitter. The following year the Saar (that territory had not yet become an integral part of Germany) issued a 15-franc stamp showing its new transmitter in Saarbrucken.

* Argentina and the Dominican Republic were the first Western Hemisphere nations to produce TV stamps. The first—issued in 1954—is a 5-peso value and again features the “CBS Eye” set against a symbolical pattern of TV waves. Trujillo’s was a 25-centavo special delivery stamp, whose design consists of a close-up view of a transmitting head atop a tall antenna tower in the island’s capital.

* Germany’s 1957 TV stamp probably is the most unusual of all. Issued to publicize the industry, it shows a grid pattern and dimming ball of light such as one sees as a set is turned on or off.

* A Hungarian, 2-forint stamp of 1958, shows what is reported to be 14-story Telecommunications Building in Budapest, with radio and TV waves from a roof-top transmitter encircling the entire picture. In addition to the regular stamp, this same design was printed on a souvenir sheet with gold margins and inscribed, “To commemorate the Founders of Hungarian Television.”

* Since these “early” years of TV postage stamps, literally dozens of other countries all around the world turned out their own. There are so many of them, in fact, that the American Topical Association, 3306 N. 50th St., Milwaukee, Wisc. 53216, has issued a special handbook which lists, describes and illustrates them as a guide for collectors who want to fill an album of their own. A few are a bit elusive, so hunting for them can add a bit of sport, but most are both readily available and inexpensive.

**Some Other Television Issues**

- **Switzerland** Scott #1001-9
- **Italy** Scott #C116-21

---

**NEW!**

DREMEL MOTO-TOOL with constant-torque permanent-magnet motor

Now all Dremel Moto-Tools belt out twice the torque of previous models! They’re virtually stall-proof, even when you’re really bearing down. Compact — lightweight — and now super-powered for grinding, drilling, polishing, carving, deburring, and sanding. Shock-proof Lexan housing. See your dealer for a demonstration.

- No. 260 super-compact .................. $22.95
- No. 270 with bronze bearings .......... $29.95
- No. 280 ball bearing construction ...... $39.95

**New Moto-Tool Kits**

Complete with Moto-Tool and 34 accessories

- No. 261 .................. $32.95
- No. 271 .................. $39.95
- No. 281 .................. $49.95

**New 160-page “Dremel Handbook of Hobbies, Crafts, and Projects”, only $1.45.**

Please send book. I enclose $1.45.

Send free power tool literature.

Name:________________________________________________________________________

Address:_____________________________________________________________________

City_____________________________State___________Zip________________________
□ Here's how you can be a first baseman. Yes, you could be the first in your neighborhood to have a new CB base station from E. F. Johnson.

Johnson's new rig is dubbed the Messenger 223 and it's a doozy! It's got a 23-channel synthesizer circuit which means that you've got no crystals to buy for full coverage. You get 15 dB more audio gain than any of the previous Messenger series sets, and it delivers the maximum legal power to your antenna.

In the looks department it's as slick as a buttered billiard ball with its built-in S meter which also shows the power output of the transmitter at no extra charge. All in all, the 223 runs 10 tubes, 8 diodes, 6 transistors.

Johnson will send you complete details. Just write to them at Waseca, Minn. 56093.

Anyone for Indians? Tennessee Valley Indians (TVI) is the popular CB term for TV Interference; and that's a popular term for Trouble. If you've got it you're a candidate for more problems than you need with neighbors and Uncle Sam. A standard remedy (and effective, too) is to rid thyself of this plague by the simple installation of a little TVI trap in your antenna line; right at the antenna connector on your rig. These traps are the famed "low pass filters" of song, story, and legend.

A new twist has now been added to the TVI trap: it's a tuning knob atop the filter which permits you to actually peak the trap for maximum efficiency with your specific rig and installation. It's a good idea and we're happy to see it available from the Gold Line Co., Muller Ave., Norwalk, Conn. 06852. Write to them for the poop and tell 'em we sent you.

Mini Rig Dept. It's always a kick to see some company totally minimize a CB base station to the point where it can be carried around in hand or pocket; and that's what the Claricon folks did with their Century 5 rig.

Think of it this way: it's a 2-channel rig that runs a full 5 watts input (3½ out), the receiver has 0.5 μV sensitivity for better than 10 dB S+N/N, it features AGC, ANL, and adjustable squelch. It will operate from house current (with an optional converter) or from rechargeable batteries. Sounds like a standard CB rig, doesn't it? Well, it's a hand-held unit.

Claricon has authorized their dealers to make a cash refund on these units if they fail to surpass any other 5-watt hand-held unit presently available. They're $175.00 per pair. Claricon
Electronics holes up at 663 Dowd Ave., Elizabeth, N.J. 07207—write them there.

Reach! An outfit called Reach Electronics, Box 308, Lexington, Neb. 68850, has come out with a nifty handset-control panel for mobile rigs. While primarily designed for mobile telephone units, it can be adapted to any rig. Besides looking very sharp, it can be fitted with various decoders and encoders for the ultimate in professional selective calling. It permits 8 channels to be selected by pushbutton control and can even be locked with a key to prevent unauthorized use of your gear.

It’s really a sophisticated chunk of electronics and if you want the complete scoop on it we suggest that you reach Reach.

Before We Sign Off. How about some of you CBers sending in a photo of yourselves with your CB gear? We’ll be glad to run any so that your brother operators will see what you’ve got going for yourself! C’mon, don’t be shy. Send to CB Rigs & Rigmarole, RADIO-TV EXPERIMENTER, 229 Park Ave. South, New York, N.Y. 10003.
CB Fix-it. Wanna discover how you can keep CB equipment in top shape, whatever the brand or special features? And it makes no matter whether you're just an operator, serviceman, or super-technician! Practical CB Radio Servicing by R. R. Freeland covers virtually every servicing problem the CBer will face.

A unique feature of Freeland's text is that each chapter is self-contained. The reader does not have to search through the entire book or refer to other chapters to find procedures for specific servicing chores. This isolation of tasks makes the text an ideal tool for spot testing and troubleshooting.

The book begins by detailing checkout procedures for both a fixed base station and for mobile units. Then, it explains a step-by-step method for measuring transmission and receiving frequencies for optimum performance and compliance with FCC rules. Measurement and corrective procedures for modulation and symmetry, power input and output, sensitivity and selectivity are fully discussed. The following chapters show how to diagnose and repair receiver problems, transmitter problems and power supply troubles easily and rapidly. Procedures for locating and correcting causes of interference, which can seriously hamper CB transmission and reception are fully covered, as well.

Practical CB Radio Servicing was written by Roy R. Freeland, President of International Crystal Mfg. Co., Inc. Roy probably sold the first CB rig ever, way back in September, 1958, and the Editor of Radio-TV Experimenter, then with another electronics magazine, was probably the first editor to be photographed with that same model CB rig back in CB's first year. The text was edited by Leo G. Sands, Editor of CB Magazine. Leo is the columnist who takes care of our Ask Me Another column as well as being a regular contributing author for Radio-TV Experimenter. Your Ol' Bookworm knows all three gentlemen and his comment is "It's getting to be a small, small world!"

You can pick up a copy of Practical CB Radio Servicing at local and mail order electronic parts houses, or direct from the publisher—Hayden Book Company, Inc., 116 West 14th Street, New York, N. Y. 10011.

Troubleshooting. Introducing Modern Electronic Troubleshooting, a new down-to-earth handbook that deals with today's electronic servicing problems on a practical level using modern test instruments and advanced troubleshooting procedures to cope with the special problems created by printed boards and solid-state circuitry. It is hard to conceive of a book that encompasses monochrome and color TV, multiband radio receivers, hi-fi equipment, tape recorders, two-way communications equipment, and test instruments for servicing all this equipment. Yet this book does! How? By getting right to the subject of how to service the equipment without the usual wordy theoretical discussions of how the circuits work.

This is a book for knowledgeable service technicians, dealing with the problems which are currently causing them the biggest headaches. The content is divided into five Sections. The first four deal with troubleshooting techniques and test instruments for servicing solid-state circuitry (in radio, TV, hi-fi, and communications gear), color-TV circuits, hi-fi and stereo equipment and two-way communications transceivers. The final section is on test equipment—not the usual run-of-the-mill theory, but special information such as how to add a triggered sweep to your old scope, how to use an R/C bridge effectively, how to service your own test equipment, etc.

In all, the 24 chapters provide the kind of all-inclusive servicing guidebook service technicians have been asking for—one that defines the troubles most prevalent in today's electronic equipment, and concentrates on quick troubleshooting procedures for locating the...

One More Time. The years since the development of high fidelity have brought with them an ever-growing number of books on all phases of the subject. Each, in its own way, has described the various advances and refinements made by the industry. Unfortunately for the hi-fi buff, too many of these volumes have been bogged down in unnecessary technical detail aimed at the technician. Now, the second edition of Hi-Fi Loudspeakers and Enclosures goes beyond the purely mechanical details to explore the possibilities of artistic excellence. Written by Abraham B. Cohen, the book recognizes that the listener himself is the final control on the realism of the reproduced sound.

To ensure a complete understanding of hi-fi sound reproduction, the book first examines the entire acoustic chain in step-by-step sequence. Each factor is treated individually and then combined in the analysis of integrated systems that follows. Recent developments, including three-element stereo and the all-in-one enclosure, are fully covered, and vital new information has been added on loudspeakers and enclosures. Pointing the way to improved acoustical performance, the book keeps the reader aware of such essentials as cost, size, appearance, and expansibility. As a special aid to the "do-it-yourself" enthusiast, 27 different basic enclosures have been provided. All of them appear in a simplified format and will suit any builder’s room size and use requirements. Available at bookstores, electronic parts dealers and mail-order houses, or direct from the publisher—Hayden Book Company, Inc., 116 West 14th Street, New York, N. Y. 10011.

Got A Watch? Here is a mammoth, quick-answer guide to over 700 TV circuit troubles—Tah’s new Pin-Point TV Troubles in 10 Minutes by Harold P. Manly.

For those who service TV receivers, this book offers practical help of a type not usually found in books of this type. Using 63 large-size photos of different picture-troubles, keyed
Fix That Set. The next time you need schematic diagrams and service information on a specific radio and TV set—don’t despair! Supreme Publications, the home fix-it fan’s family friend, is offering to send promptly by mail service material on almost any television, tape recorder, radio, stereo or record changer. Supreme is able to supply such information from its own service manuals, extensive files going back to the 1930s, and from factory released material. The usual charge is $1 for radio material, and $1.50 for TV material covering a specific set.

Your ol’ Bookworm chatted with James Lynch, manager of Supreme Publications who stated, “Each request for material is a challenge to us. And while most items can be easily and quickly filled, at times our Mr. Beitman (who has been connected with diagrams and servicing for 40 years) spends an hour or more to find a hard one.” Where else now-a-days can you get this personalized service for only a buck?

It is good to know that there is a large organization ready to supply service material on a radio or a TV set you may find hard to repair and for which you do not have a diagram and other helpful service data. Next time you run into a dog, and don’t have a schematic diagram, write to Supreme Publications, Dept. JMS, 1760 Balsam Road, Highland Park, Ill. 60035.

to trouble-finding charts which identify over 700 probable defects, the reader can pinpoint almost any TV circuit or component defect in a matter of minutes. Nearly 50 detailed trouble-finding charts pinpoint the most probable causes for defects in every circuit or major component—from tuner to picture tube, from sound and audio to power supply. A 5-page trouble-symptom chart allows the reader to quickly find the appropriate reference chart. For certain faults requiring special methods to locate and correct, not covered in the trouble-finding charts, suggested troubleshooting procedures are clearly presented in number-keyed paragraphs following the associated chart. Further, the beginning of each section gives information on circuit peculiarities, methods for improving performance, making service tests and adjustments, checking components, etc. You can get your copy direct from the publisher—Tab Books, Blue Ridge Summit, Pa. 17214.

What a Buy! Looking for a replacement for a DS501, GE-4, SM-3012, ET-7, TR-03, or 2N3314? HEP-231, the 15-amp, 150-watt germanium pnp power transistor in the TO-36 “Door Knob” package replaces them all (and some 55 other devices). But, these are only seven of the 12,000 transistors, rectifiers, zener diodes, dual diodes, and SCR semiconductor devices that hobbyists, experimenters, and professional service dealers will find cross-referenced in alphabetic order in the new Motorola HEP Cross Reference Guide. This useful and practical 62-page guide is available now at HEP representatives and distributors throughout the country, or directly from HEP, Motorola Semiconductor Products, Inc., P.O. Box 13408, Phoenix, Arizona 85002.

After analyzing thousands of published device specifications, HEP engineers compared those HEP devices that best met, or exceed the major characteristics and used these as the HEP preferred type substitute device. In addition to the semiconductor cross-reference this guide also includes sections on Important Tips on Using Universal Replacement Semiconductors; Outline Dimensions of HEP Devices, and the HEP Price List.

Fix That Set. The next time you need schematic diagrams and service information on a specific radio and TV set—don’t despair! Supreme Publications, the home fix-it fan’s family friend, is offering to send promptly by mail service material on almost any television, tape recorder, radio, stereo or record changer. Supreme is able to supply such information from its own service manuals, extensive files going back to the 1930s, and from factory released material. The usual charge is $1 for radio material, and $1.50 for TV material covering a specific set.

Your ol’ Bookworm chatted with James Lynch, manager of Supreme Publications who stated, “Each request for material is a challenge to us. And while most items can be easily and quickly filled, at times our Mr. Beitman (who has been connected with diagrams and servicing for 40 years) spends an hour or more to find a hard one.” Where else now-a-days can you get this personalized service for only a buck?

It is good to know that there is a large organization ready to supply service material on a radio or a TV set you may find hard to repair and for which you do not have a diagram and other helpful service data. Next time you run into a dog, and don’t have a schematic diagram, write to Supreme Publications, Dept. JMS, 1760 Balsam Road, Highland Park, Ill. 60035.
Troubleshooting Audio at Home

This all-in-one Audio Test Center was designed by a professional audio service man. In one versatile, battery-operated unit it incorporates all you need for fast audio-system servicing. Model 140 contains the following in only 4¼ x 7½ x 3½-in. of space: RF/IF/AF signal tracer, tone generator, multi-input amplifier, and scope preamplifier. It is specifically designed not to overload or damage transistors. Other specs: gain, 70 dB with volume control; noise, better than -60 dB; frequency response, ±3 dB, 100-12,000 Hz; harmonic distortion, less than 3%; power output, 200 mW; power supply, 9 VDC at 50 mA. Weighing only 2 lb., the Audio Test Center sells for $48.00, complete with six penlite cells and probes. For further information, write the Century General Corp., 570 7th Ave., New York, N.Y. 10018.

Century General 140 Audio Test Center

ANY RADIO - TV RECEIVING TUBE
32¢ EACH! $29.00 PER 100!

The price is not a mis-print! We have been supplying top service organizations for 15 years with our top quality new, used and factory-second receiving tubes! They are all individually boxed, branded, code-dated and guaranteed for 1 year! We have over 2500 types in stock continuously! You may order any type! Our stock covers 45 years of tube manufacturing!

If your order is under $5.00 send 50¢ handling! All postage charges paid by Nationwide. Canadian and foreign please send approximate postage! Send for complete free tube list!
NEW PRODUCTS

Phone Valet

The Crown Telephone Valet will automatically answer calls with your message, and record callers' incoming messages. The Valet answers incoming telephone calls by lifting the receiver and playing into it a message in the user's voice, recorded on an endless loop cartridge. The unit then receives and records the caller's message, after which it shuts off, ready to take the next call. Voice-activated, the cassette unit can double as a table model auxiliary recorder. The instrument features digital tape counter; push-reset counter button; tone and volume controls; function selector switch; five piano-type keys for operate, fast forward/reverse controls; and three lamp indicators for power, start, and record functions. It has a frequency response of 100 to 10,000 Hz; uses 20 transistors and 4 diodes. Price of $199.95 includes microphone and small accessories. Get more literature on the Model CTA-4400 from Crown-Industrial Suppliers Co., 755 Folsom St., San Francisco, Calif. 94107.

Massage Your Media Onto Tape

In its price bracket, this tape recorder has a lot of things going for it. Panasonic's Console-Aire, Model RS-790S, has continuous automatic or manual reverse with directional lights, three-speed operation with four-track stereo, a four-head system, two vu meters, pause control, a 4-position digital tape counter, and two 7-in. oval dynamic speakers. A dual capstan drive stereo tape recorder, the Console-Aire produces 20 watts of music power. On its 7-in. reel you can have sound on sound or sound with sound. Separate volume and tone controls are provided for each channel. It has simple lever operation and comes with dust cover. The Model RS-790S contains 14 transistors plus 10 diodes and 5 thermistors, and weighs 38½ lb. Along with it you get two dynamic microphones and stands, a 7-in. reel with tape, an empty 7-in. reel, reel holders, splicing and sensing tapes. Price is $329.95. For more specs, drop a line to Matsushita Electric Corp. of America, Pan-Am Bldg., 200 Park Ave., New York, N.Y. 10017.

For Armchair Channel Hoppers

If you're fortunate enough to own a Heathkit color TV, or have one in the works, you'll want the new Heathkit wireless remote control. This gratifying gimcrack lets you turn your Heathkit color TV on and off, set the volume, adjust color saturation, change picture tint, and select vhf channels by sonic control—without ever getting off your duff. The remote receiver uses an integrated circuit containing 15 resistors, 10 transistors, and 1 diode, and it has a built-in meter.

Heathkit Wireless Remote Control for Color TVs

The remote transmitter is powered by a 9-V battery. There are two types: the GRA-295-6 for the GR-25 and GR-295 color TVs; and the GRA-227-6 for Heathkit's GR-180 and GR-227. Both are priced at $69.95. Want more info? Write the Heath Co., Benton Harbor, Mich. 49022.
Transistor Tester

The only test equipment I have is a VOM. How can I test the transistors in my radio with it?

—T. J., Duluth, Minn.

Connect the negative lead of the VOM (set to measure DC volts) to the collector of a pnp transistor and the positive lead to its emitter. If it is an npn transistor, the VOM leads should be just the reverse. Finally, use a clip lead and short the base to the emitter. If the voltage increases, the transistor is active and you're in business.

The Beat Goes On

My small, portable eight-transistor radio picks up CW signals on 930 kHz and at about 690 kHz when I'm in Newport Beach. With my communications receiver operating in the 200-400 kHz band, I hear CW signals exactly the same as on the BCB except that they are much stronger. Could you please explain this?


It could be that the signals from the CW station are being heterodyned with a signal from a strong BCB station. For example, if a CW signal on 290 kHz beats with a BCB station on 640 kHz their sum frequency would be 930 kHz. You would hear the CW signal as an audio tone since the sum frequency and the carrier of the BCB station on 930 kHz would...
not be exactly the same. Also, the 290-kHz signal beating with a 980-kHz BCB signal would produce a beat at 690 kHz.

These may not be the actual conditions that existed when you heard the CW signals, but the principles are the same. The CW signals could have come from a beacon, Naval, or commercial shore station, or from a nearby ship.

These signals will produce a beat if the first stage of your receiver is non-linear—which would be the case if it has no RF stage ahead of it. If it has one, the RF stage could be overloading or be biased improperly for linear operation.

Uneven Exchange

I read somewhere that it is possible to pep up a receiver by replacing the RF amplifier with a tube of higher gain. I decided to do this with my Lafayette HA-63. I replaced the 6BA6 with a 6GM6 (making all socket changes). Now my "S" meter no longer works, there's no increase in sensitivity, but there is some distortion. Can you tell me what I did wrong and possibly how to correct it?

—P.A.J., Maspeth, N.Y.

The two tubes have somewhat different characteristics. Make sure you wired socket terminals 2 and 7 together! In general, it's better not to tamper with a receiver. The man who designed it obviously had good reasons for selecting the tubes he did; there is only a small difference in price between these two types. Gain is usually dependent on overall circuit design and the parameters given in tube manuals should not be taken too literally.

Triangle Sound

I need a crossover system which will pass all frequencies below 700 Hz to a woofer, those between 700 to 5000 Hz to a mid-range speaker and those above 5000 Hz to a tweeter. It should handle 35 watts. Can you help?

—R. T., Manchester, Conn.

Peak Power

I have a Lafayette wireless broadcaster which operates in the BC band. To increase its range, I have installed a tuner and loading coil on the antenna (see A). With a receiver nearby, I attempted to peak the antenna. No audible change in the signal was produced by turning the condenser plates, except at a point about halfway through its rotation where the signal seemed to disappear. Conversely, a field strength meter indicates the transmission is strongest at this fade-out point. What am I doing wrong?

—S. S., Wyncote, Pa.

For one thing, at the fade-out point you have a parallel, resonant wave trap in series with the antenna. The wave trap blocks passage of your signal.

Why don't you try connecting the coil and capacitor to form a series resonant circuit with the far end of the antenna grounded as shown in the second diagram? (See B.) This should get more current into the antenna whose length must be limited to 10 ft. according to FCC rules.

Spy Stations?

Recently I have heard transmissions on about 11.5 MHz which consist of a series of numbers, spoken in Spanish, and usually in groups of four, although there have been groups of five and six. The station signed off at 0630 GMT by saying "Hasta Luego. Hasta Luego." Could this be some sort of spy station?

Highly doubtful, but who knows? Castro never gives up. Perhaps they were price quotations of coffee.

Beefier Bass

I have a Knight-kit KG-250 24-watt stereo amplifier. I would like to add additional bass to it since I feel it does not put out enough. Other than this, it works perfectly. Could you please (Continued on page 115)
New 1969 Allied Catalog

Brand new! Fresh off the press! Allied's 1969 Catalog...536 fascinating pages jam-packed with the very latest in Hi Fi, Tape Recorders, CB, Kits, Radios, Tools, Electronic Parts, Books. Probably nowhere else on earth will you find such a complete selection of everything in electronics...and virtually all new as tomorrow! Literally thousands of items...many of them never shown before. Allied's all new 1969 Catalog makes wonderful reading...and it's yours absolutely FREE! Tear off the card...mail it in today...and we'll rush you your own personal copy of the newest and most complete book of what's new in electronics...Allied's 1969 Catalog!

NO MONEY DOWN—24 MONTHS TO PAY!
Low Monthly Payments to fit your budget.

DO A FRIEND A FAVOR—give him this card to send for his FREE ALLIED CATALOG
Why Buy by Mail from ALLIED?
Because you buy from the most unique store in the world!

Why do hundreds of thousands of people...electronics experimenters, music lovers, engineers, Amateur operators, professional radio-TV servicemen, kit builders, hobbyists, hi-fi fans, and just plain "bargain-hunters"...order tens of millions of dollars worth of merchandise-by-mail from ALLIED each year?

Variety, selection, price, and quality-testing are the answers! If we can satisfy the experts...we can satisfy you! Our continuous program of quality-testing assures you that everything you buy meets the highest standards. And nowhere else on the face of the earth are so many famous brands (and so many different models of every brand), gathered together to choose from. When it comes to parts that both beginners and experts need...ALLIED is the one source that has them all.

Thousands and thousands of items to choose from...and you'll like shopping from ALLIED because you do it in your easy chair. Our entire stock is spread before you, as it could never be in a conventional store. It takes ALLIED over 500,000 square feet of floor-space (with merchandise stacked to the ceiling!), to keep on hand all the items you hold in one hand when you pick up an ALLIED catalog.

You never had shopping so good, as when you do it at home with this famous book to guide you. No clerk, no expert, no salesman in all the world could begin to supply you with the wealth of facts, the exact specifications, the comparable data—all at your fingertips in this popular book. Almost anything you may want or need or have an interest in...is pictured, priced, and described in detail. You'll discover things you never knew existed. You'll find bargains unmatched anywhere else you may shop. You'll revel in choices, varieties, and selections beyond imagination. You'll find a whole new way to buy both the commonplace and the rare, the inexpensive and the luxurious.

Best of all—with an ALLIED Credit Fund Account, you pay no money down, and take up to 2 years to pay!

Shop Where the Experts Buy—Choose from the Biggest and Most Fabulous Selection Ever Gathered Together:

| STEREO HI-FI ELECTRONIC & HOBBY KITS | FM, AM & VHF RADIOS |
| TAPE RECORDERS AND TAPES | PORTABLE TV SETS |
| CITIZENS BAND EQUIPMENT | AMATEUR GEAR |
| WALKIE-TALKIES | INTERCOMS |
| SHORTWAVE RECEIVERS | P.A. EQUIPMENT |
| PHONOGRAPHHS | TEST EQUIPMENT |
| SPEAKERS | ANTENNAS |
| RECORD CHANGERS | TUBES AND TRANSISTORS |
| AUTOMOTIVE ELECTRONICS | TOOLS & HARDWARE |
| BOOKS | CAMERAS |
| NEEDLES | HEADPHONES |
| MICROPHONES | INTEGRATED CIRCUITS |
| WIRE & CABLE | PARTS AND BATTERIES |
Yours FREE this valuable guide to MONEY-MAKING OPPORTUNITIES with your NO RISK TRIAL subscription to the new INCOME OPPORTUNITIES Newsletter

HUNDREDS OF IDEAS that can mean big money for you assembled by INCOME OPPORTUNITIES staff in this special report. MAIL IT FREE when you mail the coupon below accepting a NO RISK Charter subscription to the new INCOME OPPORTUNITIES Newsletter—the new confidential reporting service that brings you exclusive reports of new business breakthroughs for HUNDREDS of names of millionaires making money making opportunities.

YOUR FREE SUCCESS GUIDE contains these powerful profit-makers:

- Success secrets of millionaire mail order professionals.
- 200 top-high-income, low investment opportunities.
- 55 Businesses you can start right now for under $500 investment.
- 101 Red-hot novelty items you can sell for phenomenal commissions.

EACH MONTH this exclusive confidential newsletter reporting service will bring you invaluable news of opportunities in every area...always with the names and addresses of the sources so that you can take full advantage of money making opportunities that can go into action immediately long before anyone else has heard of them.

Our nation-wide staff of reporters and the editors of INCOME OPPORTUNITIES, the world's leading magazine in this field, are in constant touch with exclusive sources of inside information on opportunities of increasing your income...and this information is rushed to subscribers in fast-reading newspaper format...together with special in-depth reports of information you can get nowhere else.

YOU TAKE NO RISK WHEN YOU SUBSCRIBE SINCE YOU MUST BE 100% SATISFIED.

To get your free exclusive report on AMERICA'S BEST MONEY-MAKING OPPORTUNITIES, all you need do is mail the post card facing this ad or the coupon below to enter your NO RISK trial subscription to the new INCOME OPPORTUNITIES Newsletter. The cost is less than 5c a day...and a single idea you get from it can be worth many times the cost of a year's subscription.

These special reports are included with your subscription as an extra valuable bonus:

22 MAIL ORDER FIRMS THAT WILL PUT YOU IN BUSINESS!
Top-notch, reputable firms... each with a profit-producing mail order program that can give you your own hours... work full- or part-time.

33 SELECT FRANCHISES FOR UNDER $500!
Choice franchises selected to return money for profit for an investment within your means. Restaurants, automotive, stores, and many, many more!

35 HOME-BASED, SPARE-TIME MONEymAKERS
For anyone who would want additional income—lambasting specialty sales, secretarial services. Full details on how to get customers and how to price your product for profit!

DIRECT SELLING DIRECTORIES
Leaders in the direct selling field—Saladmaster, Tupperware, Stanley, and many others help you put on the path to financial independence once selling nationally known products...and earning commissions of up to $1000 a month!

20 FASTEREST GROWING RETAIL BUSINESSES
Survey and report of independent businesses which are currently booming—coin-op car wash, beauty/wig salons, pool grooming parlors...economic indicators to help you make the wisest choice for a profitable business!

AND REMEMBER... THIS SUCCESS GUIDE IS NOT FOR SALE, anywheres ELSE, AT ANY PRICE!

TO GET YOUR FREE report on AMERICA'S BEST MONEY-MAKING OPPORTUNITIES, mail the coupon below to enter your NO RISK Charter subscription to the new INCOME OPPORTUNITIES Newsletter—this exclusive report that brings you advance news of money-making opportunities month after month.

HUNDREDS OF EXCLUSIVE IDEAS YOU CAN USE TO MAKE MORE MONEY

THE REASON we want to send you this valuable report on AMERICA'S BEST MONEY-MAKING OPPORTUNITIES as a free gift with your NO RISK subscription to INCOME OPPORTUNITIES Newsletter is we know that once you become a reader you will never want to be without it.

HERE'S THE EXCLUSIVE VALUABLE INFORMATION
You'll find in your free copy of AMERICA'S BEST MONEY-MAKING OPPORTUNITIES:

55 BUSINESSES YOU CAN START FOR UNDER $500!
Proven profit makers which offer independence and financial security...many can be started on a part time basis...with addresses for obtaining detailed information.

200 HIGH-PROFIT FRANCHISES!
Selected franchise profit-making opportunities with initial investment of under $5,000...covers all major areas such as: services...products...schools...sports and recreation...stores...vending machines...cosmetics...health aids and much more.

SUCCESS SECRETS OF 23 TOP MAIL ORDER PROS
The inside success stories behind the big mail order money makers...and full details you can use to get into the big mail order field.

101 RED-HOT NOVELTIES FOR SALESMAENS
How to get your share of the multi-billion dollar advertising specialties industry which offers unlimited opportunities to salesmen.

REFUND GUARANTEE. You may cancel your subscription at any time and we will reimburse you the full cost of your subscription.

Mail this coupon to:

[Address]

FREE. NO RISK. NO strings. Mail it now and receive your first issue immediately.

BEND NO MONEY NOW to get your FREE Money-Making Opportunities Report.

Enter my Charter NO-RISK subscription to the new INCOME OPPORTUNITIES Newsletter including a special report mailed above and send me FREE the exclusive report: AMERICA'S BEST MONEY-MAKING OPPORTUNITIES. The cost is $1.50 per month payable annually or semi-annually.

NAME (Please PRINT—it prevents errors)

ADDRESS

CITY

STATE

ZIP CODE

Mail to:

INCOME OPPORTUNITIES Newsletter

220 Park Avenue South, New York, N.Y. 10003

RTV-69

29
4. Bargains galore, that’s what’s in store! Poly-Paks Co. will send you their latest eight-page flyer listing the latest in available merchandise, including a giant $1 special sale.

10. Burstein-Applebee offers a new giant catalog containing 100s of big pages crammed with savings including hundreds of bargains on hi-kit, power tools, tubes, and parts.

11. Now available from EDI (Electronic Distributors, Inc.): a catalog containing hundreds of electronic items. EDI will be happy to place you on their mailing list.

104. With 70 million TV and 240 million radios somewhere somebody will need a vacuum tube replacement at the rate of one a second! Get Universal Tube Co.’s Troubleshooting Chart and facts on their $1.50 flat rate per tube.

100. You can get increased CB range and clarity using the “Cobra-23” transceiver with speech compressor-receiver sensitivity is excellent. Catalog sheet will be mailed by B & K Division of Dynascan Corporation.

108. Secure your copy of the new CB antenna catalog by Antenna Specialists! Catalogue has been sectionalized to facilitate the picking of an antenna or accessory from a handy index system. Many Antenna Specialists makes the picking easy.

112. Never mind what brand your CB set is. SENTRY has the crystal you need. Same goes for ham rigs. Seeing is believing, so get SENTRY's catalog today. Circle 102.

114. With the latest Sams books, titles range from "ABC’s of CB Radio" to "99 Ways to Improve your CB Radio." So circle 130 and get the facts from Sams.

107. Want a deluxe CB base station? Then get the specs on TRAM’s all new Titan II—it’s the SSB/AM rig you’ve been waiting for!

96. Get your copy of E. F. Johnson’s new booklet, "Can Johnson 2-Way Radio Help Me?" Aimed for business use, the booklet is useful to everyone.

129. Boy, oh boy—if you want to read about a flock of CB winners, get your hands on Lafayette’s new 1969 catalog. Lafayette has CB sets for all pocketbooks.

101. If it’s a CB product, chances are International Crystal has it listed in their colorful catalog. Whether it’s a kit or wired, accessory or test gear, this CB-oriented company can be relied on to fill the bill.

103. Squires-Sanders would like you to know about their CB transceivers, the "21'er" and the new "555." Also, CB accessories that add versatility to their S-watters.

116. Pep-up your CB rig’s performance with Turner’s M+2 mobile microphone. Get complete Send sheets and data on other Turner mikes.

48. Hy-Gain's new CB antenna catalog is packed full of useful information and product data that every CBer should know. Get a copy.

111. Get the scoop on Versa-Tronics’ Versa-Tenna catalog. If you’re a wireless nut or experimenter, you’ll take to this catalog.

50. Get your copy of Amphenol’s "User’s Guide to CB Radio"—18 pages packed with CB know-how and chit-chat. Also, Amphenol will let you know what’s new on their product line.

54. A catalog for CBers, hams and experimenters, with outstanding values. Terrific buys on CB antennas, tubes and accessories.

LITERATURE

ELECTRONIC PARTS

135. Get with ICS! RCA’s new integrated Circuit Experimenters’ Kit K132112 is the first of its kind and should be a part of your next project. Get all the facts directly from RCA. Circle 135.

140. How cheap is cheap? Well, take a gander at Cornell Electronics’ latest catalog. It’s packed with bargains like 6W4, 12AX7, 5U4, etc., tubes for only $3. You’ve got to see this one to believe it!

22. Now get the all-new 512-page, fully illustrated Lafayette Radio 1969 catalog. Discover the latest in CB gear, test equipment, ham gear, tools, books, bulb components and gifts. Do it now!

1. Allied’s catalog is so widely used as a reference book, that it’s regarded as a standard by people in the electronics industry. Don’t you have the 1969 Allied Radio catalog? The surprising thing is that it’s free!

8. Get it now! John Mehna, Jr.’s new 46-page catalog is jam packed with surplus buys—surplus radios, new parts, computer parts, etc.

22. No electronics bargain hunter should be caught without the 1969 copy of Radio Shack’s catalog. Some equipment and kit offers are so low, they look like misprints. Buying is believing.

5. Edmund Scientific’s new catalog contains over 4000 products that embrace many interests and fields. It’s a 148-page buyers’ guide for Science Fair fans.

4. Olson’s catalog is a multi-colored newspaper that’s packed with more bargains than a phone book has names. Don’t believe us? Get a copy.

7. Before you build from scratch, check the Fair Radio Sales latest catalog for electronic gear that can be modified to your needs. Fair way to save cash.

TOOLS

78. Xcelite’s new “Trav Blen” nutdriver sets feature plastic trays that lie flat or sit up on your workbench, or pack neatly in your tool box. All the tools in Xcelite’s Bulletin N666—get it!

118. Secure coax cables, speaker wires, phone wires, etc., with Arrow staple gun tackers. 3 models for wires and cables from 1" to 1" 2" dia. Get fact-full Arrow literature.

CB—AMATEUR RADIO—SHORTWAVE RADIO

100. You can get increased CB range and clarity using the “Cobra-23” transceiver with speech compressor-receiver sensitivity is excellent. Catalog sheet will be mailed by B & K Division of Dynascan Corporation.

141. Newly-designed CB antenna catalog by Antenna Specialists has been sectionalized to facilitate the picking of an antenna or accessory from a handy index system. Many Antenna Specialists makes the picking easy.

102. No one ever mind what brand your CB set is. Sentry has the crystal you need. Same goes for ham rigs. Seeing is believing, so get Sentry’s catalog today.

103. Squires-Sanders would like you to know about their CB transceivers, the "21'er" and the new "555." Also, CB accessories that add versatility to their S-watters.

106. Pick up Hallicrafters’ new four-page illustrated brochure describing Hallicrafters’ Versa-Tenna catalog. Whether it’s a kit or wired, accessory or test gear, this CB-oriented company can be relied on to fill the bill.

103. Squires-Sanders would like you to know about their CB transceivers, the "21'er" and the new "555." Also, CB accessories that add versatility to their S-watters.

48. Hy-Gain’s new CB antenna catalog is packed full of useful information and product data that every CBer should know. Get a copy.

50. Get your copy of Amphenol’s “User’s Guide to CB Radio”—18 pages packed with CB know-how and chit-chat. Also, Amphenol will let you know what’s new on their product line.

54. A catalog for CBers, hams and experimenters, with outstanding values. Terrific buys on CB antennas, tubes and accessories.

ELECTRONIC PRODUCTS

143. Bring new life to your hobby. Exciting plans for new projects—let Electronics Hobby House give you the dope. Circle 143, now.

66. Try instant lettering to mark control panels using component parts. Datak’s booklets and sample show this easy dry transfer method.

144. Hear today the organ with the “Sound-Of-Tomorrow,” the Melodytone’s new Chippery Electronics. It’s portable—take it wherever you go. Send for pics and descriptive literature.

109. Seco offers a line of specialized and standard test equipment that’s ideal for the home experimenter and pro. Get specs and prices today.

42. Here’s colorful 116 page catalog containing a wide assortment of electronic kits. You’ll find something for any interest, any budget. And Heath Co. will happily send you a copy.

128. If you can hammer a nail and move your thumb, you can assemble Schober organizer. To prove the point, Schober will send you their catalog and a 7-in. disc recording.

30 Radio-TV Experimenter
SCHOOLS AND EDUCATIONAL

142. Radio-Television Training of America prepares you for a career—not a job. 16 big kits help you learn as you build. 120 lessons. Get all the facts today!

136. International Correspondence Schools has a 384-page manual explaining the function, operation, and objectives of TV. The facts on 266 courses of study currently available. Sorry, offer may expire soon.

137. For success in communications, broadcasting and electronics get your First Class FCC license and Grantham School of Electronics will show you how. Interesting booklets are yours for the asking.

HI-FI/AUDIO

134. Discover Play-Tape—America's newest tape cartridge and tape players. Unit priced at under $17 with cartridges at 45-disc prices, Play-Tape has one of America's largest recorded libraries.

17. Mikes, speakers, amp, receivers—name it, Electro-Voice makes it and makes it good. Get the straight poop from E-V today.

27. 12 pages of Sherwood receivers, tuners, amplifiers, speaker systems, and cabinetry make up a colorful booklet every hi-fi bug should see.

99. Get the inside info on why Koss/Acoustech's solid-state amplifiers are the rage of the experts. Colorful brochure answers all your questions.

104. You can't hear FM stereo unless your FM antenna can pull 'em in. Learn more and discover what's available from Fino's 6-pages "Third Dimensional Sound."

119. Kenwood puts it right on the line. The all-new Kenwood FM-stereo receivers are described in a colorful 16-page booklet complete with easy-to-read-and-compare spec data. Get your copy today!


TAPE RECORDERS AND TAPE

123. Yours for the asking—Elpeo's new "The Tape Recording Omnibook," 16 jam-packed pages on facts and tips you should know about before you buy a tape recorder.

31. All the facts about Concord Elektro-Volt Corp. tape recorders are yours for the asking in a free booklet. Portable, battery operated to four-track, fully transistorized stereo covers every recording need.

32. "Everybody's Tape Recording Handbook" is the title of a booker packed with info for the home recording enthusiast. Includes a valuable table of recording times for various tapes.

34. "All the Best from Sony" is an 8-page booklet describing Sony Super-grooom tape recorders, microphones, tape and accessories. Get a copy today before you buy!

35. If you are a serious tape audiophile, you will be interested in the new Viking/Tekes line of quality tape recorders.

TELEVISION

70. Need a new TV set? Then assemble a Heath TV Kit. Heath has all sizes, B&W and color, portable and fixed. Why not build the next TV you watch?

127. National Schools will help you learn all about color TV as you assemble their 25-in. color TV kit. Just one of National's many exciting and rewarding courses.

February-March, 1969
For The Experimenter..!
International EX Crystal & EX Kits
OSCI LATOR / RF MIXER / RF AMPLIFIER / POWER AMPLIFIER

Type EX Crystal
Available from 3,000 KHz to 60,000 KHz. Supplied only in HC 6/U holder. Calibration is ±.02% when operated in International OX circuit or its equivalent. (Specify frequency)

$395

OX OSCILLATOR
Crystal controlled transistor type.
Lo Kit 3,000 to 19,999 KHz
Hi Kit 20,000 to 60,000 KHz
(Specify when ordering)

$295

MXX-1 Transistor RF Mixer
A single tuned circuit intended for signal conversion in the 3 to 170 MHz range. Harmonics of the OX oscillator are used for injection in the 60 to 170 MHz range.
Lo Kit 3 to 20 MHz
Hi Kit 20 to 170 MHz
(Specify when ordering)

$3.50

SAX-1 Transistor RF Amplifier
A small signal amplifier to drive MXX-1 mixer.
Single tuned input and link output.
Lo Kit 3 to 20 MHz
Hi Kit 20 to 170 MHz
(Specify when ordering)

$3.50

PAX-1 Transistor RF Power Amplifier
A single tuned output amplifier designed to follow the OX oscillator. Outputs up to 200 mw can be obtained depending on the frequency and voltage. Amplifier can be amplitude modulated for low power communication. Frequency range 3,000 to 30,000 KHz.

$3.75

BAX-1 Broadband Amplifier
General purpose unit which may be used as a tuned or untuned amplifier in RF and audio applications 20 Hz to 150 MHz. Provides 6 to 30 db gain. Ideal for SWL, Experimenter or Amateur.

$3.75

INTERNATIONAL
CRYSTAL MFG. CO., INC.
10 NO. LEE  • OKLA. CITY, OKLA. 73102

Write for complete catalog.
Now play it safe! Put an end to light fingers that make a beeline towards your unprotected car. Turn off the crooks—turn on...

It would take an experienced car thief about 15 seconds flat to silence the conventional burglar alarm in your car (once he'd set it off). No kidding, I didn't pull this number out of a hat. It's my estimate based on the length of time it took me to kill the alarm in my car.

The sad news? Just 7 seconds, including the time needed to locate the power wire running to my alarm, and the time needed to snip the wire. (It's been a while since I installed the system, so I had to do some hunting.) I figure that a pro car crook who has been around but doesn't know where the alarm box is located would take twice my time... about 15 seconds.

Most conventional alarms are really just noise makers. The majority use your car's horn as the noise source that's supposed to scare the crook away. The fact is that many thieves don't scare easily. It's unfortunate, but in most crowded cities the sound of a blaring horn (or even a siren, where such alarms are legal) usually

By Ron Michaels

AUTOGUARD
AUTOGUARD

won't even raise eyebrows, let alone summon help. So you can bet that any light-fingered thief who has his eye on your buggy may just stick around for the few seconds it takes to disable an ordinary alarm.

Consider these facts and you'll understand why I designed Autoguard—the back-up auto alarm to prevent car theft. Autoguard goes into action after my conventional horn alarm is silenced. In short, it's my second line of defense against car crooks! Any thief who'll hang around long enough to also try and disable this baby probably wants my car so badly that nothing short of taking out the engine will stop him.

In addition, my second alarm actually becomes the only effective alarm I have when my car is parked in a deserted lot or in some rural area. In these far-away places, even a novice crook might try to silence a horn. Of course, even if you don't have a conventional alarm in your car, you should consider installing Autoguard as a "first-line" alarm; it's better than most you'll find on the market.

Inside Story. The alarm system operates in two steps. The first step arms the alarm; the second step triggers it. The arming stage is controlled by your car's ignition system so that the instant the engine is started (with or without an ignition key) the Autoguard circuit arms itself. (Remember, this alarm works after the first-line alarm has been silenced and the thief has had time to jump the ignition.)

The second step—the triggering stage—can be controlled by almost any type of switch you can dig up. As I'll explain later, you can rig the device so that the alarm fires as soon as the car moves, as soon as the hand brake is released, or as soon as the transmission lever is moved. (You have lots of options.)

When Autoguard does fire, two things happen at once. First, a hidden alarm sounds (a gong is ideal); second, a short circuit is slapped across the ignition system, stopping the engine dead in its tracks.

Given enough time, a hard-boiled pro

Combination of SCR1 and K1 arms device when ignition is switched on. Triggering stage consists of SCR2 and K2. could defeat this alarm. But you've got to admit that it's not very likely he'll even try. The surprise of a second alarm firing after being comfortably seated behind the wheel should shake up even the most steel-nerved car thief.

Pulse to Gate. The Autoguard circuit is built around a pair of silicon controlled rectifiers. These solid-state switches act like electronic bear traps. Once they're made to conduct a current (upon application of a short trigger pulse to their gate electrodes), nothing will stop them from conducting except turning off the current at its source.

Once this is done they automatically reset themselves in anticipation of the next trigger pulses. Each SCR controls a 12-V relay. When the SCR is triggered, it permits

PARTS LIST FOR AUTOGUARD

K1—Relay assembly, 12-VDC coil and 10-A, spdt contact switch (Guardian 200-12D and 200-M1, Allied 41E5714 and 41E5718)
K2—Relay assembly, 12-VDC coil and 10-A, dpdt contact switch (Guardian 200-12D and 200-M2, Allied 41E5714 and 41E5719)
R1—4700-ohm, 1-watt resistor
R2, R3—270-ohm, ½-watt resistor
S1, S2—Spst, normally open, key switches (Allied 5684158 or equiv.)
SCR1, SCR2—Silicon controlled rectifier (GE-X1, Allied 4983 GE-X1-GE)
1—4 x 4 x 2-in. aluminum chassis box (Bud CU883, Allied 42B7606 or equiv.)
1—6-terminal barrier strip (Cinch-Jones 6-140, Allied 47E1802 or equiv.)
Misc.—Trigger switch, alarm, 6-lug terminal strip, heat-sink silicone compound (Dow Corning 340, Allied 60E7021), #14 hook-up wire, grommets, bus wire, solder, hardware, etc.
current to flow through the relay’s coil, thereby closing its contacts.

Rectifier SCR1 is in the arming part of the circuit. Its gate is connected to your car’s distributor (at the hot ignition terminal) via a simple voltage divider composed of R1 and R2. This divider scales down the 200-V pulses produced across the points to a triggering voltage that the SCR’s gate terminal can handle.

When SCR1 is triggered, relay K1 closes, and its spdt contacts (only half the contact assembly is used) apply +12 VDC from the car’s battery to the second (triggering) circuit composed of SCR2 and K2. Note that the gate terminal of SCR2 is connected to terminal 4 of the barrier strip mounted on the case. Next to it, terminal 3 is connected to +12 VDC through resistor R3, which is mounted externally on the strip.

Heavy bus wire connects two ground leads from rectifiers. Since unit doesn’t reveal itself, author used fake title to fool friend thief.

Shorting these two terminals together will supply a firing signal to SCR2, making it conduct, and thus causing K2 to close. Relay K2’s dpdt contacts are both grounded when they close. One short-circuits the ignition system via the same lead that brings ignition pulses to the gate of SCR1; the other acts as a switch for the hidden alarm.

Though I have specified a 12-VDC source using your car’s battery, there’s no reason why you can’t use a large 12-V lantern battery (the new heavy-duty alkaline types are perfect) to power both the circuit and the sounding alarm. (As I’ve said, a gong is ideal, but a siren or a second auto horn can be used as well.) The battery can be hidden in the trunk or under a seat. This arrangement has the advantage of keeping the alarm going even if the car battery is disconnected by the thief.

**Trigger Switch.** What closes the connection between terminals 3 and 4 that triggers SCR2? Any type of switch you choose. A simple motion-activated switch, for example, can be made by hanging an insulated metal chain in a small tin can. The first lurch of the can will swing the chain against the can’s inner surface, thereby triggering SCR2. Remember: one of the distinct advantages of using an SCR is that a pulse lasting only a few millionths of a second will trigger it. Thus, the briefest contact of a chain against the can will set off the alarm.

As an alternate, you can use a snap-action switch (Microswitch) mounted so that it will be actuated when the hand brake is released, the accelerator pedal is depressed, the transmission lever is moved, or the brake pedal is touched. Use your ingenuity and you’ll think of many more possibilities.

If you keep your car in a garage, you might even use a photoconductive, cadmium-sulfide cell as a switch. This will trigger the alarm as soon as the car is brought into the sunlight or when it passes under a street lamp at night. The more odd-ball the triggering mechanism, the better are your chances of foiling friend thief.

Safety switch S2 shorts the gate of SCR2 to ground when it is closed. This prevents the alarm circuit from working should an accidental short circuit provide power to the

(Continued on page 118)
"It's finished!"

"Let's see, that transistor battery should be in here someplace!"

"I wish you'd jar loose and buy yourself a soldering iron!"

"Going to build my own loudspeaker!"

"It's John's new hobby. It has something to do with interfering with TV and blowing fuses."

"Poor Henry—spent so much money on his gear he can not pay the electric bill and operate it!"

By Marvin Townsend

Radio-TV Experimenter
Nothing pleases like an AOK TV set (well, almost nothing, let's say), and nothing irks like a TV set on the fritz. Thing is, TVs have a way of telling you what—if anything—ails them with a message plain as the nose on your face. It's the image on the picture tube that tells the story; the problem lies in interpreting what it's trying to say. But that's easy—our 21-Second TV Cure-all includes 21 of the most frequently encountered TV ills, tells where the fault lies and how to go about correcting it. Let's start with the nicest story of all—a properly displayed test pattern on an AOK TV set.

Typical TV test pattern is transmitted perfectly round, perfectly centered, and with all wedges of equal length. Height and width have 3:4 ratio.

(Continued overleaf)
TV CURE-ALL

2 WHITE ALL OVER. OK, so your set isn’t pouring forth with the beautiful TV test pattern shown on the preceding page. Let’s say all you can see is a white screen with raster lines. There may be a tweeting sound or perhaps no sound at all coming from the speaker. First thing to check is the local oscillator tube. Next, check the first RF tube. If there’s still no picture, check the IF and first video tubes. If you’re still up the TV creek, check the IF tuner cable between tuner and chassis; a loose or poor soldered connection will result in no picture or an intermittent picture on the TV screen. As a last resort, check the AGC and second detector tube. And if yours is an older set, check even the sound output tube. Reason is that sets have been made where the sound tube actually furnished voltage to the tuner and IF stages.

3 RUSH, RUSH, RUSH! Here we have a TV screen with no picture, snowy screen, and a loud rushing sound issuing from the speaker. Switching the tuning selector from channel to channel has no effect whatever. And while the screen can be lightened or darkened, there’s still no picture or intelligible sound. Thing to do is check the first RF amplifier tube in the tuner (most RF tubes are located at the rear of the tuner). If the oscillator tube in the tuner were defective, there would be no snow on the screen or rushing sound in the speaker. And since we have plenty of both in this picture, replacing the RF tube should do it. If not, check the antenna lead-in. Assuming this passes with flying colors, take a close look at the antenna matching coils on the top of the tuner next to the lead-in. These may be shorted or open.

6 LIKE A LASER BEAM. A horizontal white line on the screen indicates lack of vertical sweep. First things to check are the vertical oscillator and vertical output tubes (dual-purpose tubes are often found in late-model TV receivers). Also check adjustment of vertical linearity height controls. Be sure to first turn the brightness control down so only a faint white line remains, however, since leaving a bright horizontal line on the screen can easily burn a line across the phosphor on the picture tube face. If you’re handy with a VOM, you may want to pull the TV chassis. This done, check voltages on the vertical oscillator and output tubes, then give the vertical output transformer a resistance test.

7 SHORT AND SQUATTY. Trouble here is plain and simple: insufficient vertical sweep. Best bet for locating culprits is to check both the vertical output and oscillator tubes, though you might start by checking the settings of the vertical linearity and height controls. A shorted or vertical transformer winding will cause the same trouble. Can’t find the vertical output tube? Here’s a quick rundown—in consoles: 6A05, 6BL7, 6CG7, 6CM6, 6CM7, 6CS7, 6CW5, 6CZ5, 6CY7, 6DE7, 6DR7, 6EA7, 6EM7, 6EW7, 6FD7, 6GE7, 6GL7, 6K6GT, 6KY8, 6S4, 6SL7, 6SN7, 6U8, 12AT7, 12AU7, 12AX7, 12BH7, 12BZ7, 12BZ4; and in portables: 5A05, 5CZ5, 5V6, 7AV7, 8CG7, 8CM7, 8CW5, 8CS7, 10CW5, 10DE7, 10DR7, 10EM7, 10GF7, 110Y7, 13DE7, 13DR7, 13DF7, 13GF7, 15KY8.
ALL WASHED UP. Even with the contrast control wide open, the best we can get out of this one is a light, washed-out picture. While local stations can be picked up, distant stations come in ever so faintly or not at all. The problem is likely a weak video or IF tube or perhaps the AGC control setting. In the event the picture has a slight trace of snow, check the RF tube or TV antenna. For the record, common video tubes in AC sets are 6AC7, 6AG5, 6AG7, 6AM8, 6AN8, 6AW5, 6AS8, 6AU8, 6AW8, 6AZ8, 6BA8, 6BH8, 6BK5, 6BK8, 6CB6, 6CH8, 6CL6, 6CL8, 6CX8, 6DB8, 6DN8, 6FH8, 6HL8, 6JY8, 6K6GT, 6K8V, 6LF8, 6U8, 6V6GT, 6W6GT, 12BH7, 12BY7, 12GH7; common video tubes in portables are 3B8V, 5AM8, 5AN8, 5AQ5, 5AS8, 5UB, 5V6, 8A08, 8A8, 8ABA8, 8BH8, 8CX8, 8DB8, 8DN8, 8JY8, 10GN8, 10HF8, 10JA8, 11KV8, 11LQ8, 12AT7, 12L5, 12W6, 16G6K, 25BK5.

LOOKS LIKE SNOW. A snowy picture can be caused by a weak RF or oscillator tube. First step is to replace the RF tube, and, if that doesn’t pay off, replace the oscillator tube. Also, check the lead-in going to the TV tuner and try rotating the fine-tuning control to clear up the picture. If a lightning- or thunderstorm has been in the area, check for a burned or open antenna coil. Some coils are mounted on top of the tuner close to the lead-in cable; others are mounted within the TV tuner itself. Still another thing to check is the outside antenna for a broken lead-in wire. Then, too, wind or rotator may have turned the antenna in the wrong direction. And, last but not least, the antenna may actually have damaged elements.

TALLER THAN TALL. A distortion of the sort pictured here would never be the case with a properly adjusted TV set, so it’s obvious that this set’s owner didn’t take full advantage of the TV test pattern shown in case No. 1. If you go in for fun-house mirrors, you may also dig the TV equivalent. Lacking this rather rare proclivity, you’ll no doubt want to adjust the set so it displays an image as faithful to the original as possible. The vertical linearity control is your tool in this case. And while you could try to alter its setting until heads here assumed reasonable proportions, you would be far better advised to make such adjustment with a test pattern. Also, remember that many sets incorporate not one but two controls affecting vertical linearity (the second is usually termed an auxiliary control), so both must be adjusted.

RUNNING UPHILL. Though a picture can roll both up and down, the site of the trouble is almost always the same: the vertical sync section. Best remedy is to replace both the vertical oscillator and sync tubes (often found in the one and same envelope). If this doesn’t solve the problem, try adjusting both the vertical height and linearity control settings. In some TV sets, incorrect adjustment of these two controls will result in a rolling picture. Physically check the vertical hold control for possible loose or poorly soldered connections. Should the vertical hold control let the picture roll in one direction only, look for a defective resistor or capacitor in the plate circuit of the vertical oscillator tube. And should vertical fold-over occur only at the bottom of the TV screen, it’s a safe bet that the trouble is the vertical output tube.

(Continued overleaf)
**TV CURE-ALL**

**10 THE LINES HAVE IT.** A screenful of black and white lines can be caused by a defective horizontal oscillator tube. First, check to see if the horizontal hold control is properly set. Once it is, check the horizontal oscillator frequency setting as well as the AFC and sync clipper tube. Since the AFC tube has been replaced by a dual-diode solid-state receiver in many of the newer sets, you may discover such a unit either plugged into a socket or soldered directly into the PC board. However, all is not lost—you can replace the soldered job by snipping off the three leads close to the body of the diodes, then forming small loops in new diode rectifier leads and soldering them to the ends of the leads you just snipped off. Bear in mind that there are two basic types of hookups: a series and a parallel.

**11 TILT!** A tilted picture can be caused by only one thing: a loose mounting screw on the deflection yoke assembly. In other words, the deflection yoke has turned on the neck of the picture tube, which can easily happen if the mounting bolt on the deflection yoke is the least bit loose. Most older TV sets have a wing nut at the top of the yoke assembly, newer ones generally have a metal yoke band with a ¼-in. cinch-nut tightener. In the latter case, the metal band fits over the plastic tabs of the yoke assembly and snugs against the neck of the picture tube. In both instances, the procedure is exactly the same: you first set the yoke level with the frame of a picture at the top of the TV screen, then adjust this picture into position with the vertical hold control. You then recheck the level, and lock the yoke in place.

**14 BOTTOMS UP!** Any TV picture running sideways or up-and-down is sure indication that sync trouble is at hand. Check both the horizontal and vertical sync tubes, bearing in mind that these tubes may be in two separate envelopes or, conversely, snug as a bug in a rug in but a single vacuum bottle. Can't find the sync tubes? In consoles, the most probable types are 6AL5, 6AM8, 6AN8, 6AU8, 6AX8, 6H28, 6BE6, 6BH8, 6BU8, 6BY6, 6CG7, 6CH8, 6CS6, 6CQ8, 6CU8, 6CX8, 6EA8, 6EB8, 6GN8, 6GW8, 6GY6, 6H6F, 6J8V, 6KA8, 6LC8, 6SN7, 6U8, 12AU7, 12AX7, 12BY7; and in portables, 3BU8, 3BY6, 3CS6, 3GS8, 4BU8, 4CS6, 4GS8, 4HS8, 5AM8, 5AN8, 5EA8, 5U8, 7AU7, 8AU8, 8AV8, 8CG7, 8CN7, 8CX8, 8EB8, 8GN8, 8J8V, 8KA8, 8LC8, 9AU7, 10GN8, 10HF8, 10JA8, 11KV8, 11LO8, 12AT7, 12AU7, 12BH7, 12SN7.

**15 SQUEEZED AND SQUASHED.** Bigger-than-life objects on an advertised-in-Life TV are normally the result of a defect in the low-voltage power supply. In older consoles, you can suspect a rectifier tube of some description; in later model sets and portables, you can expect to find a selenium rectifier or a silicon diode in its place. Pinpointing a defective solid-state job with a voltmeter is a pretty simple task: with the lead between the positive terminal and chassis ground, a half-wave rectifier should produce a voltage of 125-150 VDC. And given a full-wave or a voltage-doubler, output should be something on the order of 225 to 260 VDC. Should this approach prove fruitless, you might also check for improper setting of the tube positioning magnet on the rear of the deflection yoke (it can also produce roughly the same symptoms).
12 CHRISTMAS IS HERE! An extreme condition known as the Christmas tree effect, this problem stems from a horizontal oscillator tube or a horizontal cut-out tube. (It generally takes the form of a vertical white bar somewhere on the screen.) Also worth checking are the horizontal drive and horizontal frequency controls. First, make sure that the horizontal drive trimmer isn’t more than 1/2-turn from its tight-up position. Next, set the horizontal hold control to its center-rotation position, then adjust the horizontal frequency slug within the horizontal oscillator coil with a plastic adjustment tool. Turn the slug until the fine horizontal lines become wider and then plop into a full picture (if the slug is turned too far, the lines will slant in the opposite direction). Once this looks satisfactory, try rotating the station selector to see if the picture stays in view.

13 FOLDED GRILLE. Looking much like the dented grille of a brand-spanking new chrome-plated gas-eating chariot, this condition can result from the very same diodes that were responsible for the problems in photo 12. The demon may be the horizontal oscillator tube. Again, it may be the dual-diode AFC rectifier, so if replacing the horizontal oscillator tube doesn’t help, the next thing to tackle is the AFC diodes. Should a shorted or leaky dual-diode rectifier be the defective component, you’ll generally hear a high-pitched whistle or peeping sound from the speaker. In this case, your course of action is to replace those lousy diodes as outlined previously, turn on the set, and search for a folded grille that hopefully will be no more.

16 WIGGLE WORM. Though a trifle hard to show photographically, wiggles on a TV screen are ordinarily due to a 60- or 120-Hz component in the low-voltage power supply. They normally evidence themselves by causing the image to wobble back and forth; oftentimes, there will also be one or two dark stripes across the screen. First thing to suspect is an electrolytic capacitor in the doubler circuits. To remedy the situation, simply bridge a 100-µF, 450-V electrolytic capacitor across the suspect. Should things improve, replace the tired and testy old job with a brand-new one, having the exact capacity and voltage ratings. Also worth knowing is the fact that a defective input filter capacitor in AC/DC portables can even result in no picture, no sound, or no raster!

17 SPOTTED SCREEN. The trouble shown above started with a spot the size of a pin head, which, within two weeks, had grown to be big as an orange. What happened? Simple! The phosphor on the pic-tube was burning off. And the only remedy is replacement of the pic tube itself. Thing to watch for here, with older TVs at least, is incorrect setting of the ion trap (newer TVs are devoid of this device). The ion trap should always be set as close as possible to the picture-tube pin base so as to produce the greatest possible brightness. Still another way to ruin a pic tube is to operate a set having a defective vertical oscillator tube. As pointed out in case No. 6, the single horizontal white line across the screen will produce devastating destruction in short order, unless the brightness control is turned way, way down.

(Continued overleaf)
BLURRY, FUZZY, AND DIM. TV pic tubes that come on with all the speed of a turtle in Tipperary are probably tired as a fleet-footed floozy after an 8000-meter race. For like all tubes, boob tubes begin their journey to tube burrying ground the first time they're turned on. Eventually, images are blurred and fuzzy, even though brightness and contrast controls are wide open; closeups of faces reveal extreme white and blotchy areas even though such blemishes aren't present in the flesh. Tube brighteners or a special process called charging can stave off the inevitable for a time, but stalling for time is only delaying the inevitable. Best bet is to do the thing you'll eventually have to do—replace the picture tube.

ROAR! ROAR! ROAR! Though images of this sort make for anything but pleasurable viewing, there's really little you can do to relieve the situation. The particular form of TV interference (TVI) shown here was caused by a defective power transformer somewhere on the same power line; roughly half the picture is covered with dots and dashes, and there is a good deal of picture tearing. Since there are so many causes of TVI—police radio, CB equipment, hams, even radio TV stations—pinpointing the culprit may take some time. Installing a TVI trap in series with the antenna lead-in sometimes helps. And anything you can do to increase signal strength at the receiver itself is also worth trying. Among the various steps in this direction are installing a narrow-band (yagi) antenna, raising the antenna in height, and using shielded lead-in cable between antenna and TV set.

STRING OF ROPE. A vertical weaving line down the TV screen is generally evidence of Barkhausen, sivnets, or RF oscillation (Barkhausen and sivnet lines predominate on VHF channels). First step is to replace the horizontal output tube, which, though it may check out OK in a tube tester, may still be oscillating and causing interference. In many cases, this same type of oscillation will become more pronounced on weak or distant stations. Dressing the antenna leads away from the high-voltage cage should help. Should there be a white vertical line present on the screen, the horizontal drive control should be backed off until the line disappears. In extreme conditions, it may also be necessary to replace the horizontal output and oscillator tubes.

TEST PATTERNS, AGAIN! Having examined case after case of typical TV ills, we're back again to the faithful test pattern. The reason is easy to explain: nothing else tells you half as much about a TV set's performance—good or bad. When you come right down to it, there are dozens of TV test patterns, since each station transmits its own particular version (the one shown in case No. 1 is that transmitted by New York's WCBS-TV; the one above is that produced by the B&K Television Analyst). But regardless of which pattern you have at your disposal, you can use it to determine whether your set is properly adjusted for aspect ratio, linearity, and contrast; and how it stacks up in terms of line count, line resolution, and low-frequency phase shift. In short, TV happiness is a properly displayed test pattern!
ALLIED MODEL 1150
Battery- and AC-Operated
Portable Cassette Recorder

Here’s an attractive unit that’s likely to prove the perfect answer to those who want the convenience of a cassette portable without the tinny sound quality and poor operating features that beset many a low-priced recorder. Selling for only $89.50, Allied’s 1150 manages to provide surprisingly good sound quality along with features common to recorders priced well over $100.00.

The 1150 measures just 9¾ x 6 x 2½ in. and uses the better type of pop-up mechanism. When the OPEN button is depressed, the cassette immediately pops up and out; there’s no fumbling to dig the cassette out of the well.

Five piano keys determine operating function. There are keys for fast-forward, fast-rewind, and play/record. A fourth key provides the pause function which permits the recorder to be maintained in any mode of operation with the tape drive stopped; a fifth key controls both the stop and eject functions (a slight pressure on the key stops the recorder; additional pressure pops the cassette up and out). Two separate, top-of-deck pushbuttons provide the record interlock and the pause release.

The 1150 cassette recorder works off either six internal C cells or the AC line. The recorder is normally set for battery operation and automatically switches to AC operation when the AC line cord is plugged in.

Jacks and controls include microphone, remote control, auxiliary-in (high level), and earphone jacks; AGC-METER-SP MONITOR selector switch; and volume and tone controls. The microphone normally supplied with the 1150 (with a high-level patch cord and a plug-in line cord) has a remote-control switch built in. The mike connector simultaneously provides the mike and remote-control connections.

The meter selector switch actually controls three modes of recording operation. In the AGC position the record volume control is disconnected and the amplifier works at maximum gain, with peak limiting to prevent overload. With the switch set to the METER position, the recording level is determined by the setting of the volume control, while record level is indicated on the built-in level/battery meter. (This same meter indicates the battery condition when the recorder is in the play mode.) And with the switch in the SP MONITOR position, the volume control and meter are used to set record level and the record signal input can be heard in the speaker. However, this last arrangement is useful only for monitoring the aux. input since feedback, with its attendant howl, will occur when the mike is used.

The 1150 is all electronic in the sense that the bias oscillator also provides the erase head current. Since a magnet is not used for...
LAB CHECK

erase, the background hiss level is considerably below the audible hiss level of cassette recorders using DC erase. The tone control, the usual high-cut type, goes in very slowly, providing a long, slow range of treble attenuation.

How It Sounds. Frequency measurements of budget portable recorders are rather pointless, since the units simply aren’t intended for hi-fi use. We therefore judged performance of the 1150 on the basis of comparison with recorders of similar price and features.

Considering its low cost, the 1150 has a very good sound quality. Definitely not tinny, the sound is well balanced and the equal of that obtained from a very good quality solid-state table radio and somewhat better than that obtained from budget stereo record players. Playback sound level is notably high, and with very low distortion.

Motor speed is remarkably stable, even when battery-powered. Wow and flutter are reasonably low, though certainly not of hi-fi standards. We were able to make quite good music recordings even with battery power, and pre-recorded cassettes played back with acceptably low wow and flutter. Certainly the rock-and-roller will have no complaints.

The standard cassette provides, via two tracks, approximately two hours of recording. Extended-play cassettes provide proportionately longer recording times. Since all cassettes are interchangeable, a recording made on the 1150 can be played on any other cassette machine; the converse, of course, is also true.

Like other cassette recorders, the 1150 provides the tab interlock. On the back of

Close-up of Allied 1150 reveals speaker in top of case, tone and volume controls at left, dual-purpose meter near piano keys.

the cassette are two punch-out tabs, one for each track. When the tab is punched the record interlock is locked-out and the user cannot accidentally erase the recording. To re-use the cassette for recording, the punch-out is covered with a small piece of tape.

Summing Up. The Allied Model 1150 Cassette Recorder provides a sound quality and convenience of operation well above that normally expected from battery-powered cassette portables. It can easily serve for specialized applications or as a family recorder.

Priced at $89.95, the Allied 1150 is supplied complete with remote control microphone, patch cord, AC cable, carrying case, shoulder strap, and one cassette; batteries are optional. For additional information, write Allied Radio Corp., Dept. JR, 100 N. Western Ave., Chicago, Ill. 60680.

ELECTROMAGNETIC PULSE PICKUP

A new electromagnetic pulse pickup that monitors speeds without physical contact can sense from 2 to 200,000 revolutions per minute. Yet it sells for under $5.00 in quantity lots.

Heart of the pickup is a wirewound magnet, which induces a tiny electric pulse whenever a bit of ferrous material passes through its field. In our photo at left, the unit is measuring a fan’s rpm. But Honeywell engineers who developed the unit foresee the day when speedometers, tachometers, and similar devices will all be electromagnetic rather than mechanical, as current versions are.
... a hi-speed meter wired for power
that zeros in on your rig's modulation

By Herb Friedman, W2ZLF/KBI9457

By now, just about every CBer and ham realizes the importance of an on-the-air modulation meter—the kind found in every broadcast station from here to Formosa. For only a carrier-operated meter can show you the actual percent modulation. And only with such an instrument can you establish a reference for proper mike amplification and the precise adjustment of a clipper or speech compressor.

Only catch is, there's one little-known fact about professional modulation meters that often results in a CBer overmodulating his rig and coming across like a dime store squawk box. And this happens even though his meter may show modulation is under 100%.

The little known fact? It's that professional modulation meters don't use damped vu meters! Instead, they rely on high-speed meters which can accurately follow the peaks of a modulating waveform. For it is the peaks that determine the actual percentage of modulation.

The vu meter is an average-power indicating device that is specifically damped so that it doesn't follow the peaks, thereby making it easier to read. Since a transmitter having a vu meter will not indicate peak modulation levels, when the vu meter reads 100% modulation chances are that you've already gone over the limit. This overmodulation will result in considerable distortion and some sideband splatter.

How do you know just where your rig is peaking? Simple. Spend half an evening building our Mini-Mod and you'll have a peak-indicating modulation meter that's a CBer's and ham's delight.

Peak Power. Heart of the Mini-Mod is the high-speed meter. Its 1-in. dial has an expanded scale and its reaction time is nothing less than spectacular. Since the pointer follows all modulation peaks, it actually appears to be flying. The expanded scale between 0.2 and 0.8 (20 to 80% modulation) allows you to get in close so that you can adjust whatever accessories you use to boost talk power. This range is just where your speech clipper or compressor will function most of the time.

The meter's original dial calibration is used for percentage of modulation, so you use it exactly as you get it (0.4 is 40%, 0.6 is 60%, 1 is 100%, etc.). Further, the built-in calibration for carrier-to-modulation is good enough for the average CBer or QRP ham. Later on we'll show you how to get a precise calibration for readings of carrier power and percent modulation.

One last item. The Mini-Mod is an in-line device; it connects in series with the transmission line and provides full-time monitoring of modulation levels. Almost any negligible amount of RF power will drive it.

Portable Package. The Mini-Mod can be built into a 5 1/4 x 3 x 2 1/8-in. chassis box
Mini-Mod...

and will shrink even further if space is critical. The device can fit into a coat pocket, mount on the side of a QRP rig, or even go mobile under the dash. Parts layout is flexible, but our pictorial should help you get off to a flying start.

The meter mounts in a 1\(\frac{1}{4}\)"-in. hole and is secured by a large mounting nut which screws directly onto the threaded body of the meter. Make certain you place the fiber washer between the mounting nut and the panel; then screw the nut moderately tight—

High-speed meter has expanded scale between 0.2 and 0.8 so CB accessories such as speech compressors and clipper can be readily adjusted.

Terminal strip TS1 has 8 lugs, two of which are grounded at either end of the strip. The values of all components are critical and no substitutions (except for J1, J2, and R2) should be made. Be sure that D1, D2, and D3 are germanium diodes (not silicon), and check their polarity as well as the polarity of C2 and C4.

The polarity of the DC panel meter isn’t marked on the meter’s case. Looking toward the back of the meter with the terminals near the top, the positive terminal is on the left (with the lead going to S1).

Take another look at how R1 is connected to J1 and J2. The jacks are connected together in parallel with a jumper, and R1 connects between the jumper and TS1. Keep this resistor’s leads as short as possible (about 3\(\frac{1}{4}\) in.), and do the same with D1. Under no circumstances should you try to stuff R1’s lead into the phono jack: the excess solder will hinder insertion of a plug later on.

Check Out. Hook up your transceiver’s output to either J1 or J2, and your antenna to the remaining jack. Depress S1 (into the calibration position) and key the rig by pressing down on the mike’s PTT switch. You should get a meter reading when the rig is keyed. If you don’t, advance R2 until you do.

If no indication is forthcoming when S1 is depressed, check for a wiring error (polarity of D1, etc.). Should the meter read off-scale with D1 installed correctly, look for reversed connections to the meter. When you do get the correct upscale reading on the

High-speed meter has expanded scale between 0.2 and 0.8 so CB accessories such as speech compressors and clippers can be readily adjusted.

RF jacks on rear apron mate with existing transmission line connectors. Calibration control, once set, needn’t be reset if power remains same.
meter, adjust R2 until the meter reads full scale. Now release S1 and speak into the mike. The peak reading on the meter is the percent modulation.

Due to the tolerances of components used in the Mini-Mod, the built-in calibration is not 100% accurate, so try to keep modulation peaks between 8.5 and 9.0 on the meter scale. It's almost impossible to hear the difference between 85% and 100% levels and this way you are protected from the dangers of over-modulation.

**Calibration.** If you have access to an oscilloscope you can calibrate the Mini-Mod with greater precision. Measure your rig's modulation on the scope and then adjust R2 until the meter indicates 100% modulation. Depress S1 and note the carrier level. This reading is the new reference for calibration (now the unit can be moved from rig to rig since it is not dependent on the transceiver for calibration).

Suppose, for example, you get a reading of 0.8 with S1 depressed. To obtain a precise indication of your modulation level, you would set R2 for a 0.8 indication regardless of the transceiver you are using. If you want a full-scale calibration (at 1.0), simply adjust the value of R3 until you have a full-scale reading with S1 depressed.

Your meter has a high-speed movement, so don't try to calibrate it against another modulation meter unless you're sure the test meter isn't damped. If you're realistic about your power needs and can keep the needle between 8.5 and 9.5 (maximum), you'll be talking cleaner than ever.

---

**PARTS LIST FOR MINI-MOD**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>500-pF, 25-VDC disc capacitor</td>
</tr>
<tr>
<td>C2</td>
<td>10-uf, 10-VDC ceramic capacitor</td>
</tr>
<tr>
<td>C3</td>
<td>200-pF, 25-VDC disc capacitor</td>
</tr>
<tr>
<td>C4</td>
<td>300-uf, 3-VDC tubular capacitor</td>
</tr>
<tr>
<td>D1, D2, D3</td>
<td>1N60 or 1N34A germanium diode</td>
</tr>
<tr>
<td>J1, J2</td>
<td>See text</td>
</tr>
<tr>
<td>M1</td>
<td>0-1 mA, DC panel meter (Alco P-1000, Custom Components 32P101)</td>
</tr>
<tr>
<td>R1</td>
<td>560-ohm, 1/2-watt 10% resistor</td>
</tr>
<tr>
<td>R2</td>
<td>1000-ohm miniature potentiometer (Lafayette 32H7354 or equiv.)</td>
</tr>
<tr>
<td>R3</td>
<td>910-ohm, 1/2-watt 5% resistor</td>
</tr>
<tr>
<td>S1</td>
<td>Spdt pushbutton switch (normally closed)</td>
</tr>
<tr>
<td>T1</td>
<td>8-lug terminal strip</td>
</tr>
</tbody>
</table>

Misc.—5 1/4 x 3 x 2 1/4-in. aluminum chassis box (see text), decals, wire, hardware, solder, etc.

Note—The DC panel meter is available from Custom Components, Box 352, Alden Manor, Elmont, N.Y. 11003, for $4.95 plus 60¢ postage and handling. (Canadian orders, $1.00 for postage and handling. N.Y. State residents please add sales tax.)
Crystal sets—what grandpap called a radio—still provide challenge aplenty for the man who likes to do things the way grandpap did: roll his own. Sure, it's possible to purchase a fully-wired, ready-to-go crystal set, but anyone who values authenticity isn't going to go that route. Instead, he's going to put together his own crystal set grandpap-fashion. This means buying a crystal, then mounting it, along with the necessary catwhisker and binding posts, on a suitable base. In the unit shown below, the base is a piece of solid black walnut, and the catwhisker consists of a steel needle held in place by a magnet. Since the magnet itself rests on an iron strip, adjustments can be made by moving either the needle or the magnet, or both. For those who wish to roll their own, mounted galena crystals are available for 50¢ postpaid from Modern Radio Laboratories, 12041 Sheridan L.a., Garden Grove, Calif. 92640.

Attractive and authentic, 1969 version of home-brew crystal detector can be built from parts found in most any junk box. Circuit at right is common hookup for crystal set, but devising improved versions is all part of crystal fun.
By Steve Daniels, WB2GIF

Are you just itching to key that rig? Most Novices are. Trouble is, most people who are dying to get on the air need a little bit more code practice before they can take the exam and grab their ticket.

The No-Ticket Rig is designed with precisely this in mind. And while you won't DX (legally) any further than your front porch, you will have an AM transmitter that can pop the *dihs* and *dahs* into your portable radio with no trouble at all. In fact, you will be amazed at how loud and clear the signals are. A more pleasant way to bone up on theory simply ain't to be found.

**Circuit Operation.** Transistor Q1, resistor R1, and audio transformer T1 comprise an oscillator circuit that produces a constant audio tone. The base of Q1 is forward biased through R1, while the emitter is forward biased through the secondary of T1; as a result, the transistor conducts heavily. When the transformer's core is saturated, current flow stops, and the transistor is cut off when the magnetic field in the core reverses. This cycle repeats itself at a rate determined by T1, Q1, and R1.

The audio signal from T1 is injected into the RF stage through the emitter of Q2, and resistor R2 which also supplies the base bias for Q2. This RF oscillator is similar to the audio stage except that an autotransformer is used rather than a coil having two separate windings. The lower half of L1 augments the forward bias to Q2.

The modulated RF carrier appears at the collector of Q2 where it is coupled to a long-wire antenna. The signal can be picked up by any nearby AM radio.

**Construction.** A 1¼-in. square chip of perf board should provide enough space for
all components. The adjustable antenna coil (loopstick) is mounted on one side of the case. You can use a larger board should things be too cramped, but all leads must be kept as short as possible.

Wire the RF stage (Q2) first and bring out three leads for the loopstick. You will have to trim these to size later on. Then wire the audio oscillator, leaving an inch or so between L1’s windings and T1. The core of the driver transformer may become over-saturated if these components are too close together.

Note that transistors Q1 and Q2 are not critical and that substitutes are available (see Parts List). Remember that the value of R2 (and perhaps R1) may require adjusting when a substitution is made.

When all the parts are mounted and wired, your key should be connected in series with the battery connector; it operates as a switch to bring power into the circuit. That nice twisted pair of leads in the author’s model was obtained by securing two hookup wires in a vise and attaching the remaining leads to an electric drill. Turn on the drill for a few seconds and you have a cable.

To mount the antenna coil, start by drilling a ¼-in. hole and then ream it out until the metal collar snaps snugly in place when the coil is pushed in. Make sure that the perf board, loopstick, and battery fit easily into the case. Connections should be as rugged as possible.

Adjustment. With the battery connected (for better voltage regulation and longer life, a mercury battery can be used), attach a long-wire antenna (between 3 to 6 ft) to terminal 1 of the loopstick and close the case. Screw your key shut (for a constant tone) and tune across the BC band until you pick up your rig’s signal. Adjust the slug of L1 to get the tone on a quiet part of the band. There’s no point in trying to copy through QRM.

If the audio tone is too low, add C3 to the circuit as shown. Any value between .01 to .02 µF should do the trick.

**PARTS LIST FOR NO-TICKET RIG**

- **R1, R2—33,000-ohm, ½-watt 5% resistor**
- **R3—3000-ohm, ½-watt 5% resistor**
- **T1—10,000-ohm pri., 2000-ohm (CT) sec., miniature audio transformer (Lafayette 99T6126 or equiv.)**
- **1—3½x2½x1½-in. utility box (Lafayette 99T8077 or equiv.)**
- **Misc.—Telegraph key (Lafayette 99T2554 or equiv.), battery connector (Cinch-Jones 5D, Allied 18CS184; Lafayette 99T6287 or equiv.), perf board, push-in terminals, knob, wire, hardware, solder, etc.**
Hottest billiards game around is being played this instant in the center of the sun. To understand the trick shots, you have to know about next to nothing.

By Jorma Hyypia

Nuclear reactions that occur in the core of the sun constitute a sort of super billiards game. How? Simple. Subatomic "balls" travelling at tremendous speeds collide with each other to liberate enormous amounts of energy. Astrophysicists, of course, have long dreamed of somehow refereeing this billiard game to learn what specific combination shots produce most of the sun's energy. The feat now appears to have been accomplished—by looking for the closest thing to nothing, and not finding it!

The closest thing to nothing that science has yet discovered is an infinitely tiny subatomic particle called the neutrino. Neutrinos have no mass or electric charge and travel at the speed of light. Practically nothing ever stops them. They speed unhindered through the seething sun where they are formed. Only about one in every ten billion that happen to strike the earth is actually stopped—all the rest keep right on going as though the planet weren't there.

(Continued overleaf)
These “space spooks” are the only known nuclear reaction products that can give us direct information about the solar fires burning deep inside the sun. They are products of these nuclear reactions and, most importantly, they reach us completely unchanged. The same cannot be said of electromagnetic radiations also created in the solar process. These radiations collide with solar particles billions upon billions of times before reaching the surface of the sun. In so doing, they are changed in character. Electromagnetic radiation can therefore provide only indirect information about the solar energy-producing processes.

Recently, a team of scientists headed by Raymond Davis Jr. of Brookhaven National Laboratory set out to trap some of the solar neutrinos. In their first two attempts they failed completely to catch neutrinos that could be attributed to solar rather than other galactic sources.

But even though no solar neutrinos were caught, the experiment was by no means a failure. The negative results were considered so significant by the astrophysical community that leading scientists in the field rushed to re-think and revise their long-held views about solar processes—even about the evolution of the universe as a whole!

Why this was so will become clear after we see just what sort of nuclear billiard games go on in the sun. Incidentally, note that we’ll continue to speak about nuclear rather than atomic reactions. Reason: the intense heat of the sun strips all or most of the electrons off the atoms, so the processes are properly termed nuclear.

Solar Billiards. The nuclear reactions thought to occur in the core of the sun are like complicated billiards games involving “balls” of various sizes and energy potentials. There are two basic games going on at the same time. The game of lesser importance in terms of total energy production is called the CNO cycle. Reason is that it involves a series of nuclear changes that produce various isotopes of carbon, nitrogen, and oxygen. This cycle is a sort of trick shot that Old Sol uses now and then to add a little variety to an otherwise tedious and endless championship game.

The more important game is called the proton-proton chain. This game is believed to account for about 98 percent of the total energy produced by these two nuclear processes. It is a multi-step game consisting of an initial opening shot, followed by one or

Nuclear billiards trick shot (at left) accounts for only tiny amount
all of three possible terminal sequences.
If you're beginning to think that Old Sol is a sort of celestial Minnesota Fats, or a slick nuclear hustler in that Great Pool Room in the Sky, think again. It's just Mother Nature flubbing about in a most haphazard manner. Basically, she's a lousy pool player. It may take her thousands of years to make a single simple shot, or scores of billions of years to connect with a more difficult carom!
If Mother Nature is indeed such a mediocre player, how does she manage to create so much solar steam? The truth is that she keeps such an enormous number of nuclear balls in constant motion that a great many accidental hits are bound to happen. The probabilities are all in her favor that a certain percentage of the nuclear balls will fall into the right energy pockets to score energy releases.
Perhaps it's just as well that she isn't more adept. If she could make every shot count, the energy release would be so great that it would undoubtedly blow our entire planetary system into cosmic cue chalk dust.
Our nuclear billiards photos below provide simplified explanations of these two energy processes. The billiard balls represent various transmuted elemental isotopes; the golf balls represent protons (nuclei of light isotope hydrogen atoms); the white, black, variegated, and spotted marbles respectively represent gamma rays, neutrinos, positrons, and electrons. Pay particular attention to the black ball neutrinos in the explanation we're about to begin.
As the elements are transmuted from one to another, the attendant mass losses are translated into released energies. For example, when two protons fuse to form heavy hydrogen (H-2, or deuteron) a little excessive proton mass is released in the form of energy. And when an additional proton fuses with the heavy hydrogen to form helium-3, still more energy is released.
While studying the billiards diagrams, note that two different types of nuclear transformations are indicated. Most of the transformations result from particle collisions. Any given particle may have to wander about in the seething solar core for a very long time before an accidental collision with just the right kind of reactive second particle occurs. Scientists have calculated these average wandering times with the use of probability mathematics. Remember that these times are the statistical averages of times that may in fact be much shorter or much longer.
The second type of transformation involves spontaneous decay of a particle formed by particulate collision. In our CNO
POOLROOM IN THE SKY

mockup the two striped balls represent carbon-13 and oxygen-15 isotopes which decay into new products without interaction with other particles. These reaction times (half lives) are much shorter than the search-and-react times required in collision type transformations.

CNO Trick Shot. Though this nuclear billiards game accounts for only about 2 percent of the sun's energy output, it deserves a brief play-by-play description. This is because it illustrates a catalytic process involving the two types of transformations just discussed.

The opening shot of the CNO game (indicated by the cue stick) is anything but a fast break. Any given carbon-12 nucleus may have to hang around for about 40,000 years before Mother Nature aims a proton just right to hit it. When the hit is at last made, a gamma ray is chipped off the carbon as it is converted to nitrogen-13.

The pace of the game now quickens. In about ten minutes the nitrogen-13 decays spontaneously into carbon-13, simultaneously releasing a positron and an electron-type neutrino.

Then the game bogs down again. After some 6000 years the carbon-13 is hit by a second proton to form nitrogen-14 and a gamma ray. When a third proton strikes the nitrogen-14, oxygen-15 and another gamma ray are produced. You might just as well take a space-cruise around the Milky Way while waiting for this last shot to come off; there will be about a million years of near misses before it happens!

The game is now almost over. The oxygen-15 decays into nitrogen-15, a neutrino, and a positron in about two minutes. The final play comes 20 years later when a fourth proton smacks into the nitrogen-15 to form helium-4 and carbon-12.

Aside from the energy released, the net result is the formation of a helium-4 atom from four protons, and the complete recovery of a carbon-12 nucleus identical to the one used to start the game. The carbon-12 catalyst can now wait around for 40,000 years for another round of the same game which also may last more than a million years.

Proton Pool. Some 30 years ago physicist Hans Bethe theorized that the major part of the sun's energy is produced by a proton-proton chain fusion reaction. At that time there was no way to prove the theory. But in the following three decades supporting evidence grew to such proportions that the significance of Bethe's conjectures could no longer be doubted. In 1967 Bethe at last won a long-overdue Nobel Physics Prize for his work.

The proton-proton chain consists of an initial reaction (step 1) followed by three possible terminal reactions (see our photos). Initially, two protons collide to form hydrogen-2 (heavy hydrogen or deuteron), a positron, and a neutrino. The average time required to bring about such a collision with any given proton is 100 billion years! But after this reaction does occur, another proton is likely to be absorbed by the deuteron.

Argon nuclides formed in goldmine neutrino "telescope" are detected by counters contained in 8-ft section of 12-in. naval rifle. Installation here is for Brookhaven National Laboratory.
in only two seconds to form helium-3 and a gamma ray.

The first of the three possible terminal reactions consists of a simple fusion of two helium-3 nuclei to form helium-4 and two protons. As we'll see shortly, the absence of product neutrinos in this chain reaction is highly significant.

These first two reactions produce quantities of helium-3 and helium-4 which can now fuse to start off the second terminal sequence by forming beryllium-7 and a gamma ray (step 3). The average time needed to bring about this collision is 30 million years. In a year or so the beryllium-7 may capture an electron to produce lithium-7 while freeing two neutrinos. The lithium-7 grabs a passing proton almost immediately to produce two helium-4 nuclei. Note that in this terminal sequence helium-3 is in effect converted into helium-4 through a temporary fusion with a helium-4 nucleus already present at the start.

While the beryllium-7 in this reaction chain is wandering about looking for an electron, it may instead bump into a proton which converts the beryllium into boron-8 and a gamma ray (this is step 4). The unstable boron-8 soon decays into beryllium-8, a positron, and a neutrino. The beryllium-8 in turn splits apart into two helium-4 nuclei. Note that in each of the three possible terminal sequences the final product consists of one or more helium-4 nuclei.

**Neutrino Clue.** Solar physicists will not be content until these highly convincing theoretical possibilities are proved and sorted out in terms of their relative importance by means of actual experiments. But how does one peer into the heart of the sun? Ordinary optical instruments are useless because they can detect only photons of light which have been bounced about and altered in various ways on their tortuous travels to the surface...
of the sun. The only hope is to work with next to nothing. As we said, the neutrino is so close to being nothing that it can zip out of the sun’s core at the speed of light, unaffected by the seething and boiling mass around it.

Just as one baseball is like any other baseball of the same type, one neutrino is pretty much like any other neutrino. You can’t tell one from another by color, size, or any other physical characteristic. But, like baseballs, neutrinos can and do have different kinetic energies depending on who or what puts them into motion. A low-energy neutrino is like a baseball hit into a pop fly, a high-energy neutrino is the same kind of baseball walloped into a home run. You can easily pick the infield hits from the pop flies and the single home run by running an eye down the energy column for neutrinos believed to be formed in solar processes:

<table>
<thead>
<tr>
<th>Source (nuclear reaction)</th>
<th>Energy (million electron volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proton-proton chain:</td>
<td></td>
</tr>
<tr>
<td>Proton to deuteron (step 1)</td>
<td>0.420 MeV</td>
</tr>
<tr>
<td>Beryllium-7 to lithium-7 (step 3)</td>
<td>0.861 MeV and 3.383 MeV</td>
</tr>
<tr>
<td>Boron-8 to beryllium-8 (step 4)</td>
<td>14.06 MeV</td>
</tr>
<tr>
<td>CNO cycle:</td>
<td></td>
</tr>
<tr>
<td>Nitrogen-13 to carbon-13</td>
<td>1.20 MeV</td>
</tr>
<tr>
<td>Oxygen-15 to nitrogen-15</td>
<td>1.74 MeV</td>
</tr>
</tbody>
</table>

Experimentally, the problem facing physicists was to devise a scientific mitt to catch and count invisible neutrino “balls” traveling at the speed of light. They then had to extrapolate these rare catches into a reasonably accurate estimate of the total numbers and kinds of neutrinos pouring out of the sun.

This is a tough ball game, made even tougher by the need to weed out and discount those neutrino balls that originate from other celestial ballparks, i.e., stars other than our own sun. No one mitt could be expected to catch all types of neutrinos—the pop flies as well as the homers. Hence the equipment was designed to trap mainly high-energy neutrinos presumed to be created during the boron-8 decay process and the CNO cycle.

Clean Catch. The most suitable scientific fielder’s mitt turned out to be 100,000 gallons of dry cleaning fluid contained in a huge tank located almost a mile underground in the Homestake Gold Mine in South Dakota. The tank was placed in the mine so that the overlying earth would screen out all interfering particles except neutrinos. The tetra-chloroethylene cleaning fluid was used because it provided an abundance of chlorine atoms (the heavy isotope, chlorine-37).

When a solar neutrino, passing through the liquid, happens to collide with a chlorine atom, the chlorine is converted into an atom of radioactive argon-37 having a half life of 35 days. Any argon-37 that is produced is later trapped in a special charcoal filter, from which it is removed and sent to Brookhaven National Laboratory. There, a special radioactivity counter mounted inside a 12-in. thick Navy gun barrel determines the amount of argon-37 present and, indirectly, the number of neutrinos that had been captured.

Every chlorine atom in the huge amount of liquid (enough to fill an Olympic swimming pool!) is in effect a potential “mitt” ready to grab a passing neutrino. There are two million trillion trillion such mitts in the tank (2 followed by 30 zeros), and it had been anticipated that ten billion billion neutrinos of various kinds would pass through the tank every day. Considering the enormous number of catchers and pitched balls, the actual number of catches predicted was astonishingly low—only one to four per day!

(Continued on page 116)
Come those long winter nights—if you think the broadcast band on your receiver is jammed from end to end, you ain't heard nothin' yet, baby! In between those powerhouse stations, nearly everyone can receive real DX. What you want are the 1000-, 500-, and even 100-watt regional stations that rarely get airborne during a snowstorm.

That’s real DX! For there are few BCLs (broadcast listeners) outside their local turf who ever get to hear these signals, let alone know that the stations exist. If you dig deep enough you’ll hear real Bluegrass music from a station in West Virginia, or some authentic French folk music from a fleapower station in Quebec. How about gutsy, bawdy logging songs from the Northwest?

Just add extra sensitivity to your BC receiver and the real DX is yours for the taking. No more bragging that you heard WWVA—just about everybody gets WWVA, man. What you should come up with is WKEE, WMTD, or WLEW. Try those out on SWL club members some night! They’ll go blind looking through White’s Radio Log.

Just about the easiest way to get the extra gain needed for real DX pickup is to build our BCB Booster. It’s a battery-powered BC preamp with amplification provided by a field-effect transistor (FET). The Booster can be had for well under $10.00, takes about 2-hours’ effort, and will provide a nominal 6- to 12-dB gain (1 to 2 S-units), depending on your receiver’s antenna-input circuit. Fact is, tests with some rock-bottom BC receivers have indicated an overall improvement of 16 dB (almost 3 S-units), due to the combination of antenna matching by L1 and the amplification provided by Q1.

Construction. The BCB Booster is built into a 3 x 4 x 5-in. aluminum cabinet. We suggest you follow the layout shown, though you can substitute your own layout as long as input coil L1 and RF choke RFC1 are as far apart as possible (certainly no closer than 3 in.) and at right angles to one another.

We do suggest you use a 4-section, 5-mH RF choke for...
BCB booster

RFC1, though such a choke may be difficult to obtain (see Parts List).

Note that only one section of a 2-section tuning capacitor is used. The 2-section capacitor is pretty much standard stock at your electronics distributor. However, if you can obtain a single-section, 365-muF tuning capacitor, substitute it by all means (again, see Parts List).

First step is to mount tuning capacitor C1 temporarily. Position it as close as possible to the left side of the cabinet and make certain it doesn’t interfere with L1. Maximum chassis area should be on the right side to leave room for all the components mounted with Q1.

Mark the locations of all holes to be drilled, remove C1, and drill all cabinet holes. Make certain before you drill any holes that B1’s holder (which is mounted on the rear apron) will not interfere with the antenna binding posts J1 and J2, or output jack J3.

Wiring Wizard. Install the components in this order: capacitor C1, the two terminal strips, battery holder, J1, J2, J3, S1, and finally, L1. Note that L1 has a green dot between two of its terminals. Orient L1 so that the dot points downward towards the bottom of the cabinet. Take extra care when wiring L1 and refer to both the schematic and outline of L1’s terminals. Completely wire L1, then install D1. Mount Q1, then install R1, C2, C3, C4, and RFC1. Solder all connections except the negative lead of B1 (coming from the battery holder).

Author used miniature power switch for S1, but any spst toggle switch will work. Locate RFC1 as far as possible from coil L1.

Snap a 9-V battery (or a mercury equivalent) into the holder—observing polarity—and connect a DC milliammeter between B1’s negative terminal and the chassis ground. The meter’s negative lead goes to the negative battery terminal and the positive lead to the chassis. Set the meter’s range so it will indicate between 5 and 20 mA full-scale.

Double check all connections to Q1 (you won’t get a second chance if you’ve made a wiring error) and then turn S1 on. As soon as power is applied, the meter should indicate approximately 2 to 4 mA. If the meter indicates much less than 2 mA, Q1 probably has an open lead.

If the meter indicates between 5 and 10 mA, check the value of R1. If necessary, increase R1 to 1000 ohms until your meter indicates less than 5 mA. Should the meter indicate more than 10 mA, quickly turn off S1 and check carefully for a wiring error. You may also have to install a new FET! Once the meter indication checks out, remove the meter from the circuit and connect B1’s negative terminal to the chassis.

Installation and Alignment. Output jack J3 should be connected to your receiver’s antenna terminals with the shortest possible length of low-capacity coaxial cable—the type made for automobile antennas. If you use a long lead, or a standard coax such as RG-8/U or RG-58/U, the signal loss between the booster and receiver will be severe, perhaps approximating the total gain from the booster.

Booster covers entire BCB with single tuning capacitor. No calibration is necessary—you simply tune for maximum signal.
If you can't obtain a piece of low-capacity cable from your local auto-radio installer, you can substitute a standard, low-loss, foam-filled cable such as RG-58/U-Foam (see Parts List). You can even purchase one of the cheaper replacement auto antennas and use a section of the supplied cable.

Connect the booster to your receiver and the antenna to binding post J1. If possible, connect binding post J2 to a ground. Tune in a signal at the very high end of the BC band (near 1500 or 1600 kHz) by setting C1 so its plates are completely open; then adjust L1's slug for peak reception.

To avoid having your receiver's AVC mask the peaking, tune in the weakest possible signal, one just over the noise level. A more accurate alignment can be made by connecting an RF signal generator to J1 and using the weakest possible signal from the generator.

**Using the Booster.** Few signals, if any, will be strong enough to overload the FET, so no switch has been provided to cut the booster in and out of the transmission line. Note, however, that D1 will short out excessively high voltages picked up from transmitters, lightning discharges, etc.

To tune in a station, simply set C1 to one of three positions: plates fully closed for low-end reception, plates half-open for mid-band reception, and plates fully open for high-end reception. Then tune in the desired signal on your receiver and peak the reception with C1—that's all there is to it!

---

**Peaking L1's slug for maximum output is only alignment required. Slug is accessible at top rear of BCB Booster's cabinet.**

Should you experience some instability as C1 is tuned, make certain the shield of the output lead from J3 is connected to both the booster's and the receiver's chassis (ground terminal). If you still experience

(Continued on page 118)

---

**PARTS LIST FOR BCB BOOSTER**

| B1 | 9-V battery (Burgess 2U6 or equiv.) |
| C1 | 1- or 2-gang, 365-pF variable capacitor — see text (Lafayette 3211103 or 3211102; or equiv.) |
| C2, C3 | .05-uf, 15-VDC ceramic capacitor |
| C4 | .001-uf, 15-VDC disc capacitor |
| Cx | — see text |
| D1 | 1N60 silicon rectifier |
| J1, J2 | Insulated binding posts, red and black |
| J3 | Phone jack |
| L1 | Antenna coil (J.W. Miller A-5495-A, Lafayette 3478710 or equiv.) |
| Q1 | Field-effect transistor (RCA 40468, Allied 49F1 40468 RCA) |
| R1 | 560-ohm, 1/2-watt 10% resistor |
| RFC1 | 2.5- or 5-mH RF choke—see text (Lafayette 3478792 or 3478793, or equiv.) |
| S1 | Spst toggle switch |
| 1 | 3 x 4 x 5-in. aluminum chassis box (Bud CU-3005A, Allied 4287639 or equiv.) |
| Misc. | — Battery holder (Keystone 203P, Allied 18F5271 or equiv.), low-loss foam RG-58/U coaxial cable (Allied 5583357 or equiv.), 3-lug terminal strip, 2-lug terminal strip, knob, solder lugs, decals, solder, wire, hardware, etc. |
Someone should develop an easy way to learn electronics at home.

RCA Institutes did!

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

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

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

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

CHOOSE A CAREER PROGRAM NOW

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

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

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

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

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

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

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

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

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

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

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

SEPARATE COURSES

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

2 CONVENIENT PAYMENT PLANS

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

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

VALUABLE EQUIPMENT

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

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

Multimeter and Oscilloscope KIts At No Additional Cost. You will receive with most RCA Institutes Career Programs the instruments and kit material you need to build a Multimeter and Oscilloscope. The inclusion of both these kits is an RCA extra.

CLASSROOM TRAINING ALSO AVAILABLE

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

JOB PLACEMENT SERVICE, TOO!

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

SEND ATTACHED POSTAGE PAID CARD FOR COMPLETE INFORMATION, NO OB-LIGATION.

IF REPLY CARD IS DETACHED—SEND THIS COUPON TODAY

RCA INSTITUTES, INC., Dept. #X-29
320 West 31st Street, N.Y., N.Y. 10001

Please rush me FREE illustrated catalog. I understand that I am under no obligation.

Name ___________________________ Age ___________________________

Address ___________________________ (please print)

City ___________________________

State ___________________________ Zip ___________________________

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

Accredited Member National Home Study Council

FEBRUARY-MARCH, 1969
Here's a stereo amplifier system which should settle, once and for all time, that hi-fi question of questions: "Which is better, components or integrated amplifier?" The hard facts: in terms of flexibility and convenience, the Dynaco PAT-4/Stereo 120 combination can walk all over any integrated amplifier we've put our hands on.

Think of just about any important sound-processing feature and you'll find it in the PAT-4 preamp. And with a solid 120 watts out of the Stereo 120 power amplifier (its sole reason for being is amplification), could anyone want for more?

The Combo. The PAT-4 is an all solid-state stereo preamplifier designed to handle virtually any combination of signal sources. The selector switch inputs are tape head, phono, tape, tuner, spare, and special. Naturally, the tape head input is NAB equalized; the so-called tape input is intended for the output of a tape preamp such as that contained in a tape deck. Both the tuner and spare inputs are for high-level signals.

As for the phono input, it accommodates up to three cartridges in jacks available on the rear apron: standard RIAA-equalized low-level magnetic pickup, ceramic pickup, or RIAA-equalized high-level magnetic pickup (if such is ever made). And the input designated special can be wired as a microphone preamplifier or as a second equalized input for a low-level device, such as a second magnetic pickup (instructions are provided).

There is also an "over-ride" jack on the front panel. Intended for high-level signal sources, it automatically disconnects the input selector switch whenever there is a plug inserted.

Three for Two. Three outputs are provided. The first is the standard tape output, connected before the preamp's tone and volume controls. The two remaining outputs are connected to the preamp's output. One of these is used for driving the power amplifier; it is connected to the amplifier through a stereo monitor jack on the front panel which automatically mutes the power-amplifier feed when the headset plug is inserted. The second is intended for a tape-recorder feed when it is desired to utilize the tone, volume, and filter circuits of the preamp. It is not muted when a headset is used.

In addition to the tape input on the selector switch, there is a spring-return tape-monitor switch that allows monitoring from a three-head recorder (but only if the recorder is being fed through the standard tape output jacks).

Controls Galore. The PAT-4 is equipped with the usual dual concentric bass and
Straightforward as an amplifier can be, Stereo 120 is clean and uncrowded as they come. Business-end of amplifier has only input jacks and speaker terminals; line cord and power switch are on opposite side.

treble controls, of course, but there's much more: switch-selected, bass-boosted loudness compensation; a low-frequency filter; and a three-position high-frequency filter providing very sharp cutoff at 15, 10, or 7 kHz. Other controls and switches are volume, balance, and two unusual channel selectors.

The channel-selector switches allow any of the following combinations: stereo, L to both channels, R to both channels, 6-dB stereo mixing, or mono/mono. The 6-dB stereo mix provides a fixed 6 dB of stereo separation to avoid the extra-spacious ping-pong effect usually obtained with phones. The mono/mono circuit allows each channel to be used as a separate mono circuit. For example, using a 78-rpm phonograph on one spare input and a tape on the other, either input could be fed in mono to the speakers.

Four AC receptacles are provided; two are switched and two are unswitched. The switched receptacles can be used to control power to a tuner, say, and to the power amplifier. The unswitched receptacles will power most anything.

The Stereo 120 amplifier is a straight solid-state stereo amplifier rated for 60 watts rms per channel. It has no controls other than an on/off switch.

Performance. Since a user would most likely utilize both the preamp and the amplifier, we tested the combination as though it were a single integrated amplifier. In other words, our measured performance is for the complete PAT-4/Stereo 120 system.

Though the amplifier is rated for 60 watts at 0.5% THD (total harmonic distortion) with an 8-ohm load, the maximum THD at 60 watts with both channels driven measured 0.35% between 20 and 20,000 Hz. Maximum power output for 0.5% THD into 4 ohms was just short of 50 watts, and just short of 40 watts into 16 ohms. Input sensitivities are given in our table.

The preamp's output voltage at the rated input level(s) was approximately 2 V rms at
Overall frequency response of combined PAT-4/Stereo 120 system. Curves at high end show rolloffs achieved with high filter; with filter out of circuit high-end response was flat to 40 kHz. As explained in text, low filter has minimal effect on program material, maximum effect on rumble.

The low-pass filter proved sharp, being only 3 dB down at 70 Hz and 20 dB down at 10 Hz. In practical terms, this means the filter has little effect on the normal low-frequency program material but provides sharp attenuation of rumble frequencies. The high-pass filter, as shown in our curves, was also extremely sharp, with little attenuation below the rated frequency.

Even with all controls wide open there was almost complete silence from the system. The noise level measured better than 70 dB down on the magnetic phono input.

The Listening Test. Our ear test satisfied us that the Dynaco pair was the excellent system our instruments indicated, the overall sound being as good as can be expected from quality equipment. The big plus, of course, is the phenomenal flexibility of the PAT-4 preamplifier.

The PAT-4 is supplied complete with a metal cover (not particularly attractive, we might mention) for $129.95 factory-wired, $89.95 in kit form. The Stereo 120 amplifier, complete with cover, is priced at $199.95 factory-wired, $159.95 in kit form. Both kits go together rather easily, so the kits represent an even better buy than the wired versions.


Need service info? Try microfilm!

Let's say you're a serviceman. And let's say your fifth repair job of the day turns out to be a TV set, black-and-white, no less, vintage 1954. Fully 24 minutes of testing, checking, probing have accomplished nothing, save to convince you that this set hails from tough-dog territory. Do you pound the bench in frustrated rage? Do you mouth words unfit for man or beast, let alone a TV set? Neither. You call on microfilm to lead you out of your quandary, and you come up with both cause and cure in 10 minutes flat!

Service industry's first microfilm system instantly locates technical and service info on all home-entertainment products ever produced by Sylvania Electric. Available to company’s distributors, dealers, and servicing contractors on lease basis, system consists of two reel-to-reel microfilm cartridges and desk-top reader which projects material on to 8 x 10½-in. screen.
This scope calibrator has zener diode regulation to give you the accurate CRT traces you really need

By Thomas R. Sear, WA6HOR

Precise measurements are in! As our article on the laboratory oscilloscope (see RADIO-TV EXPERIMENTER, October/November, 1968) pointed out, today's waveforms require the best calibrated equipment you can get your hands on. If you don't have the accuracy, you just haven't got it.

More and more sophistication is the answer. Thing is, hobbyists and experimenters often find that their ideas, ambitions, and knowledge are just too advanced for the limited equipment they can afford. Operating funds simply don't permit the kind of expenditures they would like to make. As a result, many experiments and tests go right down the drain due to a lack of hardware.

Our Rapid-Pulse Calibrator is one answer to your equipment problem. If you measure a lot of electrical phenomena with an oscilloscope and want the accuracy to do the job right, this pocket calibrator will put your scope's trace right on the ol' graticule division where it belongs.

Our Rapid-Pulse Calibrator is a precision voltage source that effectively calibrates the vertical sensitivity of your scope so that your measurements will be uniform as well as accurate. You name it—square waves, sawtooths, pulses, time markers, modulation levels, power-supply ripple—all these waveforms and more can be measured with an accuracy that's limited only by the maximum frequency that your oscilloscope's vertical amplifier will pass.

Operation. This calibrated voltage source has a free-running multivibrator consisting of Q1 and Q2. A buffer stage (Q3) is followed by a precision voltage divider made up of R6 through R10. The unit is powered by a 30-V battery. The voltage applied across the divider network is regulated by D1, a zener diode that provides a constant reference voltage.

The multivibrator provides a square-wave output (Fig. 1) with a peak voltage equal to the value controlled and passed by D1 (i.e., 25 V). The oscillator
Rapid-Pulse Calibrator

circuit has two 2N1307 transistors operated as common-emitter amplifier stages, with regenerative feedback coupled (via C2/R2 and C1/R3), from the collector of one to the base of the other.

Each transistor is alternately cut off as the other conducts to saturation. The positive and negative half-cycles of the square-wave output have a time constant determined by the RC network, the overall frequency being 1200 Hz. Most oscilloscope manufacturers seem to like this frequency for a calibration voltage. It’s great for amplifier troubleshooting.

The multivibrator output is coupled to the base of Q3. This buffer stage is used as an emitter-follower to prevent loading of the oscillator by either the zener diode or any external circuit driven by the unit (if it’s used as a square-wave source). The zener diode connected to the emitter of Q3 serves as voltage source for the divider network.

You have the choice of a 25-, 10-, 2.5-, 0.25-, and 0.025-V (peak-to-peak) output. Just select the output that is appropriate for the signal amplitude you want to measure, set your scope’s vertical gain control for a convenient deflection on your graticule, and leave the gain control alone while you do your measuring.

Construction. The unit is housed in a 5½ x 3 x 1½-in. utility box that takes up so little space it’s portable as a pill. Construction is straightforward and component layout isn’t critical. Still, we suggest you follow the photos for best results.

Use a low-power iron if possible and be sure to apply some kind of heat sink to semiconductor leads when you solder them in place. Try long-nose pliers, alligator clips—anything that’ll work. The author used a phenolic circuit board with standoff terminals as tie points, but the usual perf-board-and-flea-clip arrangement can also be used and will do just fine.

When your calibrator is assembled, simply clip the battery into its holder, flip power switch S1 on, and the desired square wave voltage will appear at the appropriate tip jack. No warmup is necessary.

Adjustment. To test the unit for the

Fig. 1. Square wave serves as calibrated voltage source for accurate scope displays.

Multivibrator (flip-flop) circuit produces square-wave output at frequency of 1200 Hz. Buffer stage (Q3) prevents loading of oscillator by zener diode (D1) or external circuit.

Insulated jacks J1 through J6 provide separate output for divider network. Pin jacks were used, but you can use other types.
first time, set your scope’s controls for an AC input, a medium-speed trace, and a vertical sensitivity of about 15 V per major division. Connect the Rapid-Pulse Calibrator’s 25-V output to the scope’s vertical input. Again, refer to Fig. 1 and adjust the scope for a stable display. The trace should show very fast rise and fall times and a flat top and bottom.

If the waveform isn’t symmetrical (see Fig. 2), the value of R2 should be adjusted until the correct trace is obtained. The waveform in Fig. 3 would indicate that the vertical amplifier of your oscilloscope is tending to oscillate and is distorting the input waveform. This peak (over-response) may be due to your overloading the amplifier, or a problem in the scope’s circuitry. Some adjustment is necessary.

**Test Traces.** Calibration of your scope’s vertical input is accomplished by the substitution method. A voltage of known amplitude (i.e., 25 V peak-to-peak) is applied to the input as a substitute for the signal about to be tested. The vertical gain control is adjusted for an exact (easily read) deflection on the CRT. If the deflection is exactly one division on the scope’s graticule, every 25 V of signal will deflect the trace exactly one more division. Remember that all oscilloscope measurements are peak-to-peak. The signal voltage is measured from maximum positive to maximum negative portion of the waveform.

As long as the vertical gain control isn’t disturbed, you have a visual voltmeter with a sensitivity of 25 V per division. (This assumes a deflection of one division for the 25-V input. However, the calibration voltage and scope display will actually depend on a specific situation.) Now, whatever test signal is fed into the scope, its amplitude can be compared with the calibration voltage.

Looking at Figs. 4, 5, and 6, we see typical waveforms whose amplitude can now be measured accurately. Fig. 4 is a sine wave having an amplitude of 4 divisions. Since our calibrated sensitivity is 25 V peak-
RAPID-PULSE CALIBRATOR

to-peak, we have a signal voltage of $4 \times 25$ V, or 100 V peak-to-peak. The trace in Fig. 5 has an amplitude of $2.2 \times 25$ V, or 55 V peak-to-peak, while Fig. 6 works out as $2.6 \times 25$ V, or 65 V peak-to-peak.

Undoubtedly you will use your oscilloscope as a supplement to your VTVM or VOM. While the scope measures only peak-to-peak voltages, most meters are calibrated to indicate rms (root-mean-square) values. To avoid confusion when working with these different instruments, you should know how to convert from one value to the other. Two formulas are all you need:

$$V_{rms} = \frac{V_{peak to peak}}{2.828} \tag{1}$$

$$V_{peak to peak} = V_{rms} \times 2.828 \tag{2}$$

Using the first formula for the 100-V signal of Fig. 4, we find the rms value to be 35.4 V. This is the effective value your VTVM would read if it had the required frequency response. You can work out the rms values for Figs. 5 and 6 using the same formula. Look at a book on AC theory and make sure you understand peak vs. rms values.

If you switch to DC coupling and connect a DC signal to your scope's vertical input, the trace will shift in accordance with its amplitude. With the gain calibrated for 25 V per division, a shift of 3 divisions will work out to $3 \times 25$ V, or 75 V. There is no need to convert from a peak-to-peak value when measuring DC; your scope acts like a direct-reading voltmeter.

The advantages of a calibrated scope over a VTVM or VOM are many. A meter simply cannot do justice to the various complex waveforms you'll want to measure. One picture is still worth a thousand meter indications.

Fig. 3. Trace indicates that overshoot is starting to develop. Distortion is due to either excessive gain or scope circuitry.

Fig. 4. Using a calibrated output of 25 V peak-to-peak, sine wave occupies four divisions on graticule. Input equals 100 V.

Fig. 5. These rapid timing pulses have amplitude of 2.2 divisions; multiplying this figure by 25 V gives us 55 V peak-to-peak.

Fig. 6. Sawtooth voltage occupies 2.6 divisions, giving input of 65 V. Equation above can change this peak-to-peak value to rms.

70 RADIO-TV EXPERIMENTER
Scientists of the U. S. Fish and Wildlife Service go fishing in streams today with some unusual portable electronic gear. Thanks to their all-electronic bait, their catch is far beyond the wildest dreams of any fisherman. On a recent field trip, for example, the scientists simply made quarter-mile drifts, yet averaged between 50 and 60 fish per stretch. This phenomenon is made possible, not with the Pied Piper’s magic, but with a pole in the form of a positive electrode. This is attached to a transistorized square-wave pulsing unit, which, in turn, is powered by a 2½-kilowatt, 230-V gasoline-driven generator. The bottom of the aluminum boat is the negative electrode.

Accentuated Positive. In principle, the
system works like this: under average conditions there is an effective field radiating out about 12 feet from each electrode. The positively-charged pole is terminated in an expanded grid about 15 x 24 in. Fish that come into this field are captured by a force known as the electrotoxic effect which herds them around the positive electrode. As they approach the pole, the increased intensity of the current stuns them and the fish turn on their sides and float to the surface. Then the scientists scoop them up with a fine mesh net.

The electrotoxic effect is one of the most interesting features of the device. It is present only with DC current. And for reasons still unknown, the fish will immediately face toward the positive electrode.
Drifting into deeper water, aide mans oars while biologists Richard Thompson (left) and Ben Patten (with net) reach for next specimen. In photos below, biologists examine specimens taken on drift with electronic fishing gear (at right); another displays 51/2-lb. largemouth bass caught with electronic fishing pole he is holding.

when encountering this current. This electric pulse also causes the fishes' bodies to twitch, resulting in a swimming action in the direction of the pole. All the fish caught are as good as fish caught in the usual way.

Up With Hooks. At present, the electronic method of fishing is on debatable ground when it comes to commercial use. If everybody fished electronically, some cautious fishery scientists say it would disturb the ecological balance of the finny world.

In short, while the Feds' unusual method of fishing makes for an interesting fish story, it's not to be swallowed hook, line, and sinker. It's the hook us wee people will be catching our fish with for years to come.

Secret of reel-less fishing, pulsing unit (above) weighs less than 3 lb, can easily be mounted atop generator (photo at left).
Sexiest thing on radio since Tokyo Rose, Titana drove me wild, wild, wild. Yet as the space ship landed, I had reason to wonder whether either she or that rarest of all QSLs would ever be mine.

By C. M. Stanbury II
Rinaldo smiled ever so slightly. "You want to go to Titan for $50,000.00. Montalban, on the other hand, wants to negotiate a treaty with the Titans. Trade a certain rare substance found only on Earth for their cosmic knowledge."

Even for that kind of money the thing sounded too risky. "Suppose I decide not to go? There's nothing in my contract about Saturn, you know."

The fat man stood up. "That would delay the flight until we found another technician. You would not be paid, of course. And you'd be detained until that treaty with Titan was concluded."

It may have been Antarctica but I had begun to sweat a little.

"Montalban has spent a great deal of money on this project and wouldn't risk a disloyal employee divulging information on Titan before the deal is cinched. Whatever the Titans have to offer, Montalban intends to have exclusive rights to it on this planet."

"And if I go, what's my part in the mission?"

Rinaldo pressed a button on his desk. Instantly, the planetary chart projected on the wall behind him was replaced with a picture of the CIA's portable BCB station. "We picked you, Mr. Tanner, because of your previous experience with this unit." Rinaldo sat down again. "Titan's ionosphere is such that this station, obtained through one of our Washington contacts, would be best suited for communications purposes. On Titan medium-wave frequencies behave like short-wave channels do on this planet."

I had to admit, at least to myself, that Titan sounded like a BCB DXer's dream.

"But we'll give you time to think about it, Mr. Tanner." Rinaldo pressed another button on his desk and the office door slid open behind me. "Overnight."

"You're a real sport."

"And on your way to your quarters, do pick up one of those translating devices from the lab so that you can monitor Titan for yourself."

I did.

In order to monitor Titan signals, you first filter out all the modulation (which is just noise designed to discourage unauthorized listeners) and feed the carrier into an oscilloscope. The scope is then scanned by an appropriately programmed computer which decodes the message. When I tuned them in they were advertising their cosmic knowledge. (Continued on page 113)
If you've ever tried to duplicate the PC board used in a Radio-TV Experimenter project, you know how difficult it can be to lay down the resist when the foil is very closely spaced. In fact, in some of the latest mini-size PC projects, the width of the tape resist is actually greater than the area between two foil connections!

But once you're equipped with an Injectorall 500 kit you can tackle just about any PC job an editor can dream up. Reason is that the kit is specifically designed for fine-foil layout.

The Injectorall 500 kit consists of a resist pen, etchant, resist solvent, a ½-in. drill bit, two small copper-clad boards (useful for practice and small projects), and a plastic carrying case that doubles as the etching tray. The really big item is the resist pen—which appears to be a standard fiber-tip fine-line loaded with resists instead of ink. (With it, you can actually draw a fine accountant's line just as you would with a fine-line fiber pen.)

To check the Injectorall 500 kit we tried making a board from a project that had appeared in our sister publication, Elementary Electronics. We first placed a piece of carbon paper between the copper-clad board and the PC layout, then traced the foil outline with a ballpoint pen. When we removed the carbon paper the layout was visible on the board. Next, we painted around the edges of the outlines with the resist pen. Finally, we tried filling in the outline with the pen.

For small areas the pen did just fine, but larger areas required resist fill with a tube of resist or resist tape. Also, we used the resist pen to mark small circles at the drilling points.

The board was then placed in the plastic tray and covered with etchant. After about (Continued on page 117)
What's going on in community antenna land—and who's behind it all!

By Charles Simpson

Nearly 60 million American homes reach up and snatch TV signals out of the air. They pick them up on everything from indoor rabbit ears to a fish-like skeleton of rods on their roof. But another group of American homes—about 4 million—couldn't care less about antennas. Their signals sneak into the set through cable. If the futurists are correct, the two groups will do a turnabout. Someday, goes the prediction, most homes will be wired for TV reception.

The reason is CATV—Community Antenna Television. It's coming out of the hills where it began back in.

(Continued overleaf)
The CATV Caper

The days of 1949 to bring signals down the mountain to TV-starved backwoods areas. Public acceptance has been so strong, it's now invading big towns like New York, San Francisco, and Philadelphia. CATV is even trying on a new name. More and more insiders are calling it Cable TV—which foretells the day when entertainment won't be the only type of service fed down the line.

Whatever the name, the wired-TV industry is fulminating with new developments. The U.S. Supreme Court recently handed it several momentous legal decisions and engineers are dreaming up innovations to expand its technical possibilities. Since these developments nibble at the foundation of commercial TV broadcasting as we know it today, it's worth a closer look at CATV to see where it is and where it may be headed.

Only No. 2. Since televiewing has turned out to be the nation's second biggest addiction (sleeping is first—measured in hours) CATV nearly begged to be born. The technical idea is easy. If TV signals are shaded from a town by rough terrain, or wakened by an obstructing horizon, one answer is height. So CATV technicians head for the hills to erect large antennas which snare signals at great distances. The signal is then routed via coaxial cable down the mountain and split among homes below. Some systems even use microwave relay to "import" signals picked up hundreds of miles away.

Early installations were crude. The cable might have been merely an open-wire line. Amplifiers to boost sagging signals were often simple types, actually intended for MATV, the Master Antenna systems for motels and other short-run applications. Nevertheless those early CATV systems tickled the hungry eye of the TV viewer. They often multiplied the number of channels he received from maybe one, to four or five. It wasn't long before technology could fill his dial with 12 channels. Today engineers talk about routing more than 30 programs through a single cable. Bringing in more viewable channels, though, is not the only reason for CATV's soaring success. Better reception, as we'll see, runs a close second.

Hometown, U.S.A. What happened in Lafayette, Indiana, illustrates how CATV can grab a whole population. After cablemen came into town, they advertised the imminent CATV system to a potential 16,000 subscribers in the area. No less than 6000 homes, signed up for the service. The shocker is that the system wasn't even turned on yet! Existing reception in the area explains CATV's potent appeal.

Nestled in the Wabash Valley, Lafayette viewers had only one local TV station. It was Channel 18, a uhf outlet. Since the FCC law which requires uhf reception on all sets was barely on the books at the time, most sets couldn't even receive the lone local signal. So townspeople erected tall towers, elaborate antennas, and rotors to intercept tantalizing city signals passing over nearby hilltops. TV reception, though, was hardly better than poor.

Head end of CATV system includes high-gain antennas for different channels and signal-processing equipment—is often unmanned.

Banks of signal processors are part of automatic head-end operation. Devices amplify signals and sometimes switch channel frequencies.

Radio-TV Experimenter
The cable company solved the problem by finding the highest available antenna site just outside of town. On high terrain they raised a huge 250-ft. tower and topped it with separate high-gain antennas for each receivable channel. Signals were processed (see photo) and led down to town through miles of coaxial cable. Linemen strung wire on more than 6000 utility poles to reach every corner of town. Some 350 amplifiers along the way fortified the system against power loss. Each paying subscriber received a house drop to drive his TV set with studio-quality pictures.

Was it worth an installation fee ($18.50) and a monthly subscription charge ($4.50) for the service? To answer the question, consider what the townspeople could now see on their screens: from Chicago came independent station WGN-TV, plus an educational outlet, WTTW-TV. From South Bend came Notre Dame's WNDU-TV. Indianapolis stations supplied two of the big networks via WFBM-TV (an NBC outlet) and WLWI-TV (ABC), as well as independent WTTV. A signal captured from Elkhart, Indiana, brought in WSJV. The CATV company also fed the local TV station through the cable, as well as Channels 72 and 76 of the Midwest Program on Airborne Television Instruction. (The uhf frequencies of the last three are translated down to regular vhf channels.)

That's not all. Subscribers on the cable also received a local music/weather program on an unused channel. It shows time, temperature, winds, and other convenient information. All the while, music from a local FM station plays when the viewer tunes this channel.

So this Indiana town received 10 channels where only one had existed before. When non-believers saw the quality and diversity of signals on neighbors' screens, many quickly became converts to CATV.

**TV, Yes or No?** The Lafayette phenomenon is easy to comprehend. There was a yawning gap to be filled and CATV did it. Up to now the youthful industry has constructed about 2000 systems around the country. Nearly 12 million people today willingly pay for programs they couldn't see before or received only at great expense because of difficult or impossible reception conditions. About 400 new systems are now under construction and nearly 2000 more communities have given the go-ahead to cable operators. Another 1700 communities are considering applications for new systems. (Since cables use city streets and utility poles, CATV operators must be awarded a franchise from each local government.)

The lure of CATV is seemingly endless. Not too long ago one operator installed a system in Greensboro, N.C. Success was hardly assured since the town is within 80 miles of 11 commercial TV stations. What's more, the FCC allowed this operator a maximum of four signals in the system. Despite such strictures, the company signed up 5000 subscribers in the first 10 months of operation and expects 10,000 by about now. The monthly fee to subscribers is $5 and few people drop the service once it's installed. Seems that anywhere CATV strings its wires, viewers respond with sock-it-to-me fervor.

**Born Free?** The medium's explosive growth was bound to attract attention. As coaxial tentacles spread and coffers filled, cablemen discovered they'd touched off con-
The CATV Caper

Main coax cable (on utility pole) runs from left to right under support cable. Splitter (center) provides four separate house drops.

The CATV system's potential to provide a variety of television programs was being enthusiastically embraced by early cable operators. CATV systems provided a valuable service to viewers, but the broadcasters saw the specter of competition. If CATV could relay air signals into the home, it could also insert its own channels on the line. This simply requires an unused channel on the TV dial. A CATV operator could originate his own programs and embark on what's called "cablecasting." Next step would be to sell time and commercials, like the regular stations do. Broadcasters were also horrified by their special poltergeist-pay TV. A cable can feed homes via a closed-circuit with movies, plays, and sports, and bill the viewer.

So broadcasters also saw increased competition for the viewer's eye. The local TV stations were now joined by distant "imports" which might prove economically disastrous, especially to many shaky independent UHF-TV stations.

Another antagonist (at least from the CATV point of view) is the telephone company. Although the total amount of cable TV business is piddling by phone company standards, mention communications and the giant stirs. CATV, after all, rides alongside phone lines into the home and could grow to formidable proportions.

At the heart of the issue is data transmission. Today's phone lines operate at low bandwidth to carry a narrow range of voice tones. The CATV coaxial cable, on the other hand, can carry thousands of voices or other messages simultaneously, since frequency response rises to hundreds of megacycles. This could provide pathways for linking, say, a centralized computer to homes for doing income tax returns, or even supplying Mom with a recipe for braised pheasant. That brand of data transmission is, of course, the province of the phone company. So Ma Bell is interested in CATV.

It explains why she has increasingly expanded her influence in the medium. About one in four cable systems today is either owned or leased by a telephone company. The broadcasters haven't been sitting still, either. They now own about one in three CATV systems and their piece of the pie is rapidly increasing as new systems are built.

Trade and Mark. Copyright has triggered another lively issue. Obviously a CATV operator picks up copyrighted programs and merchandises them for profit. Fairness, you might say, dictates that a cableman should pay a royalty for enticing subscribers with such protected items as Bonanza and Roger Ramjet. But there's another side to the argument.

CATV operators see it this way: every set needs an antenna, and cable TV merely supplies it as a service to the viewer. It's in the same category as a viewer's own antenna, or the master antenna which feeds many sets in one building or location. Copyright, therefore, doesn't apply.

The argument failed to convince a U.S. District judge who ruled that CATV was, in fact, liable to pay a royalty on copyrighted programs. (In the test case at hand, programs were motion pictures produced by United Artists.) Though it was generally agreed within the CATV industry that royalty fees were inevitable, events then took a surprising twist.

Weather information is typical of program CATV puts on unused channel for subscribers. Rotating mirror reflects image into lens.
The case reached the U.S. Supreme Court in 1968. The Court echoed the cable operators' argument in saying: "It is true that a CATV system plays an 'active' role in making reception possible in a given area, but so do ordinary television sets and antennas. CATV equipment is powerful and sophisticated, but the basic function the equipment performs is little different from that performed by the equipment generally furnished by a television viewer."

Thus the high court tossed out the earlier decision and CATV did joyous handsprings. It was now cleared of copyright obligations. The Supreme Court had found CATV "on the viewers side of the line"—not the "performer's" side, like a TV broadcaster (who must pay copyright fees). Despite the ruling, there is still feeling within the CATV industry that copyright fees may yet be required at some future date, probably after new legislation is passed by Congress.

The 1968 copyright victory was one of two important Supreme Court rulings affecting the industry. At about the same time, the Court clearly affirmed FCC authority to control CATV. Although the Commission had assumed such authority back in 1966, it took a court decision to clinch it. The test case concerned a cable company importing a Los Angeles TV signal into San Diego. The rub was that the operator also wanted to send his own commercials over the line. This was contrary to an FCC ruling which forbade the operator from "originating advertising materials." The case ultimately reached the Supreme Court with the victory going to the FCC.

Though there is no blanket restriction on CATV commercials today, the FCC has the power to decide each case. Another cable operator, for example, was not ordered to stop originating commercials because it couldn't be proved that he was hurting TV broadcasters.

With FCC jurisdiction firmly established, the Commission's other regulations over CATV take on renewed force. For example, each system must carry on the cable all local channels, in addition to distant signals. A CATV system may not bring in programs from a distant station when they duplicate programs carried by local stations. (This only applies on a same-day basis. Planned switchers at the CATV head-end automatically prevent such duplication.) Further, if a CATV operator wishes to build a system in one of the nation's top 100 TV markets, he must obtain FCC approval. The Commission then decides whether the system will hurt existing TV stations.

The liveliest action in CATV today is in those 100 top markets, the big cities that contain a vast proportion of TV viewers. Why a cable where channels are usually numerous and close at hand? One operator neatly answers the question. Viewers in Astoria, Oregon, he says, get a clearer pic-

Since distant channels may not duplicate local stations, operators use programmed switchers to prevent reception of these signals.

Officials of Newport Beach watch installation of underground cable. Trench is dug quickly with special equipment and no poles need be used.
The CATV Caper

picture of Johnny Carson than New Yorkers located a few blocks from the studio where he originates. Manhattanites often suffer horrendous TV reception. Ghosts, rollovers, herringbones, jitters, overloads, and other distortions are common as signals careen and collide through concrete canyons. Buyers of color sets get Excedrin headaches (in blue) after spending $599 to see psychedelic confetti.

But the cable is coming to the rescue. As in several other large cities, CATV operators in New York are laying cable and signing up subscribers.

Big-city operation is no easy matter of stringing cable along utility poles. The cable must often run through underground ducts at a phenomenal cost (as high as $100,000 per mile.) Operators hit another snag at the threshold of large multiple dwellings—the landlord, who usually wants part of the take for admitting the cable.

It’s the high cost of cable-running in the city that’s caused CATV men to look skyward. Like the broadcasters, cable companies want a free ride through the atmosphere. The quest for cheap signal distribution has led to two new proposals.

First is microwave relay. Microwave transmissions have long been used by CATV operators to import distant TV signals that couldn’t be picked up by mountaintop antennas. A recent trial approval by the FCC also allows microwave transmissions on a local basis to hop over underground ducts.

For instance, an 18-GHz signal is beamed toward apartment houses. A small receiver atop the building converts the microwave signal (which can carry several dozen channels simultaneously), and programs are fed through the building’s cable network. The range of the microwave signal is now about 12 miles. Though microwave relay is usually considered a point-to-point medium, one CATV operator believes the beam can spread over a large arc to cover many buildings at once.

(Continued on page 118)
For home movies and slide shows:

AUTODIM...

... the all-electronic control that both dims and brightens lights in the majestic, big-theatre fashion

By Ron Michaels

The audience fidgets in their seats for a few moments, then the house lights slowly and majestically dim to a gentle glow. The curtain rises and the show begins.

Once upon a time, scenes like this happened only in movie theatres. Happily, the very same thing can now take place in your own living room before a slide or home-movie show. You provide the fidgety audience, and this unusual device—which we call the Autodim—will provide the smoothly dimming house lights.

All you need do is plug a floor or table lamp (up to 300 watts) into its socket. At the downward flip of a switch, the lamp slowly slides from normal brightness down to whatever level you preselect—anywhere from just under full brightness to a just-visible golden glow or even total darkness. When the show's over, you flip the switch upwards and the light level rises back to normal (smoothly, but about twice as fast as the dip down).

Actually, the Autodim is more than just a gadget. By bringing room lights down slowly—the downwards trip takes about 8 seconds—rather than turning them off all at once, viewers' eyes have time to become accustomed to the change. You and the members of your audience will applaud the lack of visual blackout.

How It Works. Heart of the circuit is a conventional full-wave SCR light-dimmer circuit (shown within dotted lines on the schematic diagram). In usual applications, this circuit is controlled by a variable resistor in the emitter circuit of the unijunction transistor (Q2). The degree of dimming depends on the amount of resistance present in the emitter circuit.

In the Autodim circuit, the usual variable resistor is replaced by a field-effect transistor or FET. This device (Q3) functions as a voltage-controlled resistor; the more negative the voltage applied between the gate and source electrodes, the greater the resistance between the drain and source electrodes. Thus, the FET's gate/source voltage in effect controls the light dimmer circuit.

The smooth downwards and upwards sliding operation of the dimmer is achieved by feeding a smoothly decreasing or increasing voltage sweep to the FET. How this is done is best explained by considering what the
AUTODIM

different front and side panel controls do.

Function switch S2 is a three-position lever switch. In its uppermost position (MANUAL), the FET input terminals are connected directly across manual light-lever control R5. This means that the device will function much like an ordinary dimmer circuit—varying R5 will change the light level. Prime function of R5 is to permit you to set the “normal” light level in your living room (this will be the “up” or “high brightness” setting).

When you flip switch S2 to its center position (AUTO UP), capacitor C3 is placed across the FET’s gate/source circuit. This is a time delay capacitor, and you may find that it now takes several seconds for the light level to reach the NORMAL level you specified by setting R5. This delay corresponds to the time required for C3 to charge.

When you flip the switch to its bottommost position (AUTO DIM), the FET input circuit, complete with capacitor C3, is switched from control R5 to control R4 (the low limit set control). As the capacitor discharges to the more negative voltage represented by R4’s setting, it smoothly carries the FET’s input along with it. As a result, the room lights slowly dim until they reach the low point you specified by setting control R4. There they remain until you flip the function switch back to AUTO UP. R5’s high-limit setting then takes over, and the capacitor charges again, carrying the FET input voltage and the room light level up with it.

Building It. The cabinet used for our model is a 4-in. wide sloping panel aluminum utility box (Bud AC-1612-A or equiv.). However, there’s nothing critical about the layout, so don’t hesitate to custom-mount the AUTODIM most anywhere you wish. All of the components except the switches, manual control R4, and output socket J1 (which are all cabinet mounted) are mounted on a piece of perforated phenolic chassis board. Using epoxy, cement a small heat sink for the SCR onto the chassis; then wire the other components on the chassis board using push-in terminals as soldering points.

Double-check the polarity of the diodes and transistors before you solder them in place. Note that the “case” lead on the FET (see the diagram supplied with the transistor) should be cut off before you mount the unit. Also, use considerable care when you solder the small solid-state components, since both the unijunction and FET can be easily damaged by excess heat.

The wiring to the “left” of R1 on the diagram (including the SCR and the diode bridge composed of D1 through D4) will handle high AC or DC voltage (117 VAC and approximately 100 VDC, at different circuit points), so keep leads well spaced, and be especially watchful for short circuits. The circuit itself is not grounded to the case. However, since an improbable combination of component failure and short circuit could, conceivably, make the case electrically hot,

Front and rear views of completed Autodim. Unit is plugged into AC outlet; slide projector plugs into socket at rear of Autodim. Because of this arrangement, switch S1 must be on for projector to operate. Note position of grounded, three-prong socket (J1) at rear of unit.
a three-wire, grounded line cord must be used. Connect the green ground lead to the case.

Bias battery B1 is mounted in a battery holder inside the top of the case; current drain from this battery is miniscule, and it should last for well over a year of normal dimmer use. When no setting of R4 will dim room lights completely it's time to replace the battery.

Note that screwdriver-adjust pot R4 is mounted on a small metal bracket bolted to the chassis board. Cut a small access hole in the side of the case so that you can reach R4's slotted shaft with a small-blade screwdriver.

**Adjustment and Use.** Setting R4 can be tricky because of the time delay effect of capacitor C3. To adjust it, plug a lamp into the unit and set the function switch to the AUTO DIM position. Turn R4's shaft fully counterclockwise to produce a fully lit lamp (if you've wired the pot's lug's backwards, you may have to turn the shaft full clockwise). The lamp will require several seconds to reach full brightness.

Next, turn the shaft in the opposite direction, in small steps. After some movement you'll note that the lamp brightness will decrease. Allow at least 10 seconds between each step to give the circuit time to stabilize. Stop the procedure when you reach a low-brightness setting you consider pleasing.

Before each use of the AUTODIM, flip the function switch to MANUAL and use R5 to set the normal room light level. Bear in mind that R5 will be effective only about 30-percent of its rotation; at the far clockwise and counterclockwise settings the room lights will be either full off or full on.

You may also find that setting R5 to its maximum lights on full-on position introduces occasional slight flickering. This is caused by the ultra-sensitive FET unijunc-
AUTODIM

tion circuit responding to slight voltage transients. To remove them, simply back off on R5’s rotation slightly; maximum room brightness level will be unaffected.

One final point: whenever you turn the device on, cycle the lamp brightness down and up once or twice. This will permit capacitor C2 to build up a proper charge. You’ll probably observe that on the first downward dip, the light level will follow a kind of rollercoaster path, as C2 charges.

**Timing Modification.** If you wish to lengthen the time of the downward light level dip, increase the value of C3. As a rule of thumb, doubling its value (to 1.0 uF) will double the down and up times.

Two views of Autodim with cover removed. As explained in text, heatsink for Q1 is first cemented to chassis board, then other components are wired in place using flea clips as soldering points. Hole drilled in side of cover permits screwdriver adjustment of R4.

TWO-BAND TUNER IN A ONE-BAND CASE

As any TV technician well knows, frequencies of TV channels have a habit of hop, skip, jumping across the spectrum. (Channel one, now defunct, once fell between 44 and 50 MHz, yet channel two opens up on 54 MHz and channel seven way up on 174 MHz.) Worse yet, the fact that there are two distinct FM bands in use has meant that most TV sets have actually incorporated two distinct tuners—one for VHF channels, the other for UHF. Now, a new tuner developed by Oak Mfg. Co. puts UHF and VHF tuning circuits in a single housing. Dubbed the Mark IV, the tuner owes its success to two factors: invention of a new switching scheme and some unusual, three-transistor circuitry.
One change that doesn't show up on the propagation chart this time of year is a subtle shift which will take place in reception from Africa and Latin America. As spring approaches, the emphasis will gradually shift from equatorial stations to those further south into the southern hemisphere. This especially applies to DX below 9 MHz.

On 49 meters you can start looking for stations in Argentina, Chile, Uruguay, and of course southern Brazil (where Portuguese is the language). On 60 Meters you'll see gradually improving reception from potential hot spots like Rhodesia, Angola, South Africa and Zambia. With the exception of Angolans, a particularly favorable time for this area is between 2200 and 2330 EST, when many broadcast voices in lower Africa S/on.

Shortwave listeners can expect regular reception from R. Hanoi on 15015 kHz (just one kiloHertz below our Apollo man-on-the-moon program's prime SW channel) during afternoon hours. Prior to this current phase in the sunspot cycle, afternoon hours have been the poorest time for Asian reception in most of North America. Incidentally, North Vietnam's menu includes English at 1500 EST, so don't mistake their announcer for one of our men on his way to the moon.

By C. M. Stanbury II
December 1968/January 1969

To use the table put your finger on the region you want to hear and log, move your finger down until it is alongside the local standard time at which you will be listening and lift your finger. Underneath your finger digit will be the shortwave band or bands that will give the best DX result. The time in the above propagation table is given in standard time at the listener's location, which effectively compensates for differences in propagation characteristics between the East and West Coasts of North America. Abbreviations: w—Western North America and e—Eastern North America. When w or e follow a band listing, it means the band is only good for that part of the continent. The short-wave bands in brackets are suggested as possible second choices. Refer to White's Radio Log for our world-wide Shortwave list.
"Psst! Hey, buddy! You want a ham license? You do? Good. Just step back here in this dark doorway where nobody can see us and I'll fix you up. You say you don't know the code? Aw, c'mon, Clyde, don't be a dummy—you don't need that stuff any more! And you're not so hot on theory? Forget it! Just step back here in the shadows and I'll show you how to get a genuine ham ticket real easy. By this time tomorrow, you'll be on the air, having a ball!"

An imaginary conversation? Right now fortunately, it is. But there are forces at work trying to make our little back-street melodrama for real.

All sorts of individuals and organizations have been taking stabs at making it easier to get a ham ticket. Any of those stabs could be a stab in the back for ham radio if they succeeded.

"We're just trying to inject more new blood into ham radio," they proclaim innocently. "Ham radio is not growing proportionately to the rest of our society, so we're just trying to encourage more people to take up this fascinating hobby."

And I say "Hogwash."

Ham radio does not need quantity to thrive, it needs quality. Increasing the number of hams will do nothing to make our hobby healthier if those hams get their licenses through easy exams that fail to weed out incompetents.

Not one of the proposals for easier licenses and expanded privileges will stand this test: will the proposal improve the ability of the new licensee to understand the operation of his equipment or to carry on useful, meaningful communications.

Some of the nutty proposals call for abolishing the code test, or for a slower code speed than the present 5 wpm required of Novices and Technicians. Some of the proposals seek to put Novices or Techs on 10 Meters, or Novices on 6 Meters, or Novices back on one on 2 Meters. Others seek to make the Novice ticket renewable, thus missing the whole point of having the Novice Class in the first place: purely as a means of obtaining on-the-air experience in working toward a higher-class ticket.

Every now and then, someone who pretends to be of sound mind proposes creation of a new type of license, which might be called a "hobby" license or a "communicators" license, with little or no examination of applicants. Idle talking has become such a big part of our easy-come, easy-go society that some misguided souls think filling the air with meaningless chatter should be extended to all ham bands.

None of these proposals hold water when you ask how they would make ham radio better. What is clear is that they would water down our ranks tremendously by bringing in a lot of warm bodies, many devoid of brains.

A while back, we finally got back on the right track toward upgrading the Amateur Radio Service with a return to incentive licensing. Let's keep that plan in operation by junking all these silly requests for give-away licenses. If we don't, we'll be giving away ham radio. And we'll never get it back.

**New DX Challenge.** For several years, the future of the DXCC award has been in doubt. For the ham who has everything, DXCC became a hollow victory. After all, once you have it, what can you do for an encore?

Now, there is an encore possible, and it's a dilly! A new five-band DXCC award has
been created by the ARRL. To receive it, a ham must have confirmation of at least 100 countries on each of five separate bands. Some of the hard workers probably have the QSL cards stashed away right now to get this award, but there's a hooker: all contacts must have been made after January 1, 1969!

That'll separate the men from the boys for quite a while, and breathe some new life into what had become a "so what?" type of award. With the current sunspot cycle starting downhill and a slice of 40-Meter DX frequencies now taken away from all but the Extra and Advanced Class operators, this award is going to be the object of some feverish activity.

**High-Priced Hamming.** "Never mind the bruises—collect, collect, and make a speech now and then about restraint and holding the line."

That's Ernie Welling, VE2YU, complaining, and he has plenty to complain about. Ernie is editor of *electron* (a Canadian electronics magazine), and he writes a regular column in the magazine dealing with ham radio.

Lately he's been taking editorial pot shots at the high taxes, duties, and fees which Canadian hams must pay, and he appears to have a sharp aim. When you consider what our neighbors north of the border must pay for licenses and taxes on their equipment, it's remarkable there is any ham radio in Canada at all.

The latest oppressive indignity to be dumped on the VE/VO hams is a fantastic increase in license fees: from $2.50 to $10.00! That's a 400% increase, and they have to pay it every year! Amendments to an existing license now cost $6.00!

Ernie's reaction to this dumbfounding development is concise and to the point:

"The increase in the amateur license fee is an outrage. It has been forced on the licensees without consultation; it is visited upon a group who are not using radio for profit or reward; it penalizes a large number of non-wage earners; it will seriously affect the growth of the hobby among the young, where the country needs it most; and it does not correspond to any increase in services by the Department of Transport. We will obviously have to stop thinking of this as a license fee because what we now have on our hands is a tax—'a contribution levied for support of the government.'"

Those words could well be taken to heart by U.S. hams, who have rather blithely accepted our license "fees" without questioning where the money really goes or what it's spent for. (For the record, license fees which U.S. hams pay do *not* go into the FCC budget, and they are *not* proportional to the amount of service which hams receive from the FCC.) I've insisted since the beginning that these are not fees we pay—they are taxes in the true sense of the word. What's more, they are unfair, discriminatory, and illegally-levied taxes at that.

Our Canadian comrades have the same problem, save that they must cough up more than we do. We could be next in this mad mania of modern governments to tax everything in sight and then keep raising the price.

Ernie reports there has been quite a ruckus raised over the license-fee increase, with several petitions filed opposing it.

But the license tax isn't the only price of being a ham in Canada. For all store-bought equipment, there's also the not-so-little matter of the 15% Federal excise tax. Then there's the 11% Federal sales tax. In some cases, there's a provincial sales tax. And if

(Continued on page 114)
White's Radio Log was founded in Providence, R. I. by Charles De Witt White as an extension of his earlier publishing activities. Interestingly enough, these, in turn, were a continuation of the business established by his father: the publication of city directories, street guides, and municipal tax guides.

In the early days of broadcasting, compiling a list of operating stations and their frequencies was no simple task. Reason was that prior to the Dill-White Radio Act of 1927, any feed merchant, auto dealer, barber, or undertaker who wanted to advertise his wares or services had only to select a frequency and go on the air. A great many experimenters and businessmen did just that. Nevertheless, Mr. White's directory publishing experience had convinced him that he could successfully assemble a radio log. In 1924 he justified this conviction with The Rhode Island Radio Call Book, following this shortly after with White's Triple List of Radio Broadcasting Stations.

In 1927 the two publications were merged and nation-wide distribution established. In ensuing years related publications, such as Sponsored Radio Programs, Radio Announcer's Guide, Short-Wave Schedule Guide, and a special Canadian edition of the Log (which had had its title shortened to the one it bears today), were also issued.

The Log itself eventually reached a combined circulation of well over a million copies. It also came up with some rather unusual bedfellows. In 1929-31 it was distributed as the Enna Jettick Radio Log (to promote the sale of shoes); in 1938-9 as the General Electric Radio Log to promote General Electric's "sensational 1939 receivers with pushbutton tuning."

The Fall-Winter number of the 1927 Log listed 701 U.S. stations. Most powerful were WEAF (now WRCA), New York, with 50,000 watts; KDKA, Pittsburgh; WGY, Schenectady; and WJZ (now WABC), New York, each with 30,000 watts; WGN-WLJ, Chicago, with 15,000 watts; and Boston's WBZ, also with 15,000. Five stations listed (one a Junior High School in Norfolk, Va.) operated on a mighty 5 watts; more than 100 stations had outputs of less than 100 watts.

The current Log cross-indexes over 4244 U.S. standard-broadcast (AM) stations, over 2247 U.S. frequency-modulation (FM) and over 810 television stations, has a complete compilation of Canadian broadcasters, and, in addition, has a comprehensive world-wide roster of shortwave stations.

With the success of his Log, Charles De Witt White (a direct descendant of Peregrine White, the first child born on the Mayflower's historic crossing and bearer of the name of another illustrious ancestor, De Witt Clinton) disposed of his city directory and street guide interests. In time, he transferred his editorial operations to Bronxville, N. Y., a suburb of New York City, where he could remain in close touch with the
broadcasting industry. On April 6, 1957, having only recently completed revising and updating material for the 34th consecutive year of his Log, Mr. White died in his sleep. He was 76 years old.

Charles De Witt White’s daughter and heir, Mrs. W. R. Washburn, sold all rights in and to the Log to Science & Mechanics Publishing Co., and entrusted us with continuing her father’s work. This we were proud to do back in 1958 in the fifth issue of Radio-TV Experimenter—then an annual publication.

Beginning with our first bimonthly issue in 1964, White’s Radio Log was divided into three parts (it had grown to 60 pages in size and was much too large to incorporate in any one issue). From 1964 until the present, we published the Log in three parts, updating each part right up to press time.

Now, in 1969, the size of the Log again necessitates a change. Therefore, White’s Radio Log will be published in six parts during 1969. In each issue we will include a major listing for either AM Broadcasting Stations, FM Broadcasting Stations or Television Stations; plus the expanded World-Wide Shortwave Section (brand new for each issue); plus the all-new Emergency Radio Listing for major U.S. cities (a different major city will appear in every issue).


As always, as we go to press on each issue of White’s Radio Log, station additions, changes, and deletions are made by the U.S. and Canadian governments. The same holds true for the world-wide shortwave broadcasters. Therefore, the Editor cordially invites all readers to inform him of any changes that must be made to keep the Log up to date. (In some instances our readers discover and notify us of changes before the FCC or DOT officially inform us.) Keep your cards and letters coming—they are most sincerely appreciated, and it’s the one way you can help us make a better Log.

### WHITE’S RADIO LOG CONTENTS FOR 1969

<p>| RTVE Issue       | Listing                                                        | Page |
|------------------|----------------------------------------------------------------|
| Feb./March       | U.S. AM Stations by Frequency                                  | 92   |
|                  | World-Wide Shortwave Stations                                   | 107  |
|                  | Emergency Radio Services—Chicago Area                          | 109  |
| April/May        | U.S. TV Stations by States                                     |      |
|                  | Canadian TV Stations by Cities                                  |      |
|                  | Canadian AM Stations by Frequency                               |      |
|                  | World-Wide Shortwave Stations                                   |      |
|                  | Emergency Radio Services—New York City Area                    |      |
| June/July        | U.S. AM Stations by Location                                   |      |
|                  | World-Wide Shortwave Stations                                   |      |
|                  | Emergency Radio Services—San Francisco Area                    |      |
| Aug./Sept.       | U.S. FM Stations by States                                     |      |
|                  | Canadian AM Stations by Location                                |      |
|                  | Canadian FM Stations by Location                                |      |
|                  | World-Wide Shortwave Stations                                   |      |
|                  | Emergency Radio Services—Boston Area                           |      |
| Oct./Nov.        | U.S. AM Stations by Call Letters                                |      |
|                  | World-Wide Shortwave Stations                                   |      |
|                  | Emergency Radio Services—Philadelphia Area                     |      |
| Dec./Jan.        | U.S. FM Stations by Call Letters                                |      |
|                  | Canadian AM Stations by Call Letters                            |      |
|                  | Canadian FM Stations by Call Letters                            |      |
|                  | World-Wide Shortwave Stations                                   |      |
|                  | Emergency Radio Services—Washington-Baltimore Area             |      |</p>
<table>
<thead>
<tr>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEAB Greer, S.C.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KDDD Dumas, Tex.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WVEV Creve, Ill.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WKEE Huntington, W.Va.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>810 - 370.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KGO San Francisco, Calif.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KWSR Redwood City, Calif.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRIA Indianapolis, Ind.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WEKG Jackson, Ky.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WSPW Rockford, Mich.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WWLL Lima, Ohio</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>820 - 365.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WAIL Champaign, Ill.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WSOM Columbus, Ohio</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WFAA Dallas, Texas</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>830 - 361.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KIKI Honolulu, Hawaii</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>WCCO Minneapolis-St. Paul, Minn.</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>KBOA Kennewick, Wash.</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>840 - 356.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WTUF Mobile, Ala.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRMY New Britain, Conn.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WQNO New Orleans, La.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WVPO Stroudsburg, Pa.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>850 - 352.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WYDE Birmingham, Ala.</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>KGKO Anchorage, Alaska</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>WURF Gainesville, Fla.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WEAT W. Palm Beach, Fla.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WCLR Crystale Lake, Ill.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WKIZ Muncie, Ind.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WFKU Dayton, Ohio</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WJZJ Indianapolis, Ind.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WKYN Knoxville, Tenn.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KTAC Tacoma, Wash.</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>860 - 348.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHRT Harrisburg, Alta.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGIM Tucson, Ariz.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KFKF Phoenix, Ariz.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KOSE Salinas, Calif.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGHE Bakersfield, Calif.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGUI Newton, Iowa</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WQOS Ruston, La.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WADK Danbury, Conn.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WZLD Rockville, Conn.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WATF Wilmington, Del.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WJAT Swansboro, Ga.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WERS Anderson, S.C.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>XKIC Iowa City, Iowa</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WYCL Minneapolis, Minn.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WVAL Rapid City, S.D.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WMC Memphis, Tenn.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WTRM Hampton, Va.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WUTA Lubbock, Tex.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KQED Oakland, Calif.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WSIG Mount Jackson, Va.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGMI San Francisco, Calif.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGMI Bellingham, Wash.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KJRD Spokane, Wash.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WSNW Dubuque, Iowa</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>870 - 344.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KIEV Glendale, Calif.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KAIM Hemet, Calif.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WVLH New Orleans, La.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WCHU Ithaca, N.Y.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WPHS Worthington, Ohio</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRFL White River Jet, Vt.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>880 - 340.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KRYN Lexington, Neb.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WDAY New York, N.Y.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRIZ Clinton, N.C.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WFLR Worthington, Ohio</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>890 - 336.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KUGI Seattle, Wash.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WHNC Henderson, N.C.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KBYE Okla. City, Okla.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>900 - 331.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATV Baltimore, Md.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WOZQ Akron, Ohio</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KOSY Texarkana, Tex.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KFHP Arlington, Va.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KQED Anchorage, Alaska</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WQKI Fairbanks, Alaska</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WGCK Corpus Christi, Texas</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WJRT Kent, Wash.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WJAT Jackson, Miss.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WPNR Tuscaloosa, Ala.</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>KGAM Glennallen, Alaska</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>KXAR Anchorage, Alaska</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>KJKC Juneau, Alaska</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>WLBE Lesburg, Fla.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WPBF Cedar Rapids, Iowa</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WSPC Pensacola, Fla.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WFOR Fort Myers, Fla.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WYNN Bricktown, Okla.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WGRA Calico, Ga.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KGOM Cortez, Colo.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WJET Erie, Pa.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRDI Detroit, Mich.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WCRV Sedalia, Mo.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRKZ Pacific Grove, Calif.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRMS Beardstown, Ill.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WAKV Canton, Ohio</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WAKY Louisville, Ky.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WRMU Rumford, Me.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WYTM Des Moines, Iowa</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WORF Oshkosh, Wis.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WQHY Last Chance, Mont.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KGHL Billings, Mont.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WAVI Wilkes Barre, Pa.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WLSW Wellsville, N.Y.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WQMB Watertown, S.D.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KFGO Fargo, N.D.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KGKL Guaymas, Ariz.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KGJZ Abilene, Tex.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>910 - 329.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOOG Paducah, Ky.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>WDRC Brooklyn, N.Y.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WPLA Plant City, Fla.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGWM Grand Island, Ne.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WQAT Valdosta, Ga.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGAY Las Vegas, Nev.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGDF Midwest City, Okla.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WJZJ St. Louis, Mo.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KBRR Denver, Colo.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WRHX New Britain, Conn.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>WPAL Plant City, Fla.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGRL Grand Forks, N.D.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGTA Toledo, Ohio.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KGXX Gainesville, Ga.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KCOX Oklahoma City, Okla.</td>
<td>2500</td>
<td></td>
</tr>
<tr>
<td>KALF Temple, Tex.</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>KATX Waco, Tex.</td>
<td>2500</td>
<td></td>
</tr>
</tbody>
</table>
Discover the ease and excitement of NRI’s 3 DIMENSIONAL METHOD of Electronics, Communications, TV-Radio Training

12 HOME STUDY PLANS TO CHOOSE FROM

 Practically all vocational and engineering schools require students to conduct carefully planned laboratory demonstrations to prove theory presented in textbooks. So does NRI. Why? Because the only way to really learn at home... to recognize and understand circuits... is to get your hands on actual equipment, including transistors, printed circuits and today’s other solid-state devices. NRI’s unique, 3-Dimensional training method puts theory you learn into actual practice. You learn with your hands as well as your head. You learn by unique “discovery” methods the WHY of Electronics, Communications, TV-Radio... WHY circuits do the things they do. NRI training starts with carefully, condensed “bite-size,” interesting books programmed with absorbing, revealing experiments using the finest parts money can buy. You get the kind of technical training that gives you experience equal to many, many months of performance on the job.

Whatever your interest, whatever your education, the NRI 3-Dimensional training method can fill your needs. Learning becomes as close to being fun as any school can make it. Tens of thousands of men have learned the NRI way. Pick the field of your choice and mail the postage-free card today for your FREE NRI Color Catalog. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D.C. 20016.

BEGIN NOW AN ABSORBING ADVENTURE—LEARN ELECTRONICS THE NRI WAY—MAIL CARD TODAY

OVER 50 YEARS OF LEADERSHIP IN ELECTRONICS TRAINING
1 Start Fast with NRI's Educator-Acclaimed Achievement Kit

The day you enroll with NRI this remarkable starter kit is on its way to you—regardless of the course you choose. It is specifically designed for you and your training objective. It has one purpose—to get you started quickly and easily. It is an outstanding way of introducing you to NRI training methods...an unparalleled "first dimension" that opens the way to new discoveries, new knowledge, new opportunities. The Achievement Kit is worth many times the small payment required to start your training. Find out more about it. Mail the postage-free card now.

2 NRI "Bite-Size" Lesson Texts
Program Your Training

Reading is a necessary part of any training program, but it takes a great deal of stamina to wade through a 300-page technical textbook. Every NRI course is condensed into "bite-size" texts that are simple, direct, well illustrated, averaging an easily-digested 40 pages. These are "programmed" with NRI training equipment you build, experiments you perform, to bring to life the fundamental laws of electronics, the theory, the training of your choice. You are always kept well supplied with these books, NRI does not require you to "pay as you go."

3 You Get Practical Experience
With Actual Electronic Equipment

NRI does not leave the practical side of Electronics to your imagination. Electronics becomes a clear, understandable force under your control as you build, experiment, explore, discover. NRI pioneered the concept of home-lab training equipment to give you 3-Dimensional knowledge and experience. Every kit is designed by NRI to demonstrate principles you must know and understand. Kits contain the most modern parts, including solid state devices. NRI invites comparison with equipment offered by any other school, at any price. Prove to yourself what nearly a million NRI students could tell you...that you get more for your money from NRI. Mail postage-free card for your NRI Color Catalog. No obligation. No salesman will call.

APPROVED UNDER GI BILL. If you served since January 31, 1955, or are in service, check GI line in postage-free card.
<table>
<thead>
<tr>
<th>Station</th>
<th>Call Letters</th>
<th>City, State</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBH</td>
<td>WMAB</td>
<td>Miami, Fl.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMBF</td>
<td>Beaufort, N.C.</td>
</tr>
<tr>
<td>WKY</td>
<td>WMCA</td>
<td>Chattanooga, Tenn.</td>
</tr>
<tr>
<td>WBG</td>
<td>WMID</td>
<td>Iowa City, Iowa</td>
</tr>
<tr>
<td>WCF</td>
<td>WMIR</td>
<td>Scranton, Pa.</td>
</tr>
<tr>
<td>WSG</td>
<td>WMIN</td>
<td>Minneapolis, Minn.</td>
</tr>
<tr>
<td>WCI</td>
<td>WMIN</td>
<td>Kalamazoo, Mich.</td>
</tr>
<tr>
<td>WDD</td>
<td>WMMC</td>
<td>York, Pa.</td>
</tr>
<tr>
<td>WBM</td>
<td>WMNI</td>
<td>Milwaukee, Wisc.</td>
</tr>
<tr>
<td>WBR</td>
<td>WMMI</td>
<td>Lebanon, Tenn.</td>
</tr>
<tr>
<td>WBG</td>
<td>WMMI</td>
<td>Augusta, Ga.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMR</td>
<td>Port Chester, N.Y.</td>
</tr>
<tr>
<td>WCR</td>
<td>WMMT</td>
<td>Indiana University, Bloomington, Ind.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Kansas City, Mo.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Madison, Wis.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Oklahoma City, Okla.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Springfield, Mass.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Toledo, Ohio</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Wilmington, Del.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Jacksonville, Fla.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Providence, R.I.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Atlantic City, N.J.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Birmingham, Ala.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Las Vegas, Nev.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Dallas, Tex.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>WBB</td>
<td>WMMU</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>kHz</td>
<td>Wave Length</td>
<td>W.P.</td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>5000</td>
<td>WIXI Lancaster, Ky.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WDSU New Orleans, La.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>KWW Atlanta, Ga.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WABK Gardner, Mo.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WFYD Alma, Mich.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WFTC Minneapolis, Minn.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WSCD Taylorville, Miss.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>KYRO Laramie, Wyo.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WCGY Silver City, N.M.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WFXN Atlanta, Ga.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WJTO Portland, Me.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>KJZI Minot, N.D.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WABT Cleveland, Ohio</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>Wawi New Haven, Conn.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WTKT Cocoa Beach, Fla.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WADD Simms, Mont.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WSAW Green Bay, Wis.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WLOL Green Bay, Wis.</td>
<td>1000d</td>
</tr>
<tr>
<td>5000</td>
<td>WGLM Warren, Pa.</td>
<td>1000d</td>
</tr>
</tbody>
</table>

---

**220 - 227.1 MHz**

- **1320 - 1322 MHz**

- **1340 - 1343 MHz**

---

*February-March, 1969*
<table>
<thead>
<tr>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>WLSB</td>
<td>Copperhill, Tenn.</td>
<td>1000</td>
<td>KJST</td>
<td>Joshua Tree, Cal.</td>
<td>1000</td>
<td>WLSIS</td>
<td>Old Saybrook, Conn.</td>
<td>1000</td>
<td>WBNR</td>
<td>Bradfordton, Fla.</td>
<td>1000</td>
<td>WTGR</td>
<td>Silver Spring, Md.</td>
</tr>
<tr>
<td>1000</td>
<td>WHAL</td>
<td>Shelbyville, Tenn.</td>
<td>1000</td>
<td>WLBIS</td>
<td>Saybrook, Conn.</td>
<td>1000</td>
<td>WBOC</td>
<td>Bridgen, Fla.</td>
<td>1000</td>
<td>WREST</td>
<td>St Augustine, Fla.</td>
<td>1000</td>
<td>WSMI</td>
<td>Sandesten, Fla.</td>
</tr>
<tr>
<td>1000</td>
<td>WHUN</td>
<td>Bullingdon, Tex.</td>
<td>1000</td>
<td>WLBNN</td>
<td>Business, Tex.</td>
<td>1000</td>
<td>WSMV</td>
<td>Mobile, Ala, Ind.</td>
<td>1000</td>
<td>WFTF</td>
<td>Tallahassee, Fla.</td>
<td>1000</td>
<td>WSMW</td>
<td>Winchester, Tex.</td>
</tr>
<tr>
<td>1000</td>
<td>WUBB</td>
<td>Mission, Tex.</td>
<td>1000</td>
<td>WLBRC</td>
<td>Arlington, Tex.</td>
<td>1000</td>
<td>WSMR</td>
<td>Sandesten, Fla.</td>
<td>1000</td>
<td>WFTH</td>
<td>Sarasota, Fl.</td>
<td>1000</td>
<td>WSMY</td>
<td>Weldon, N.C.</td>
</tr>
<tr>
<td>1000</td>
<td>WUBF</td>
<td>Garfield, Tex.</td>
<td>1000</td>
<td>WLBST</td>
<td>Addison, Tex.</td>
<td>1000</td>
<td>WSMU</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTL</td>
<td>Daytona Beach, Fla.</td>
<td>1000</td>
<td>WSNB</td>
<td>Wilmington, Del.</td>
</tr>
<tr>
<td>1000</td>
<td>WUBL</td>
<td>Galveston, Tex.</td>
<td>1000</td>
<td>WLBTS</td>
<td>Irvington, Tex.</td>
<td>1000</td>
<td>WSNW</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTM</td>
<td>Bartlesville, Okla.</td>
<td>1000</td>
<td>WSNY</td>
<td>Reno, Nev.</td>
</tr>
<tr>
<td>1000</td>
<td>WUBQ</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBTV</td>
<td>San Antonio, Tex.</td>
<td>1000</td>
<td>WSNY</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTO</td>
<td>Temple, Tex.</td>
<td>1000</td>
<td>WSOU</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCUA</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBVT</td>
<td>San Antonio, Tex.</td>
<td>1000</td>
<td>WSNZ</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTO</td>
<td>Temple, Tex.</td>
<td>1000</td>
<td>WSPD</td>
<td>Bowling Green, K.Y.</td>
</tr>
<tr>
<td>1000</td>
<td>WCUJ</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBWR</td>
<td>San Antonio, Tex.</td>
<td>1000</td>
<td>WSNZ</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTO</td>
<td>Temple, Tex.</td>
<td>1000</td>
<td>WSTD</td>
<td>Bowling Green, K.Y.</td>
</tr>
<tr>
<td>1000</td>
<td>WCUK</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBWS</td>
<td>San Antonio, Tex.</td>
<td>1000</td>
<td>WSNZ</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTO</td>
<td>Temple, Tex.</td>
<td>1000</td>
<td>WWIN</td>
<td>Bowling Green, K.Y.</td>
</tr>
<tr>
<td>1000</td>
<td>WCUU</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBWT</td>
<td>San Antonio, Tex.</td>
<td>1000</td>
<td>WSOU</td>
<td>Montgomery, Ala.</td>
<td>1000</td>
<td>WFTW</td>
<td>Niagara Falls, N.Y.</td>
<td>1000</td>
<td>WSUN</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCUV</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBX</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTW</td>
<td>Niagara Falls, N.Y.</td>
<td>1000</td>
<td>WSUX</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCUW</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBZ</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCVK</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDC</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCVL</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDD</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCVN</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDE</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCVO</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDF</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCVR</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDI</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCVT</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDM</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCWU</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDO</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCWV</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDP</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCWY</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDR</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
<tr>
<td>1000</td>
<td>WCWZ</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WLBDS</td>
<td>Corpus Christi, Tex.</td>
<td>1000</td>
<td>WSOO</td>
<td>Weldon, N.C.</td>
<td>1000</td>
<td>WFTX</td>
<td>New York. N.Y.</td>
<td>1000</td>
<td>WSXW</td>
<td>Montgomery, Ala.</td>
</tr>
</tbody>
</table>

**February-March, 1969**
<table>
<thead>
<tr>
<th>Call Letters</th>
<th>Frequency (kHz)</th>
<th>City</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>WKBX</td>
<td>940</td>
<td>Winston-Salem, N.C.</td>
<td></td>
</tr>
<tr>
<td>WQIC</td>
<td>950</td>
<td>Nanticoke, N.Y.</td>
<td></td>
</tr>
<tr>
<td>WMNT</td>
<td>970</td>
<td>Matamoras, N.Y.</td>
<td></td>
</tr>
<tr>
<td>WEAC</td>
<td>1000</td>
<td>Gaffney, S.C.</td>
<td></td>
</tr>
<tr>
<td>WDKT</td>
<td>1020</td>
<td>Altoona, Calif.</td>
<td></td>
</tr>
<tr>
<td>WWCN</td>
<td>1030</td>
<td>Trenton, Tenn.</td>
<td></td>
</tr>
<tr>
<td>WTYO</td>
<td>1040</td>
<td>Sherman, Tex.</td>
<td></td>
</tr>
<tr>
<td>KANI</td>
<td>1070</td>
<td>Wharton, Tex.</td>
<td></td>
</tr>
<tr>
<td>WKSO</td>
<td>1080</td>
<td>Reliance, Ariz.</td>
<td></td>
</tr>
<tr>
<td>WSOA</td>
<td>1090</td>
<td>Ontario, Calif.</td>
<td></td>
</tr>
<tr>
<td>WIKY</td>
<td>1100</td>
<td>Fresno, Calif.</td>
<td></td>
</tr>
<tr>
<td>WDKO</td>
<td>1110</td>
<td>Littleton, Colo.</td>
<td></td>
</tr>
<tr>
<td>WWBC</td>
<td>1120</td>
<td>New London, Conn.</td>
<td></td>
</tr>
<tr>
<td>WJRC</td>
<td>1130</td>
<td>Joliet, Ill.</td>
<td></td>
</tr>
<tr>
<td>WKMA</td>
<td>1140</td>
<td>Melbourne, Fla.</td>
<td></td>
</tr>
<tr>
<td>KBPC</td>
<td>1150</td>
<td>Port Sulphur, La.</td>
<td></td>
</tr>
<tr>
<td>WMEX</td>
<td>1160</td>
<td>Boston, Mass.</td>
<td></td>
</tr>
<tr>
<td>WIOG</td>
<td>1170</td>
<td>Jackson, Miss.</td>
<td></td>
</tr>
<tr>
<td>WLKM</td>
<td>1180</td>
<td>Three Rivers, Mich.</td>
<td></td>
</tr>
<tr>
<td>WPDP</td>
<td>1190</td>
<td>Prentiss, Miss.</td>
<td></td>
</tr>
<tr>
<td>WCTY</td>
<td>1200</td>
<td>Columbus, Neb.</td>
<td></td>
</tr>
<tr>
<td>WJIC</td>
<td>1210</td>
<td>Salem, N.Y.</td>
<td></td>
</tr>
<tr>
<td>WJCI</td>
<td>1220</td>
<td>Carlisle, Pa.</td>
<td></td>
</tr>
<tr>
<td>WJAI</td>
<td>1230</td>
<td>Nashville, Tenn.</td>
<td></td>
</tr>
<tr>
<td>KABH</td>
<td>1240</td>
<td>Midland, Tex.</td>
<td></td>
</tr>
<tr>
<td>KMOD</td>
<td>1250</td>
<td>Mineola, Tex.</td>
<td></td>
</tr>
<tr>
<td>KSTV</td>
<td>1260</td>
<td>Stephenville, Tex.</td>
<td></td>
</tr>
<tr>
<td>KGSA</td>
<td>1270</td>
<td>Saskatiw, Wash.</td>
<td></td>
</tr>
<tr>
<td>WADA</td>
<td>1280</td>
<td>Oskaloosa, Ala.</td>
<td></td>
</tr>
<tr>
<td>KMOP</td>
<td>1290</td>
<td>Hollister, Cal.</td>
<td></td>
</tr>
<tr>
<td>WKME</td>
<td>1300</td>
<td>Columbus, Ohio</td>
<td></td>
</tr>
<tr>
<td>WGLX</td>
<td>1310</td>
<td>Columbus, Ohio</td>
<td></td>
</tr>
<tr>
<td>WKXW</td>
<td>1320</td>
<td>Parkersburg, West.</td>
<td></td>
</tr>
<tr>
<td>WJIC</td>
<td>1330</td>
<td>Columbus, Ga.</td>
<td></td>
</tr>
<tr>
<td>WABN</td>
<td>1340</td>
<td>Columbia, Mo.</td>
<td></td>
</tr>
<tr>
<td>WYEG</td>
<td>1350</td>
<td>Greenville, N.C.</td>
<td></td>
</tr>
<tr>
<td>WNNM</td>
<td>1360</td>
<td>New Orleans, La.</td>
<td></td>
</tr>
<tr>
<td>WYIA</td>
<td>1370</td>
<td>Miami, Fla.</td>
<td></td>
</tr>
<tr>
<td>WKSB</td>
<td>1380</td>
<td>Salt Lake City, Utah</td>
<td></td>
</tr>
<tr>
<td>WKMB</td>
<td>1390</td>
<td>Montgomery, Ala.</td>
<td></td>
</tr>
<tr>
<td>WABC</td>
<td>1400</td>
<td>Brooklyn, N.Y.</td>
<td></td>
</tr>
<tr>
<td>KIIK</td>
<td>1410</td>
<td>Knoxville, Tenn.</td>
<td></td>
</tr>
<tr>
<td>WFRS</td>
<td>1420</td>
<td>Pleasanton, Calif.</td>
<td></td>
</tr>
<tr>
<td>WSMO</td>
<td>1430</td>
<td>Mobile, Ala.</td>
<td></td>
</tr>
<tr>
<td>WSCR</td>
<td>1440</td>
<td>Shreveport, La.</td>
<td></td>
</tr>
<tr>
<td>WKYQ</td>
<td>1450</td>
<td>Chattanooga, Tenn.</td>
<td></td>
</tr>
<tr>
<td>WBTX</td>
<td>1460</td>
<td>Albertville, Ala.</td>
<td></td>
</tr>
<tr>
<td>WJGH</td>
<td>1470</td>
<td>Athens, Ga.</td>
<td></td>
</tr>
<tr>
<td>WXAM</td>
<td>1480</td>
<td>Charleston, S.C.</td>
<td></td>
</tr>
<tr>
<td>WDCJ</td>
<td>1490</td>
<td>Cleveland, Ohio</td>
<td></td>
</tr>
<tr>
<td>WJHG</td>
<td>1500</td>
<td>Huntington, W.Va.</td>
<td></td>
</tr>
<tr>
<td>WAGS</td>
<td>1510</td>
<td>Santa Monica, Calif.</td>
<td></td>
</tr>
<tr>
<td>WAGU</td>
<td>1520</td>
<td>Tucson, Ariz.</td>
<td></td>
</tr>
<tr>
<td>WAGR</td>
<td>1530</td>
<td>Greenville, S.C.</td>
<td></td>
</tr>
<tr>
<td>WAGU</td>
<td>1540</td>
<td>Richmond, Va.</td>
<td></td>
</tr>
<tr>
<td>WAGU</td>
<td>1550</td>
<td>Oklahoma City, Okla.</td>
<td></td>
</tr>
<tr>
<td>WAGU</td>
<td>1560</td>
<td>South Bend, Ind.</td>
<td></td>
</tr>
<tr>
<td>WAGU</td>
<td>1570</td>
<td>Pueblo, Colo.</td>
<td></td>
</tr>
<tr>
<td>WAGU</td>
<td>1580</td>
<td>Flint, Mich.</td>
<td></td>
</tr>
</tbody>
</table>

**February-March, 1969**
Thank you! The Editors of Radio-TV Experimenter would like to thank all readers who offered information on station changes, additions and deletions during the past few months. Though many of the letters overlapped, each added us considerably in making the task of keeping White's Radio Log current as possible at press time. If we left your name out, please forgive us!

Frank E. Aclen, Boise, Idaho
Michael Ames, Cortland, N.Y.
James M. Berry Bedard, Charlesburg, Chelsea.
William Boerner, Massillon, Ohio
Dale F. Buda, Fort Walton Beach, Florida

David Butler, Lombard, Ill.
James E. Carter III, Augusta, Georgia
Ralph Chapman, Buffalo, N.Y.
Tom Craigs, Milwaukee, Wis.
Brian Egan, No Address
Gary Enimotive, Council Bluffs, Iowa
Clayton Farrell, Southeast Asia
Lucien Filiatruiss, Islip, N.Y.
Wills Geo. Franham, Boise, Idaho
Arthur Frederick, New Kensington, Pa.
John Garofano, Framingham, Mass.
Walter M. Gold, Brockton, Mass.
W. Grandather, Ashburn, N.C.
Glenn Groenewold, Davis, Calif.
William F. Hanson, Aurora, Colo.
Peter Kelleher, Minot, N.D.
Ken Kleinth, Ononta, N.Y.
Robert Locke, Winnipeg, Manitoba
Grant MacDonald, Islington, Ontario
Michael E. Martin, Cincinnati, Ohio
Dan McQuade, Omaha, Nebr.
J. B. Martin, Chicago, Ill.

John M. Meier, Woodward, Iowa
O. E. Milliet, Toronto, Ontario
Thomas Mount, Brookline, Mass.
Marke Paise, North Surrey, B.C., Canada
Johnny Parks, Portland, Ore.
Peter Pellant, Chicopee, Mass.
Jim Petersen, Yorktown Heights, N.Y.
Robert F. Post, Upland, Calif.
Richard Powers, Frederickton, N.B., Canada
John N. Ramsey, West Hartford, Conn.
Bob Rodman, Bradford, Mass.
Richard Ringenback, Fair Lawn, N.J.
John Robertson, Port Huron, Mich.
Carl Rossell, Kearny, N.J.
Peter Salant, Park Ridge, N.J.
George Schwenk, San Pedro, Calif.
Sheldon Swartz, Grand, Misc.
Jimmie Thines, Nampa, Idaho
Robert White, Chanhassen, Minn.
C. M. Wilkin, Rio, Mexico
John Vanderplough, Bloomington, Ind.

---

106  RADIO-TV EXPERIMENTER
World-Wide Shortwave Stations

□ This time our big contest (the one without prizes or awards, that is) is going to be a bit different. It seems, from the mail we receive, that too few monitors know some of the basic rules of the road for DX’ing. That gave us the idea to ask you some questions on the hobby itself along with our usual demands for you to listen for off-beat DX stations. Scoring info at the end of the quiz.

1. What basic information bits should be sent to stations when you are submitting a reception report with the hopes of getting a QSL card in return?

2. When, after as many as three tries on your part, a station refuses to acknowledge your signal reports with a QSL card, you should: A—Notify all radio clubs that this station is a non-QSL’er and should be blacklisted; B—Send them a carbon copy of your original report every two months until they come through with a QSL card; C—Forget them and give up; D—Give them a few more chances before giving up, possibly with a more detailed or different approach to the report you send; E—Write to the station and let them know that they are being “unfair” to the DX’ing hobby.

3. True or False: The longer the wire for the receiving antenna, the better the chances you will have for pulling those far away stations.

4. True or False: 26 or 27 mHz is about the upper limit of the radio spectrum insofar as the DX hobbyist is concerned.

5. Here’s a rareie from out in the Pacific; it’s the station of the Fiji Broadcasting Commission on 6005 kHz, heard around 0300 GMT. They are hard to hear in the Eastern half of the States and Canada but will QSL promptly. The address is Box 334, Suva, Fiji Islands.

6. A clandestine (secret location) station calling itself “Radio Free Russia” is now being heard on 6368 and 6376 kHz around 1900 GMT. Can you hear this one?

7. Anybody for Nepal? Don’t all scramble at once to hear Radio Nepal on 4795 kHz now that their new higher powered rig is installed. Loom for them on from 1320 to 1620 GMT. Also heard testing on 9590 kHz.

8. Yeah man, here’s a chance to hear Yemen, that little kingdom in the middle east which has been in the news during the past few years. A station calling itself “Yemeni Royalist Radio,” and thought to really be in Yemen, is being heard at 1640 GMT on a frequency somewhere between 9972 and 9985 kHz.

9. New Korean station is the “Voice of Hope,” operated from Seoul by the S. Korean Army. Look for it on 6170 kHz at 1200 and 0815 GMT.

10. Guess what? That old pirate Radio Libertad is back (according to many reporters) and guess where they are; you betcha—right on 6000 kHz, the frequency formerly used by Radi Americas from Swan Island. This was predicted some time ago — that when Radio Swan/Americas closed down its functions would be taken over by Radio Libertad. Check the channel in the evenings.

Scoring. Take 10 points per question or DX challenge, with 1 point deducted for each thing you forgot to include in your answers to question 1.

Here are the answers to the questions:

1. Send them a detailed report listing all announcements and musical selections monitored during a period of not less than 15 minutes duration. Information on their signals (fading, strength, interference, modulation quality), the time you heard them (in GMT), the date, the details of your receiving equipment, and an International Reply Coupon to pay the return postage for your QSL.

2. The answer is D. Never try to blacklist a station or send them a nasty letter. QSL cards are a courtesy to the hobby and not a necessary part of the station’s obligation to...
the world public. Your reception report has only minimal value from a technical standpoint and if the station never received it, they would really just be as happy. Maybe your report got lost in the mail, maybe the station personnel are busy, maybe they are slow answerers, or maybe your report was inadequate. Don't lose patience, just send them a more detailed report—possibly in their own language.

3. False! The most efficient antenna is a directional one which is cut for the specific band you are monitoring. A long, long, long, zig-zagging random length wire may actually be very poor for hearing certain frequencies or in certain directions.

4. False! It may be the upper frequency limits of International Broadcasting, but it is the bottom edge of a whole new world of so-called "utilities" DX which consists of several ham bands, police, fire, business, and emergency communications. With an inexpensive VHF receiver and a small antenna you can receive more thrills and excitement than you ever dreamed possible. See our new listing following the World-Wide Shortwave section.

### kHz - Call - Identification - Location - GMT

<table>
<thead>
<tr>
<th>Call</th>
<th>Identification</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3990</td>
<td>HCERS</td>
<td>Esquelas R. Populaires</td>
<td></td>
</tr>
<tr>
<td>4765</td>
<td>R-TV Congolaise</td>
<td>Brazzaville, Congo</td>
<td>0430</td>
</tr>
<tr>
<td>4795</td>
<td>HIAS</td>
<td>S. Domingo R.</td>
<td>0430</td>
</tr>
<tr>
<td>4820</td>
<td>HRVC</td>
<td>Teucigalpa, Honduras</td>
<td>0515</td>
</tr>
<tr>
<td>4880</td>
<td>R. Yaracuy</td>
<td>Yaracuy, Venezuela</td>
<td>0630</td>
</tr>
<tr>
<td>4890</td>
<td>R. Dakar II</td>
<td>Dakar, Senegal</td>
<td>0745</td>
</tr>
<tr>
<td>4980</td>
<td>VYKB</td>
<td>Caracas, Venezuela</td>
<td>0930</td>
</tr>
<tr>
<td>4985</td>
<td>R. RSA</td>
<td>Johannesberg, S. Afr.</td>
<td>0945</td>
</tr>
<tr>
<td>4900</td>
<td>YVNK</td>
<td>R. Juventud Barquisimeto, Venezuela</td>
<td>0945</td>
</tr>
<tr>
<td>4920</td>
<td>VLM4</td>
<td>A.B.C. Brisbane, Australia</td>
<td>0910</td>
</tr>
<tr>
<td>4940</td>
<td>R. Mil</td>
<td>S. Domingo D.R.</td>
<td>0940</td>
</tr>
<tr>
<td>4951</td>
<td>HRZZ</td>
<td>R. Jurigalpa Teucigalpa, Honduras</td>
<td>0945</td>
</tr>
<tr>
<td>4955</td>
<td>HUCQ</td>
<td>R. Nacional Bogota, Colombia</td>
<td>0510</td>
</tr>
<tr>
<td>4965</td>
<td>HJAF</td>
<td>R. Santa Fe Bogota, Colombia</td>
<td>0515</td>
</tr>
<tr>
<td>4990</td>
<td>YVMQ</td>
<td>R. Barquisimeto Barquisimeto, Venezuela</td>
<td>0945</td>
</tr>
<tr>
<td>5005</td>
<td>OAX2S</td>
<td>V. de Frontera Lima, Peru</td>
<td>0940</td>
</tr>
<tr>
<td>5010</td>
<td>OAXBV</td>
<td>V. de Chacas Lima, Peru</td>
<td>0943</td>
</tr>
<tr>
<td>5025</td>
<td>Southern Cross R. La Paz, Bolivia</td>
<td>0930</td>
<td></td>
</tr>
<tr>
<td>5048</td>
<td>R. Tojo</td>
<td>R. Tojo Peru</td>
<td>0945</td>
</tr>
<tr>
<td>5875</td>
<td>HRN</td>
<td>V. de Honduras Teucigalpa, Honduras</td>
<td>0945</td>
</tr>
</tbody>
</table>

### kHz - Call - Identification - Location - GMT

<table>
<thead>
<tr>
<th>Call</th>
<th>Identification</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5960</td>
<td>HRRH</td>
<td>V. de Occidente Santa Rosa, Honduras</td>
<td>1210</td>
</tr>
<tr>
<td>5970</td>
<td>HVUJ</td>
<td>HVUJ BonatS, Colombia</td>
<td>0515</td>
</tr>
<tr>
<td>5975</td>
<td>ZY44</td>
<td>G. Globo Florianopolis, Brazil</td>
<td>0925</td>
</tr>
<tr>
<td>5995</td>
<td>LK52</td>
<td>R. Splendid Buenos Aires, Argentina</td>
<td>0910</td>
</tr>
<tr>
<td>5990</td>
<td>RAI</td>
<td>Rome, Italy</td>
<td>0415</td>
</tr>
<tr>
<td>6000</td>
<td>R. Inconfidencia</td>
<td>Belo Horizonte, Brazil</td>
<td>0945</td>
</tr>
<tr>
<td>6005</td>
<td>CGKX</td>
<td>CF Radio Montreal, Que.</td>
<td>0900</td>
</tr>
<tr>
<td>6010</td>
<td>CJ/CX</td>
<td>CACX Sydney, Australia</td>
<td>0900</td>
</tr>
<tr>
<td>6025</td>
<td>HICB</td>
<td>V. de los Andes Quito, Ecuador</td>
<td>0715</td>
</tr>
<tr>
<td>6030</td>
<td>R. Baghudd</td>
<td>Baghudd, Iraq</td>
<td>0250</td>
</tr>
<tr>
<td>6035</td>
<td>TIFC</td>
<td>Faro del Caribe San Jose, C.R.</td>
<td>0900</td>
</tr>
<tr>
<td>6045</td>
<td>RRI</td>
<td>R. Santa Rosa Lima, Peru</td>
<td>0910</td>
</tr>
<tr>
<td>6070</td>
<td>CFXR</td>
<td>CFXR Toronto, Ont.</td>
<td>0900</td>
</tr>
<tr>
<td>6075</td>
<td>R. RSA</td>
<td>Johanneburg, S. Afr.</td>
<td>0245</td>
</tr>
<tr>
<td>6110</td>
<td>BBC</td>
<td>BBC London, England</td>
<td>0215</td>
</tr>
<tr>
<td>6120</td>
<td>4VEH</td>
<td>V. Evangelist Cap Hatien, Haiti</td>
<td>0115</td>
</tr>
<tr>
<td>6130</td>
<td>R. Nacional</td>
<td>Madrid, Spain</td>
<td>0315</td>
</tr>
<tr>
<td>6135</td>
<td>CHNIX</td>
<td>CHNIX Halifax, N.S.</td>
<td>0400</td>
</tr>
<tr>
<td>6135</td>
<td>R. Habana</td>
<td>Habana, Cuba</td>
<td>0300</td>
</tr>
<tr>
<td>6137</td>
<td>R. TV Francaise</td>
<td>Papeete, Tahiti</td>
<td>0510</td>
</tr>
<tr>
<td>6140</td>
<td>R. El Sol</td>
<td>Cali, Colombia</td>
<td>1020</td>
</tr>
<tr>
<td>6155</td>
<td>Far East Net</td>
<td>Tokyo, Japan</td>
<td>1000</td>
</tr>
<tr>
<td>6160</td>
<td>RRA</td>
<td>R. Tirana Tirana, Albania</td>
<td>0150</td>
</tr>
<tr>
<td>6160</td>
<td>HUKJ</td>
<td>E. Nuevo Granada Bogota, Colombia</td>
<td>0200</td>
</tr>
<tr>
<td>6165</td>
<td>XEWW</td>
<td>XEWW Mexico City, Mex.</td>
<td>0110</td>
</tr>
</tbody>
</table>

### kHz - Call - Identification - Location - GMT

<table>
<thead>
<tr>
<th>Call</th>
<th>Identification</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>6185</td>
<td>ZYR77</td>
<td>R. Bandeirantes Brazil</td>
<td>1000</td>
</tr>
</tbody>
</table>

### 41-Meter Band—7100-7300 kHz

<table>
<thead>
<tr>
<th>Call</th>
<th>Identification</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>7110</td>
<td>BBC</td>
<td>London, England</td>
<td>0250</td>
</tr>
<tr>
<td>7115</td>
<td>R. Peking</td>
<td>Peking, China</td>
<td>0425</td>
</tr>
<tr>
<td>7126</td>
<td>ETLF</td>
<td>R. V. Gospel Abby, West Indies</td>
<td>0330</td>
</tr>
<tr>
<td>7155</td>
<td>R. Peking</td>
<td>Peking, China</td>
<td>1340</td>
</tr>
<tr>
<td>7165</td>
<td>OAWX</td>
<td>Peking, China</td>
<td>1100</td>
</tr>
<tr>
<td>7295</td>
<td>ZAA</td>
<td>R. Tirana Albania</td>
<td>2330</td>
</tr>
<tr>
<td>7345</td>
<td>R. Prague</td>
<td>Prague, Czech.</td>
<td>2215</td>
</tr>
<tr>
<td>7840</td>
<td>ZAA</td>
<td>R. Tirana Albania</td>
<td>0140</td>
</tr>
</tbody>
</table>

### 31-Meter Band—9500-9775 kHz

<table>
<thead>
<tr>
<th>Call</th>
<th>Identification</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>9505</td>
<td>HSD</td>
<td>Santo Domingo, D.R.</td>
<td>0315</td>
</tr>
<tr>
<td>9510</td>
<td>R. Japan</td>
<td>Tokyo, Japan</td>
<td>1310</td>
</tr>
<tr>
<td>9515</td>
<td>BBC</td>
<td>Washington, D.C.</td>
<td>0214</td>
</tr>
<tr>
<td>9520</td>
<td>OAX4V</td>
<td>R. America</td>
<td>0700</td>
</tr>
<tr>
<td>9520</td>
<td>ZL118</td>
<td>R. New Zealand</td>
<td>0700</td>
</tr>
<tr>
<td>9520</td>
<td>OAX4J</td>
<td>R. LaCronica</td>
<td>0310</td>
</tr>
<tr>
<td>9525</td>
<td>R. Warsaw</td>
<td>Warsaw, Poland</td>
<td>0700</td>
</tr>
<tr>
<td>9530</td>
<td>R. Habana</td>
<td>Havana, Cuba</td>
<td>0700</td>
</tr>
<tr>
<td>9530</td>
<td>NHK</td>
<td>Tokyo, Japan</td>
<td>0945</td>
</tr>
<tr>
<td>9540</td>
<td>ZL2</td>
<td>R. New Zealand</td>
<td>0700</td>
</tr>
<tr>
<td>9545</td>
<td>DMQ9</td>
<td>Deutsche Welle</td>
<td>0457</td>
</tr>
<tr>
<td>9560</td>
<td>NHK</td>
<td>Tokyo, Japan</td>
<td>0480</td>
</tr>
<tr>
<td>9560</td>
<td>R. Australia</td>
<td>Melbourne, Australia</td>
<td>0320</td>
</tr>
<tr>
<td>9580</td>
<td>R. Portales</td>
<td>Santiago, Chile</td>
<td>0530</td>
</tr>
<tr>
<td>9580</td>
<td>PCJ</td>
<td>Hilversum, Neth.</td>
<td>0415</td>
</tr>
<tr>
<td>9595</td>
<td>ZOJ3</td>
<td>Japan BC Tokyo, Japan</td>
<td>0945</td>
</tr>
<tr>
<td>9600</td>
<td>BBC</td>
<td>London, England</td>
<td>0745</td>
</tr>
<tr>
<td>9605</td>
<td>R. Prague</td>
<td>Prague, Czech.</td>
<td>2245</td>
</tr>
<tr>
<td>9610</td>
<td>A.B.C.</td>
<td>Perth, Australia</td>
<td>1045</td>
</tr>
<tr>
<td>9615</td>
<td>ORU</td>
<td>Belgian Radio Brussels, Belgium</td>
<td>2230</td>
</tr>
<tr>
<td>9620</td>
<td>R. Belgrande</td>
<td>Belgrade, Yugo.</td>
<td>2210</td>
</tr>
<tr>
<td>9625</td>
<td>R. Canada</td>
<td>Montreal, Que.</td>
<td>0630</td>
</tr>
<tr>
<td>9630</td>
<td>R. Prague</td>
<td>Prague, Czech.</td>
<td>0415</td>
</tr>
<tr>
<td>9635</td>
<td>R. Prague</td>
<td>Prague, Czech.</td>
<td>2315</td>
</tr>
<tr>
<td>9640</td>
<td>ZYR38</td>
<td>V. Aparecida Rio de Janeiro, Brazil</td>
<td>0930</td>
</tr>
<tr>
<td>9640</td>
<td>HLK5</td>
<td>V. Free Korea</td>
<td>0815</td>
</tr>
<tr>
<td>9660</td>
<td>VLQ9</td>
<td>Melbourne, Australia</td>
<td>0910</td>
</tr>
<tr>
<td>9665</td>
<td>R. Malaysia</td>
<td>Kuala Lumpur, Malaysia</td>
<td>1230</td>
</tr>
<tr>
<td>9675</td>
<td>NHK</td>
<td>Tokyo, Japan</td>
<td>1100</td>
</tr>
<tr>
<td>9685</td>
<td>BED73</td>
<td>V. Free China</td>
<td>0510</td>
</tr>
<tr>
<td>9685</td>
<td>V. Afghani</td>
<td>Afghanistan, China</td>
<td>0945</td>
</tr>
<tr>
<td>9710</td>
<td>Trans World R.</td>
<td>Bonaire, Nigeria</td>
<td>0300</td>
</tr>
<tr>
<td>9725</td>
<td>BBC—Far East</td>
<td>Taiwan, Repub.</td>
<td>0100</td>
</tr>
<tr>
<td>9730</td>
<td>R. Berlin Int'l.</td>
<td>Berlin, Germany</td>
<td>0200</td>
</tr>
<tr>
<td>9790</td>
<td>R. Moscow</td>
<td>Moscow, USSR</td>
<td>0940</td>
</tr>
<tr>
<td>9790</td>
<td>R. Soc. National</td>
<td>Santiago, Chile</td>
<td>0900</td>
</tr>
<tr>
<td>9770</td>
<td>R. Austria</td>
<td>Vienna, Austria</td>
<td>0400</td>
</tr>
</tbody>
</table>
Radio-TV Experimenter furnishes this exclusive listing of emergency radio stations as an aid to our many readers now engaged in the fascinating and rapidly growing hobby of monitoring emergency radio communications. We will be publishing similar lists devoted to different metropolitan areas in forthcoming issues of Radio-TV Experimenter so in the months ahead you'll be able to accumulate a sizable array of this difficult-to-obtain data.

All frequencies shown are in MHz unless otherwise noted. Communities not shown in our listing are serviced by an adjoining community, or by county or state agencies. Check county and state listings in this section for this data. When the word "mobiles" is used instead of a callsign, it is because the agency either has no base station and its mobiles use the base station of another agency, or the frequency shown is used for mobile-to-mobile communication only. When the frequency 155.37 is shown along with another one for a police station, the other frequency is usually the main dispatching channel for patrol cars.

Section 605 of the Communications Act of 1934 provides severe penalties for unauthorized divulging or making use of information obtained by monitoring non-broadcast communications. All readers are hereby cautioned that the data contained herein is to be used solely for hobby listening, private, non-commercial, and/or other purposes which are not in violation of federal, state, county, or local laws. Publisher assumes no further responsibility.

Our listings were compiled and condensed from the well-known series of Emergency Radio Service Monitoring Bulletins, by special arrangement with their publisher, Communications Research Bureau, Box 56, Chicago, Illinois.
Commack, N. Y. 11725. Their series of directories includes police, fire, and other emergency radio station listings for all large cities, many counties, and all states. A complete catalog of these directories is available by sending your name and address and a 65¢ stamp directly to the Communications Research Bureau (not to Radio-TV Experimenter). No portion of this bulletin may be reproduced in any manner whatsoever without the express written permission from the Editor. Coded listings have been included to check copyright violations.

### CHICAGO POLICE DEPT.
- KAZ299
- KAZ296
- KAZ297
- KKA298
- KBA200
- KBA201
- KBA636

### CHICAGO FIRE DEPT.
- KSC711

### ILLINOIS MUNICIPAL POLICE & FIRE DEPTS.

<table>
<thead>
<tr>
<th>City</th>
<th>Police</th>
<th>Freq.</th>
<th>Fire</th>
<th>Call</th>
<th>Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addison</td>
<td>KSF311</td>
<td>155.01</td>
<td></td>
<td>KDT720</td>
<td>154.31</td>
</tr>
<tr>
<td>Alsip</td>
<td>KFG448</td>
<td>155.19</td>
<td></td>
<td>KJS849</td>
<td>155.31</td>
</tr>
<tr>
<td>Arlington Hts.</td>
<td>KSA861</td>
<td>155.13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrington Hills</td>
<td>KSH426</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bartlett</td>
<td>KFZ748</td>
<td>155.43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedford Park</td>
<td>KSB268</td>
<td>155.37</td>
<td></td>
<td>KSF481</td>
<td>154.43</td>
</tr>
<tr>
<td>Bellwood</td>
<td>KSA423</td>
<td>155.37</td>
<td></td>
<td>KDS250</td>
<td>154.43</td>
</tr>
<tr>
<td>Bensenville</td>
<td>KSA282</td>
<td>155.01</td>
<td></td>
<td>KDS610</td>
<td>154.31</td>
</tr>
<tr>
<td>Berkeley</td>
<td>KGJ757</td>
<td>155.37</td>
<td></td>
<td>KDS613</td>
<td>154.43</td>
</tr>
<tr>
<td>Berwyn</td>
<td>KSA972</td>
<td>155.31</td>
<td></td>
<td>KBS635</td>
<td>154.31</td>
</tr>
<tr>
<td>Bloomingdale</td>
<td>KDG325</td>
<td>155.37</td>
<td></td>
<td>KBS635</td>
<td>154.31</td>
</tr>
<tr>
<td>Blue Island</td>
<td>KB5579</td>
<td>155.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolingbrook</td>
<td>KJX731</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridgeview</td>
<td>KAY733</td>
<td>155.43</td>
<td></td>
<td>KAY846</td>
<td>154.43</td>
</tr>
<tr>
<td>Broadview</td>
<td>KSE644</td>
<td>155.43</td>
<td></td>
<td>KAR459</td>
<td>154.37</td>
</tr>
<tr>
<td>Brookfield</td>
<td>KSA870</td>
<td>155.37</td>
<td></td>
<td>KBE444</td>
<td>154.25</td>
</tr>
<tr>
<td>Burbank Manor</td>
<td>KSD732</td>
<td>155.43</td>
<td></td>
<td>KSB300</td>
<td>154.31</td>
</tr>
<tr>
<td>Calumet City</td>
<td>KEL353</td>
<td>153.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calumet Park</td>
<td>KGB803</td>
<td>155.19</td>
<td></td>
<td>KDN561</td>
<td>154.07</td>
</tr>
<tr>
<td>Carol Stream</td>
<td>KJX235</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpentersville</td>
<td>KFS256</td>
<td>155.37</td>
<td></td>
<td>KAR790</td>
<td>154.43</td>
</tr>
<tr>
<td>Cary</td>
<td>KSD554</td>
<td>155.37</td>
<td></td>
<td>KSI211</td>
<td>154.25</td>
</tr>
<tr>
<td>Central Stickney</td>
<td>KJS235</td>
<td>155.37</td>
<td></td>
<td>KBS280</td>
<td>154.43</td>
</tr>
<tr>
<td>Chicago (U. III.)</td>
<td>KJS236</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicago Heights</td>
<td>KSB881</td>
<td>155.37</td>
<td></td>
<td>KBS471</td>
<td>154.37</td>
</tr>
<tr>
<td>Chicago Ridge</td>
<td>KZI466</td>
<td>155.19</td>
<td></td>
<td>KAU731</td>
<td>154.37</td>
</tr>
<tr>
<td>Cicero</td>
<td>KSA425</td>
<td>155.31</td>
<td></td>
<td>KJC636</td>
<td>154.19</td>
</tr>
<tr>
<td>Clarendon Hills</td>
<td>KSG480</td>
<td>155.01</td>
<td></td>
<td>KDS296</td>
<td>154.25</td>
</tr>
<tr>
<td>Cloverdale</td>
<td>KGB527</td>
<td>155.37</td>
<td></td>
<td>KSD483</td>
<td>154.31</td>
</tr>
<tr>
<td>Crest Hill</td>
<td>KCO709</td>
<td>154.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crestwood</td>
<td>KSG200</td>
<td>155.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Des Plaines</td>
<td>KSA962</td>
<td>155.19</td>
<td></td>
<td>KBU640</td>
<td>154.34</td>
</tr>
<tr>
<td>Dixon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dowers Grove</td>
<td>KSB850</td>
<td>155.01</td>
<td></td>
<td>KSF985</td>
<td>154.25</td>
</tr>
<tr>
<td>Dowers Grove Estates</td>
<td>KJW463</td>
<td>155.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Hazel Crest</td>
<td>KAY240</td>
<td>156.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elk Grove</td>
<td>KFS850</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elmhurst</td>
<td>KSA551</td>
<td>155.01</td>
<td></td>
<td>KAY709</td>
<td>155.31</td>
</tr>
<tr>
<td>Elmhurst</td>
<td>KSA551</td>
<td>155.01</td>
<td></td>
<td>KJL677</td>
<td>154.31</td>
</tr>
<tr>
<td>Evergreen Park</td>
<td>KSB943</td>
<td>155.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flossmoor</td>
<td>KSE513</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest Park</td>
<td>KSA785</td>
<td>155.37</td>
<td></td>
<td>KBJ207</td>
<td>154.19</td>
</tr>
<tr>
<td>Forest View</td>
<td>KSB82</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fox Lake</td>
<td>KSG715</td>
<td>155.37</td>
<td></td>
<td>KSB820</td>
<td>154.31</td>
</tr>
<tr>
<td>Foxtown Grove Village</td>
<td>KSB532</td>
<td>155.01</td>
<td></td>
<td>KJS635</td>
<td>154.37</td>
</tr>
<tr>
<td>Franklin Park</td>
<td>KSB241</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glencoe</td>
<td>KSA493</td>
<td>155.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glendale Heights</td>
<td>KEB441</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glen Ellyn</td>
<td>KSA904</td>
<td>155.01</td>
<td></td>
<td>KJX395</td>
<td>154.31</td>
</tr>
<tr>
<td>Glenview</td>
<td>KSA860</td>
<td>155.25</td>
<td></td>
<td>KSD486</td>
<td>154.43</td>
</tr>
<tr>
<td>Glenwood</td>
<td>KSB803</td>
<td>155.19</td>
<td></td>
<td>KDN61</td>
<td>154.07</td>
</tr>
<tr>
<td>Golliard</td>
<td>KSF480</td>
<td>155.37</td>
<td></td>
<td>KDS280</td>
<td>154.43</td>
</tr>
<tr>
<td>Grayslake</td>
<td>KSA860</td>
<td>155.25</td>
<td></td>
<td>KSD486</td>
<td>154.43</td>
</tr>
<tr>
<td>Hanover Park</td>
<td>KSA493</td>
<td>155.17</td>
<td></td>
<td>KSB820</td>
<td>154.31</td>
</tr>
<tr>
<td>Harvey</td>
<td>KSA963</td>
<td>155.37</td>
<td></td>
<td>KSD651</td>
<td>154.38</td>
</tr>
<tr>
<td>Harvard Hts.</td>
<td>KAY709</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazel Crest</td>
<td>KSA930</td>
<td>155.37</td>
<td></td>
<td>KJS405</td>
<td>154.37</td>
</tr>
<tr>
<td>Hickory Hills</td>
<td>KSD728</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highland Park</td>
<td>KSA481</td>
<td>155.37</td>
<td></td>
<td>KSE454</td>
<td>153.89</td>
</tr>
<tr>
<td>Highwood</td>
<td>KJX944</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hillsdale</td>
<td>KSF856</td>
<td>155.37</td>
<td></td>
<td>KSD299</td>
<td>154.37</td>
</tr>
<tr>
<td>Hoffman Estates</td>
<td>KSA684</td>
<td>155.01</td>
<td></td>
<td>KJX395</td>
<td>154.31</td>
</tr>
<tr>
<td>Illinois</td>
<td>KSB241</td>
<td>155.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>Police Call</td>
<td>Freq.</td>
<td>Fire Call</td>
<td>Freq.</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>-------</td>
<td>-----------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>Lombard</td>
<td>KSB709</td>
<td>155.07</td>
<td>KOG477</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Lake Bluff</td>
<td>KS1245</td>
<td>155.73</td>
<td>KSEG81</td>
<td>154.43</td>
<td></td>
</tr>
<tr>
<td>Lake Forest</td>
<td>KSC344</td>
<td>155.37</td>
<td>KSEG50</td>
<td>154.43</td>
<td></td>
</tr>
<tr>
<td>Lake Villa</td>
<td>KSC258</td>
<td>155.37</td>
<td>KSH764</td>
<td>154.37</td>
<td></td>
</tr>
<tr>
<td>Lemoent</td>
<td>KCL516</td>
<td>155.37</td>
<td>KSG477</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Lombard</td>
<td>KSB709</td>
<td>155.07</td>
<td>KOG477</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Lyons</td>
<td>KB8927</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Lockport</td>
<td>KS1517</td>
<td>155.37</td>
<td>KS444</td>
<td>154.40</td>
<td></td>
</tr>
<tr>
<td>Loyola</td>
<td>KSB927</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>McHenry</td>
<td>KS816</td>
<td>155.07</td>
<td>KQA221</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>McHenry</td>
<td>KSB927</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Matteson</td>
<td>KSB411</td>
<td>155.49</td>
<td>KCR943</td>
<td>154.37</td>
<td></td>
</tr>
<tr>
<td>Medinah</td>
<td>KSF414</td>
<td>155.49</td>
<td>KSH61</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Midlothian</td>
<td>KSB414</td>
<td>155.49</td>
<td>KU939</td>
<td>154.07</td>
<td></td>
</tr>
<tr>
<td>Morton Grove</td>
<td>KSD621</td>
<td>155.13</td>
<td>KDC125</td>
<td>154.26</td>
<td></td>
</tr>
<tr>
<td>Mount Prospect</td>
<td>KSD985</td>
<td>155.13</td>
<td>KBU990</td>
<td>154.34</td>
<td></td>
</tr>
<tr>
<td>Mundelein</td>
<td>KSA759</td>
<td>155.01</td>
<td>KS389</td>
<td>154.43</td>
<td></td>
</tr>
<tr>
<td>Naperville</td>
<td>KSD621</td>
<td>155.13</td>
<td>KDC125</td>
<td>154.26</td>
<td></td>
</tr>
<tr>
<td>New Lenox</td>
<td>KEM608</td>
<td>155.67</td>
<td>KDN532</td>
<td>154.40</td>
<td></td>
</tr>
<tr>
<td>Niles</td>
<td>KSB603</td>
<td>155.37</td>
<td>KJC688</td>
<td>154.34</td>
<td></td>
</tr>
<tr>
<td>Northbrook</td>
<td>KSF474</td>
<td>155.25</td>
<td>KSC805</td>
<td>154.43</td>
<td></td>
</tr>
<tr>
<td>North Chicago</td>
<td>KSD361</td>
<td>155.25</td>
<td>KCR319</td>
<td>153.89</td>
<td></td>
</tr>
<tr>
<td>Norwood Park</td>
<td>KSA462</td>
<td>155.37</td>
<td>KJB874</td>
<td>154.38</td>
<td></td>
</tr>
<tr>
<td>Oak Brook</td>
<td>KCL501</td>
<td>155.01</td>
<td>KSG818</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Oak Brook Terr.</td>
<td>KAY228</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Oak Park</td>
<td>KSF474</td>
<td>155.25</td>
<td>KSC805</td>
<td>154.43</td>
<td></td>
</tr>
<tr>
<td>Palos Heights</td>
<td>KDD995</td>
<td>155.19</td>
<td>KKE230</td>
<td>154.07</td>
<td></td>
</tr>
<tr>
<td>Palos Hills</td>
<td>KB8995</td>
<td>155.19</td>
<td>KSG477</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Palos Park</td>
<td>KSE748</td>
<td>155.19</td>
<td>KSE769</td>
<td>154.43</td>
<td></td>
</tr>
<tr>
<td>Park Forest</td>
<td>KSB646</td>
<td>155.19</td>
<td>KDE584</td>
<td>154.37</td>
<td></td>
</tr>
<tr>
<td>Park Ridge</td>
<td>KS359</td>
<td>155.13</td>
<td>KBW191</td>
<td>154.34</td>
<td></td>
</tr>
<tr>
<td>Parkside</td>
<td>KUA746</td>
<td>155.37</td>
<td>KSC936</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Posen</td>
<td>KSB709</td>
<td>155.07</td>
<td>KOG477</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Prospect Heights</td>
<td>KSB709</td>
<td>155.07</td>
<td>KOG477</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Richton Park</td>
<td>KSB927</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Riverdale</td>
<td>KSB927</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>River Forest</td>
<td>KSA492</td>
<td>155.37</td>
<td>KS167</td>
<td>154.19</td>
<td></td>
</tr>
<tr>
<td>River Grove</td>
<td>KSB413</td>
<td>155.37</td>
<td>KTA238</td>
<td>154.37</td>
<td></td>
</tr>
<tr>
<td>Riverside</td>
<td>KSB281</td>
<td>155.07</td>
<td>KC1712</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Robbins</td>
<td>KDS502</td>
<td>155.19</td>
<td>KSB579</td>
<td>154.37</td>
<td></td>
</tr>
<tr>
<td>Rolling Meadows</td>
<td>KSF461</td>
<td>155.11</td>
<td>KZB953</td>
<td>154.34</td>
<td></td>
</tr>
<tr>
<td>Romeoville</td>
<td>KSB977</td>
<td>155.19</td>
<td>KFG485</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Roselle</td>
<td>KAY934</td>
<td>155.37</td>
<td>KSI94</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Rosemont</td>
<td>KBY796</td>
<td>155.13</td>
<td>KUC187</td>
<td>154.37</td>
<td></td>
</tr>
<tr>
<td>Round Lake</td>
<td>KSJ460</td>
<td>155.21</td>
<td>KDN450</td>
<td>153.89</td>
<td></td>
</tr>
<tr>
<td>Sauk Village</td>
<td>KSB927</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Schaumburg</td>
<td>KSB927</td>
<td>155.01</td>
<td>KSD937</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Schiller Park</td>
<td>KSB333</td>
<td>155.13</td>
<td>KSE480</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Schaumburg</td>
<td>KSB333</td>
<td>155.13</td>
<td>KSE480</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>South Chicago</td>
<td>KSB333</td>
<td>155.13</td>
<td>KSE480</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>South Holland</td>
<td>KSB333</td>
<td>155.13</td>
<td>KSE480</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Steger</td>
<td>KSB333</td>
<td>155.13</td>
<td>KSE480</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Steger</td>
<td>KSB333</td>
<td>155.13</td>
<td>KSE480</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Stone Park</td>
<td>KSB128</td>
<td>155.13</td>
<td>KSB128</td>
<td>155.13</td>
<td></td>
</tr>
<tr>
<td>Streamwood</td>
<td>KSB333</td>
<td>155.13</td>
<td>KSE480</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Summit</td>
<td>KSA444</td>
<td>155.19</td>
<td>KJ957</td>
<td>154.37</td>
<td></td>
</tr>
<tr>
<td>Stoddard Park</td>
<td>KSB128</td>
<td>155.13</td>
<td>KSB128</td>
<td>155.13</td>
<td></td>
</tr>
<tr>
<td>Stoddard Park</td>
<td>KSB128</td>
<td>155.13</td>
<td>KSB128</td>
<td>155.13</td>
<td></td>
</tr>
<tr>
<td>Villa Park</td>
<td>KSB128</td>
<td>155.13</td>
<td>KSB128</td>
<td>155.13</td>
<td></td>
</tr>
<tr>
<td>Waukegan</td>
<td>KSB128</td>
<td>155.13</td>
<td>KSB128</td>
<td>155.13</td>
<td></td>
</tr>
<tr>
<td>Waukegan</td>
<td>KSB128</td>
<td>155.13</td>
<td>KSB128</td>
<td>155.13</td>
<td></td>
</tr>
<tr>
<td>West Chicago</td>
<td>KSE465</td>
<td>155.01</td>
<td>KSB812</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Western Springs</td>
<td>KSA444</td>
<td>155.07</td>
<td>KSE200</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Westhaven</td>
<td>KJR317</td>
<td>155.37</td>
<td>KSH468</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Westmont</td>
<td>KSH313</td>
<td>155.01</td>
<td>KSH468</td>
<td>154.25</td>
<td></td>
</tr>
<tr>
<td>Wheeling</td>
<td>KSD200</td>
<td>155.13</td>
<td>KBG289</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Willowdale</td>
<td>KSB359</td>
<td>155.13</td>
<td>KSB359</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Wilmont</td>
<td>KSB359</td>
<td>155.13</td>
<td>KSB359</td>
<td>154.31</td>
<td></td>
</tr>
<tr>
<td>Winfield</td>
<td>KSB359</td>
<td>155.13</td>
<td>KSB359</td>
<td>154.31</td>
<td></td>
</tr>
</tbody>
</table>

City: Lombard, Lisle, Lockport, Lombard, Lyons, McCook, McHenry, Markham, Matteson, Maywood, Melrose Park, Merrionette Park, Midlothian, Morton Grove, Mount Prospect, Mundelein, Naperville, New Lenox, Niles, Norridge, Northbrook, North Chicago, Northfield, Northlake, North Riverside, Norwood Park, Nottingham Park, Oak Brook, Oak Brook Terr., Oak Forest, Oaktown, Oak Park, Olympia Fields, Ord Park Park.
**WHITES**

**RADIO LOG**

Winnetka KSA591 155.25 KFB217 154.19
Wood Dale KSI668 155.01 KBE777 154.31
Woodridge KAZ247 155.01 KGW780 154.31
Worth KSD226 155.19 KCZ472 154.28

**INDIANA MUNICIPAL POLICE & FIRE DEPTS.**

<table>
<thead>
<tr>
<th>City</th>
<th>Police Call</th>
<th>Police Freq.</th>
<th>Fire Call</th>
<th>Fire Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Chicago</td>
<td>KSA499</td>
<td>155.37</td>
<td>KSC252</td>
<td>154.31</td>
</tr>
<tr>
<td>East Gary</td>
<td>KSD539</td>
<td>155.13</td>
<td>KJJ456</td>
<td>154.28</td>
</tr>
<tr>
<td>Gary</td>
<td>KSA441</td>
<td>155.01</td>
<td>KSB939</td>
<td>154.19</td>
</tr>
<tr>
<td>Griffith</td>
<td>KSI570</td>
<td>155.37</td>
<td>KAZ894</td>
<td>154.31</td>
</tr>
<tr>
<td>Hammond</td>
<td>KSA465</td>
<td>155.37</td>
<td>KCP524</td>
<td>154.28</td>
</tr>
<tr>
<td>Highland</td>
<td>KSE473</td>
<td>155.37</td>
<td>KSC286</td>
<td>154.31</td>
</tr>
<tr>
<td>Hobart</td>
<td>KSC288</td>
<td>155.37</td>
<td>KSC758</td>
<td>154.31</td>
</tr>
<tr>
<td>Munster</td>
<td>KSE425</td>
<td>155.13</td>
<td>KSH760</td>
<td>154.31</td>
</tr>
<tr>
<td>Ogden Dunes</td>
<td>KSE514</td>
<td>155.13</td>
<td>KGB660</td>
<td>154.31</td>
</tr>
<tr>
<td>Portage</td>
<td>KSI420</td>
<td>155.13</td>
<td>KGS668</td>
<td>154.31</td>
</tr>
<tr>
<td>Schererville</td>
<td>KSG984</td>
<td>155.37</td>
<td>KGB509</td>
<td>154.31</td>
</tr>
<tr>
<td>Valparaiso</td>
<td>KSA547</td>
<td>155.13</td>
<td>KGS509</td>
<td>154.31</td>
</tr>
<tr>
<td>Whiting</td>
<td>KSA784</td>
<td>155.13</td>
<td>KFG523</td>
<td>154.31</td>
</tr>
</tbody>
</table>

**COUNTY AGENCIES**

Cook Co. Sheriff: 154.68 155.37 155.535 155.595 159.09
Note—Mobile units of municipal police departments can operate on 154.68 in order to contact Cook Co. Sheriff or III. State Police. Main Cook Co. channel is 159.09.
DuPage Co. Sheriff: KSI577 155.37 158.79
Lake Co. (III.) Sheriff: KSA465 158.97
Note—158.97 is main channel.
Lake Co. (III.) Fire Dept.: 153.89 154.40
Note—153.89 is main channel.
Lake Co. (Ind.) Sheriff: KSA591

**STATE POLICE**

Illinois: 39.46 42.50 42.52 42.56 42.60 154.68 154.92 155.37
Narcotics Control Div. (mobiles): 39.06 154.71
Public Welfare PD (mobiles): 155.43
Indiana: 42.42 155.37
Ind. Toll Road Comm. 154.755 155.415 156.03

**FORESTRY**

City of Chicago: 159.45 DuPage Co.: 31.86

**PUBLIC UTILITIES**

Chicago Dept. Water & Sewers 158.25
Commonwealth Edison Co. 153.59 153.71
Peoples Gas Lt. & Coke Co. 158.13 153.41 153.47
N.Indiana Public Service 37.78 451.10

**HOSPITALS & MEDICAL**

Chicago—Amer. Red Cross KSH537 42.42
Chicago—Mercy Hospital KJD851 47.62

**CHICAGO**

Chicago—Michael Reese KFB820 47.46
Chicago—State Hosp. KDP359 155.34
Elmhurst—DuPage Co. KD465 155.28
Harvey—Amer. Red Cross KZS01 47.42
Evergreen Pt.—L. C. Mary KCP24 155.28
Lake County Home KCW438 155.28
Libertyville—Cordell Hosp. KCN222 155.28
Park Ridge—Am. Red Cross KGB440 47.42
Waukegan—Lake Co. Gen. KCW657 155.28
Waukegan—Lake Co. TB KCW661 155.28
Waukegan—St. Therese KCW658 155.28
Waukegan—Victory Mem. KCW660 155.28
Zion—Benton Hosp. KCW659 155.28

**MARINE EMERGENCY COMMUNICATIONS, CHICAGO AREA**

Calling and emergency: 2182 kHz 156.80
U.S. Coast Guard: 2033 2187 2662 2670 2678 2686 2694 2702
3241 3253 3402.5 4403 5320 6320 kHz 41.22
Continuous Weather Forecasts: KWO39 162.55

**CHICAGO AREA AERO EMERGENCY COMMUNICATIONS**

Emergency channel: 121.5
Air search & rescue: 121.6 (soon changing to 123.1)
Civil Air Patrol: 4468 4503 4603 4630 kHz 26.62 143.9 148.15

**LAND TRANSPORTATION**

Chicago Transit Auth. KSA977 44.54
Chicago Motor Club KSA756 37.50

**CIVIL DEFENSE NETWORKS**

III. State 45.44 Lake Co. III. 155.28

---

**Everybody's a Salesman**

"This one has the tape deck, 4-track tape and stereo but not the leather carrying case and deluxe mike of this model which has the stainless trim, spare reels and phone jack like this model except that it's fully transistorized, two inches wider and two pounds lighter with extra optional..."
“The Universe and everything in it, even you, repeats each 82 billion years. With our help you can escape this purposeless cycle and live continuously forever outside the Universe. Come to Titan and be saved!” The message coming out of my computer was being read by a sexy female voice. Once each hour she identified herself as Titana.

Like I said, yours truly is a fanatic DXer and logging a moon of Saturn was about the rarest catch I could imagine. So what really persuaded me to go on the mission wasn’t Montalban’s 50 grand (though I never turn down money); it was the Titan QSL I’d be able to bring back for my collection.

I logged the date, time, exact frequency, and Titana’s message word for word to prove my reception, then got a good night’s sleep. We blasted off at 5:00 a.m.

Traveling at 300,000 mph, the flight took a little over three months. Throughout the journey Titana’s voice kept urging us on with descriptions of those delights to be found on her “planet.” Sunlight, of course, is definitely on the dim side by the time it reaches Titan (Saturn blocks it completely at times), so the whole sphere is lit artificially in Disneyland-at-night fashion.

Titana also pointed out that the ground was strewn with rubies, emeralds, and diamonds which we could have for the taking. This excited Rinaldo almost as much as their cosmic knowledge. Meanwhile, I checked those giant portable towers every day for possible vibration damage. Much to my surprise, there wasn’t any. The ship Titana had designed for Montalban took the speed as coolly as though it were standing still.

As we passed Mars and Jupiter I tuned the bands in search of DX but all I could hear out there were Titana’s seductive tones. And our first look at the place seemed to confirm her wildest claims. We landed in the central square of a crystalline city which was bathed in psychedelic blue-and-green light.

Though we landed at the spot designated by Titana, there was no one on hand to greet us. But when Rinaldo, myself, and Montalban’s three security men stepped out of our space ship, the ground—exactly as she had promised—was covered with those precious stones. We bent down to pick up a few, and that was our mistake.

The moment we were distracted, Titana and an armed guard of about 40 stepped from the shadows with their laser guns trained on us.

“Welcome to Titan, moon of Saturn.” Titana had long red hair, a 36-24-36 figure, and looked like a human save that she was almost transparent. Titana was a real looker if you dig spooks. She nodded and five of her “men” (who looked to be 100% human) boarded our ship and went straight to that compartment where my giant towers were kept. Titana assumed her most charming smile. “My soldiers aren’t really human. They’re androids designed to resemble you Earth people.”

Rinaldo had become a little grim. “This is hardly the way to begin fruitful negotiations.” He still gripped Titana’s rocks tightly in his pudgy right fist.

One of her androids returned and bowed in Titana’s direction. “Their portable antenna is on board and in good condition.”

Titana walked past yours truly on her way to Rinaldo. “You’re kind of cute for a human,” she murmured, looking me straight in the eye. I’m going to keep you around a while.”

I felt reassured in a creepy kind of way.

She faced Rinaldo. “There really is nothing to negotiate. We plan to take over your planet by infiltrating its power structures”

(Concluded on next page)
with our androids. The only obstacle had been a means to control these androids at widely scattered points."

A crane-like device wheeled itself up to our ship and began to unload the towers.

"When you have finished with those, take this one and his bodyguards to my lab." Titana pointed to Rinaldo and the crane nodded. "Our computers have deduced that the secret alloy which makes towers of this size portable just happens to be the same one which will enable us to control our androids in your planet's particular magnetic field. All we have to do is transmit a radio signal near Earth's gyrofrequency from these towers and any android within range will then respond perfectly to our every command."

Rinaldo dropped his rubies and diamonds, one by one.

"Of course the first agency we'll infiltrate will be Montalban Electronics, by building an android in your likeness."

The crane swooped up Rinaldo along with the three security men, then carried them and my towers off toward Titana's lab.

Titana turned to me. "But I'm going to give you some of those lessons in cosmic knowledge I promised over the air." She motioned for me to follow her into the city.

"I'll show you how to really escape the Universe."

So I knew all was not lost. And the way things are now, I still stand a pretty good chance of getting my QSL from the moon of Saturn—if, that is, I can figure out how an opaque Earthman can make out with a transparent Titan, name of Titana.

---

**Ham Traffic**

*Continued from page 89*

the equipment is imported, which most of it is, there's a 22½% import tariff!

See what I mean when I say it's surprising there are any hams in Canada!

I asked Ernie what effect all these taxes have on hams and experimenters, and he replied: "Quite simply to smother hobby electronics. Take the catalog price of anything in the U.S. and add 50% for the Canadian price. For example, the Heathkit HW-16 Novice transceiver costs $99.50 from Benton Harbor and $149.50 from Toronto (then there is an 8% currency difference, too). Little wonder we have such difficulty increasing the number of hams in Canada."

For Canadian hams, apparently the best bet is to join together and keep protesting in any effective way possible, in hopes government will someday respond. U.S. hams should keep a sharp eye peeled for any attempt to try the same thing here.

**Are Phone Patches Legal?** At this writing, the answer is still "no." But there is hope the good folks at Ma Bell may someday be forced to approve them if they meet reasonable technical standards.

An FCC decision a while back in what is known as the Carterphone case held that telephone companies may not arbitrarily stop their customers from connecting "a private radio system" to their telephones, as long as the radio doesn't interfere with the telephone company's equipment or other people's use of it.

However, Ma Bell is protesting that decision. So, a clear-cut, permanent answer may be delayed a while. Meanwhile, most phone companies probably will continue to look the other way if you're using a phone patch, as long as it doesn't create interference on the phone lines and as long as you use it for "public service" communications, not commercial purposes.

For example, not even the mighty voice of the Bell System can deny that ham radio phone patches linking overseas servicemen
with their families is a noble, worthwhile service. While the diplomats are still carving up the world to suit their personal ambitions, it seems reasonable that those of us who are left should be allowed to talk to one another occasionally.

Here's Lookin' At Ya. Want to see the mug of that fellow you've been talking to on 40 Meters? Here's your chance. Television is now permitted on the ham fone bands!

You may have heard about some of those special experiments run by hams on 20-Meter fone a while back with special permission of the FCC. The results were so good, and so many technically-minded hams have shown an interest in TV, that picture transmissions are now permitted on all fone bands from 75 Meters through 225MHz.

No undue interference with regular fone operation should result, the FCC comments, for two reasons: 1) Operation is allowed only on those frequencies which are restricted to Advanced and Extra Class operators, and so these frequencies should be less congested than the rest of the fone bands; 2) Bandwidth of the TV signal should be no greater than a single sideband signal on bands below 6 Meters, or a double sideband signal on 6 Meters and above.

Actually, according to the FCC's official report, there's more chance for the fone signals to interfere with the TV signals than vice versa!

The type of picture transmitted will be what is called slow scan, which is capable of sending only still photos or stationary scenes. Fast-scan images, needed for so-called live TV, such as we're accustomed to seeing on the commercial boob tube, require a much wider bandwidth. And there just isn't room for this type of transmission, except on much higher frequency bands.

So, the ham TV signals on the lower bands will be basically still photos instead of moving images. But TV, they'll be nevertheless.

Sending photos of people, equipment, scenery, QSL cards, and possibly of schematic diagrams should be fairly routine before long for those who have the necessary equipment and the ability to use it. Most of the fellows build their own gear, incidentally. You don't have to be rich to enjoy ham TV—just have a little extra technical savvy.

Pictures have already been transmitted across the Atlantic on 20 Meters. With a bit of skip activity ahead of us for a year or two, we're bound to hear much more.

---

Tell me how I might be able to accomplish this?
—R. S., Berkley, Mich.

The engineers who designed the amplifier indicate that increasing bass response could cause the amplifier to oscillate because of the feedback loop in the circuit. To get more bass, use bigger speakers in appropriate baffles. You might also place the baffles in corners of the room to improve efficiency.

On to mm Waves?
Do you know where I can buy a receiver that picks up 225 to 297 MHz frequencies? How much do they cost?
—E. D., Madison, Wis.

More than $1000, Charley! And what's to hear except hloop-bleep telemetering signals? Why not leave this sort of thing to vhf engineers?

What Is It?
While salvaging parts from an old 5-tube BCB receiver, I found a strange part which I have sketched (see diagram). On one side there is the number 21B4847. I would like to know what this thing is.

—A. K., Atlanta, Ga.

It's undoubtedly a circuit module—probably made by Centralab. To find out for sure, write to the manufacturer of the radio for the service manual for that particular model. Who knows, you may be in for a big surprise!

Dropout
I have a GE Model 260 portable radio and the power source is a 2-volt battery. It can be operated while it is on charge or on the battery alone. Is there any way I can modify it so I can use it mostly on AC current and not bother with a battery at all?

Stay with the battery and charger, friend. The battery functions both as a hum filter and voltage regulator.
Fascinating Failure. When the first results of the Homestake neutrino experiment were revealed by Dr. Raymond Davis Jr. of Brookhaven National Laboratory, an elite clique of solar physicists rushed to recheck and recalculate their mathematical models of the sun. Why? Because the neutrino trap had failed to catch even the few neutrinos predicted!

A layman might figure that the experiment was a bust. Not so the physicists who apparently continue to have complete faith in the reliability of the equipment. The generally accepted conclusion in scientific circles is that the high-energy neutrinos that the equipment was designed to catch simply aren't being generated in the amounts previously thought likely. This negative result may prove to have been a milestone in solar research because it brought about an intensive re-examination of existing theories about solar energy processes.

Neutrinos derived from the decay of boron-8 in the sun were expected to be observed; their absence now suggests that the flux of these neutrinos is less than 2 million per square centimeter per second. Also, if the sun were producing energy by the historically famous CNO cycle, neutrinos resulting from the decay of nitrogen-13 and oxygen-15 would have been observed. Since these also weren't detected, it is concluded that less than 9 percent of the sun's energy is produced by the CNO cycle.

It now appears that practically all of the sun's energy is created by the relatively simple proton-proton chain reactions shown in steps 1 and 2; the initial proton-proton fusions yield only low energy neutrinos, and the helium-3 fusion to form helium-4 yields no neutrinos. This conclusion is still tentative since one or two experiments of this complexity and delicacy can hardly be considered adequate for a firm decision.

The Davis experiment brought happy confirmation—even if tentative—of the deductions of those physicists who already had theoretical reasons for believing that the helium-3 fusion dominates in solar energy production. For example, in 1967 T. A. Tombrello of the California Institute of Technology reported that two groups at the institution had carried out laboratory experiments leading to the conclusion that the helium fusion process accounts for virtually all of the sun's energy, not merely half of it as had previously been supposed.

Drawing Boards Again. The Davis experiment sent other leading astrophysicists—including John Bahcall, associate professor of theoretical physics at Cal Tech, a leading solar theoretician who works in collaboration with his wife, Neta, Prof. William Fowler, and Dr. Giora Shaviv (now at Cornell University)—scurrying back to their drawing boards. Purpose: to rethink and redraw their mathematical solar models.

In 1967 Bahcall estimated that the flux of high-energy neutrinos that reach the earth from the sun is in the order of 16 million neutrinos per square centimeter per second. This estimate was derived through complex calculations based on what was then believed about the density, chemical composition, age, and temperature of the sun.

When, in February 1968, Davis announced the results of his first solar neutrino experiment, Bahcall went back to work using newer experimental values of nuclear reaction rates and new information about the composition of the sun. He wound up with a new estimate—a probable flux of 5 million neutrinos. But he conceded that his paper estimate might still be high because of uncertain factors in his equations, and that the flux could be as low as the 2 million indicated by the Davis experiment.

Bahcall concurs that the helium fusion process is almost surely the main energy system of the sun. But the scientist doesn't stop there. He offers other rather radical conclusions based on the Davis experiment.

1) The sun is composed of a smaller percentage of elements heavier than helium than had been expected—less than 2 percent of the total mass.

2) No more than 25 percent of the original primordial mass of the sun was composed of helium.

3) The central temperature of the sun is about 14.9 million degrees Kelvin, or 27 million degrees Fahrenheit.

4) The central density of the sun is about 150 grams of matter per cubic centimeter.

If these conclusions stand the test of time and of further neutrino experiments, a lot of textbooks will have to be re-written. Many a cosmologist will have to ponder where his theoretical speculations went wrong because some of the most popular scientific theories concerning the evolution of the universe de-
pend on the now seemingly refuted assumption that the primordial sun consisted of more than 25 percent helium.

The "facts" and figures contained in countless astrophysical texts will have to be revised. For example, most modern references report that the central temperature of the sun is in the order of 15 to 20 million degrees Centigrade (59 to 68 million degrees Fahrenheit), and that the central density of the sun is 100 grams per centimeter. These are significantly out of line with the new conclusions drawn by Bahcall.

It would appear that Dr. Davis, in his lonely vigil in the depths of a South Dakota goldmine, is leading the science of astrophysics into some new and exciting discoveries. And how is he doing it?

By looking for, and not finding, next to nothing!

---

**STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION**

Date of Filing: Oct. 1, 1968

Title of Publication: RADIO-TV EXPERIMENTER

Frequency of Issue: Bi-Monthly

Location of Known Office of Publication: 229 Park Ave., South, New York, N.Y. 10003

Location of the Headquarters or General Business Offices of the Publishers: 229 Park Ave., South, New York, N.Y. 10003

Names and Addresses of Publisher, Editor, and Managing Editor:

Publisher—B. G. Davis, 229 Park Ave., South, New York, N.Y. 10003

Editor—J. M. Stabenowicz, 229 Park Ave., South, New York, N.Y. 10003

Managing Editor—R. A. Flanagan, 229 Park Ave., South, New York, N.Y. 10003

Owners:


Davis Publications, Inc., 229 Park Ave., South, New York, N.Y. 10003

B. G. Davis, 229 Park Ave., South, New York, N.Y. 10003

Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities: None

Extent and Nature of Circulation:

<table>
<thead>
<tr>
<th>Average No. Copies Each Issue During</th>
<th>Actual No. of Copies of Single Issue Published Nearest to Filing Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Total No. Copies Printed (Net Press Run)</td>
<td>158,290 149,100</td>
</tr>
<tr>
<td>B. Paid Circulation</td>
<td>49,940 39,000</td>
</tr>
<tr>
<td>1. Sales through dealers and carriers, street vendors and counter sales</td>
<td>31,027 33,000</td>
</tr>
<tr>
<td>2. Mail subscriptions</td>
<td>80,867 72,000</td>
</tr>
<tr>
<td>C. Total Paid Circulation</td>
<td>1,866 723</td>
</tr>
<tr>
<td>D. Free Distribution (including samples) by mail, carrier or other means</td>
<td>82,835 72,723</td>
</tr>
<tr>
<td>E. Total Distribution (Sum of C &amp; D)</td>
<td>75,455 76,377</td>
</tr>
<tr>
<td>F. Office Use, Left-Over, Unaccounted, Spoiled After Printing</td>
<td>118,290 149,100</td>
</tr>
<tr>
<td>G. Total (Sum of E &amp; F—should equal net press run shown in A)</td>
<td>158,290 149,100</td>
</tr>
</tbody>
</table>

I certify that the statements made by me above are correct and complete.

V. C. Stables, Business Mgr.

---

**Lab Check—Injectorall Kit**

Continued from page 71

20 minutes the excess copper was no longer evident, and the PC board was removed from the etchant and washed. A few strokes of the brush attached to the cap of the resist ink solvent bottle quickly removed the resist, and the board was ready for drilling.

We found that the 1/4-in. drill bit supplied with the kit is just about right for most standard components—transistor, capacitor, resistor, and diode leads.

**Under An Hour.** From start to finish, it took about 50 minutes to complete a 2 1/2 x 4-in. PC board. Areas around the edges of the etched foil where the resist pen was used were sharp and unaffected by the etchant. Small fill-in areas protected by the resist pen were also unaffected. However, larger areas showed some etchant attack, indicating that we had not built up a sufficient layer of resist.

Unlike some use-up-and-done kits, replacement supplies are available for the Injectorall 500. For additional information and prices, write Injectorall Electronics Corp., Dept. S, 4 North Rd., Great Neck, N.Y. 11024.
A second system, known as Laser Link, is still highly experimental. Again, an air signal is used to bypass costly underground cable runs. This one's similar to a microwave relay in that a signal bearing many channels is beamed at apartment buildings. However, at a frequency of about 42 GHz, the wave (in the millimeter range) approaches the visible-light or infrared portion of the spectrum. (The system does not use a laser, as the name would imply.) Since such signals often resemble light in certain transmission characteristics, it remains to be demonstrated how well the system will work during fog and other complications. The developer states that the Laser Link's range is unaffected by weather conditions at distances up to three miles.

Looking Ahead. The invasion of large cities is only one phase in cable TV's astounding development. Consider what some believe are CATV's possibilities:

A wired city concept sees a vast number of homes connected to the cable. With a capability of more than 30 channels, the system would not only bring TV into the home, but a variety of other services. Some examples: newspaper via wire, computer services, alarm systems, and banking facilities. One concept, the remote reading of gas and electric meters, has already been tried.

Also in the experimental stage are two-way communications via cable so a subscriber may transmit signals through the line back to the source. This would enable a student to query a computer, for example, and get help in his homework. Proponents of TV-by-wire thus point out that congested airwaves could be freed for use by hard-pressed mobile communications.

CATV has proved to be a runaway success almost any place it lays cable—even where channels are already receivable. A growing public seems more than willing to pay a monthly tab of about $4 to $5 for additional channels and the guarantee of clear reception (which is especially critical for color). If industry growth keeps up, it could live up to a prediction made by one of its leaders. That is, if all restrictions were lifted, 90% of all homes would be subscribing to CATV service within 10 years.

Device. Switch S2 should be kept closed during long trips or whenever the alarm is out of commission for long periods of time. You may notice on one of the photos the printed legend, "caution . . . do not use charger when engine running." After building the device, I decided to add this bit of camouflage. The alarm looks like a battery charger, so why not confuse anyone trying to find it? Only you and I know that this battery charger is really a thief discharger.

Building Hints. Autoguard fits inside a 4 x 4 x 2-in. aluminum chassis box. There's nothing critical about parts placement, but leave as much space as possible between components. Short circuits could be embarrassing when you're on the road.

The two SCRs are mounted at one end of the box. Use the mounting kit provided with the SCRs, and put some heat-sink compound underneath the mica washers to help transfer heat between the SCRs and the aluminum. Actually, the SCRs don't dissipate much power when they're conducting, so an additional heat sink isn't necessary. Insulate the SCRs from the metal box.

The circuit is designed for use with a 12-volt, negative-ground electrical system whenever a car battery is used as a power source. However, it can't be used in positive ground or 6-volt systems—for these installations, you'll need a separate 12-volt lantern battery.

Instability (using the proper shielded connections) install capacitor Cx across L1, as shown in the schematic; Cx should be a 500-VDC disc capacitor rated between 10 and 25 µF.

AVC Masking. If it appears your BCB Booster has no effect make certain you are not tuned to a medium-to-strong station, as the receiver's AVC action will simply compensate for the booster's additional gain! The booster's gain will generally be noticed only on very weak signals, signals too weak to be received normally without using it. Tests indicate that the booster will literally fill dead spots on any BCB receiver's dial.
ADDITIONAL INCOME

MONEY—Sparet ime Opportunity Panelists At Home Wanted By New York Researcher. Leading research firm seeking people to furnish honest opinions by mail from home. Pays cash for all opinions rendered. Clee to "Popular Supply" Co. for details. For information write: Research 669, Mineola, N. Y. 11501. Dept. 662-RTV.

FREE! Details on Essential Item For Every Store and Business. Adco, Box #31, Station "A," Vancouver, Canada.

MAKE Your Classified Ad Pay. Get "How To Write a Classified Ad That Pulls." Includes certificate worth $3.00 toward classified ad in S & M. Send $1.25 (includes postage) to C. D. Wilson, Science and Mechanics, 229 Park Avenue South, New York, New York 10003.

AUTHOR'S SERVICE

PUBLISH your book! Join our successful authors: publicity advertising promotion, beautiful books. All subjects invited. Send for free manuscript report and detailed booklet. Carlton Press, Dept. SMH, 84 Fifth Avenue, New York 10011.

BOATS, MOTORS & MARINE SUPPLIES


BUSINESS OPPORTUNITIES

I MADE $40,000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof! Torrey, Box 318-T, Ypsilanti, Michigan 48197.


EARTHWORMS


EDUCATION & INSTRUCTION

FCC License and Associate Degree correspondence residence courses. Write bulletin free. Grantham Institute of Electronics, 1500 N Western Ave., Hollywood, California 90027.


INVENTIONS WANTED

WE either sell your invention or pay cash bonus. Write for details. Universal Inventions, 2889-M, Marion, Ohio 43303.

MAGIC TRICKS, JOKER NOVELTIES & PUZZLES


MISCELLANEOUS

ROOT BEER Formulas: Instructions $3.00, Tomarch, 1114-41st, Brooklyn, New York, N. Y. 11219.


QUART dried hops $1.00, with 101 recipes—Homebrewing, Winemaking, Hops, Brewers, Boudoirs, and supplies catalog. Nichols Nursery, Northpaco, Albany, Oregon 97321.


MONEYMAKING OPPORTUNITIES

100% PROFIT Bronzing Baby Shoes. Free Literature, Box 11069, Kansas City, Missouri 64119.

FREE! The World's Leading Money-making Magazine. How and when to get a Second Income, develop a Spare-time business, get into Profitable Franchising, become a successful Agent. For your free copy—write Income Opportunities, 220 Park Avenue South, New York, N. Y. 10003.

MUSIC & MUSICAL INSTRUMENTS

ELECTRONIC device writes music as you play. Details $1.00. Music P. O. Box 722, Logansport, Indiana 46947.

PERSONAL

"Do We Have All The Bible? A Candid, Box 3235, Lebanon Valley, Penna. 17046.

RADIO & TELEVISION

THOUSANDS AND THOUSANDS of types of electronic parts, tubes, transistors, instruments, etc. Send for Free Catalog. Arcturus Electronics Corp., 842-22nd Street, Union City, N. J. 07087.

KITS, Metal Detector $5.00. Audio Telescope $5.50 Others. Electronics, Box 42, Madison Heights, Mich. 48071.

BUILD Distance Crystal Sets. 10 plans $25. 20 different—$50. 20 different—$50. Catalog. Laboratories, 12941-H Sheridan, Garden Grove, Calif. 92640.

3800 VOLT rectifier 55¢, 1200 volt electric shock module $5.95. 14" x 12" fiberglass epoxy printed circuit boards $3.95. Radio jammer $3.95. Radio jammer parts $1.85. TV jammer $1.95. TV jammer plans $1.50. Catalog 20¢. Franks Scientific Co., P. O. Box 184, Marlure, Iowa 52358.

TREASURE FINDERS—PROSPECTING EQUIPMENT


There is no charge for the zip code—please use it in your classified ad
You can earn more money if you get an FCC License

...and here's our famous CIE warranty that you will get your license if you study with us at home

NOT SATISFIED with your present income? The most practical thing you can do about it is "bone up" on your electronics, pass the FCC exam, and get your Government exam.

The demand for licensed men is enormous. Ten years ago there were about 100,000 licensed communications stations, including those for police and fire departments, airlines, the merchant marine, pipelines, telephone companies, taxicabs, railroads, trucking firms, delivery services, and so on.

Today there are over a million such stations on the air, and the number is growing constantly. And according to Federal law, no one is permitted to operate or service such equipment without a Commercial FCC License or without being under the direct supervision of a licensed operator.

This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract gives an average of about $100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Coming Impact of UHF

This demand for licensed operators and service technicians will be boosted again in the next 5 years by the mushrooming of UHF television. To the 300 or so VHF television stations now in operation, several times that many UHF stations may be added by the licensing of UHF channels and the sale of 10 million all-channel sets per year.

Opportunities in Plants

And there are other exciting opportunities in aerospace industries, electronics manufacturers, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs.

The reason is simple. Passing the Federal government's FCC exam and getting your license is widely accepted proof that you know the fundamentals of electronics.

So why doesn't everybody who " tinkers" with electronic components 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 the Cleveland Institute of Electronics.

CIE courses are so effective that better than 9 out of every 10 CIE-trained graduates who take the exam pass it. That's why we can afford to back our courses with the iron-clad Warranty shown on the facing page: you get your FCC License or your money back.

There's a reason for this remarkable record. From the beginning, CIE has specialized in electronics courses designed for home study. We have developed techniques that make learning at home easy, even if you have had trouble studying before.

In a Class by Yourself

Your CIE instructor gives his undivided personal attention to the lessons and questions you send in. It's like being the only student in his "class." He not only grades your work, he analyzes it. Even your correct answers can reveal misunderstandings he will help you clear up. And he mails back his corrections and comments the same day he receives your assignment, so you can read his notation while everything is still fresh in your mind.

It Really Works

Our files are crammed with success stories of men whose CIE training has gained them their FCC "tickets" and admission to a higher income bracket.

Mark Newland of Santa Maria, Calif., boosted his earnings by $120 a month after getting his FCC License. He says: "Of 11 different correspondence courses I've taken, CIE's was the best prepared, most interesting, and easiest to understand."

Once he could show his FCC License, CIE graduate Calvin Smith of Salinas, California, landed the mobile phone job he'd been after for over a year.

Mail Card for Two Free Books

Want to know more? The postpaid reply card bound-in here will bring you free copies of our school catalog describing opportunities in electronics, our teaching methods, and our courses, together with our special booklet, "How to Get a Commercial FCC License." If card has been removed, just mail the coupon at right.

2 NEW CIE CAREER COURSES

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

THESE CIE MEN PASSED THE FCC LICENSE EXAM...NOW THEY HAVE GOOD JOBS

Matt Stuczynski, Senior Transmitter Operator, Radio Station WHOE

"I give Cleveland Institute credit for my First Class Commercial FCC License. Even though I had only six weeks of high school algebra, CIE's AUTO-FORMED LESSONS make electronics theory and fundamentals easy. I now have a good job in studio operation, transmitting, proof of performance, equipment servicing. Believe me, CIE lives up to its promises."

Chuck Hawkin, Chief Radio Technician, Division 12, Ohio Dept. of Highways

"My CIE Course enabled me to pass both the 2nd and 1st Class License Exams on my first attempt...I had no prior electronics training either. I'm now in charge of Division Communications. We service 119 mobile units and 66 base stations. It's an interesting, challenging career. And, incidentally, I got it through CIE's Job Placement Service."

ENROLL UNDER NEW G.I. BILL: All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are a reserve, check box on reply card for G.I. Bill information.

Cleveland Institute of Electronics

1776 East 17th St., Cleveland, Ohio 44114

Please send me without cost or obligation:
Your 48-page book "How to Succeed in Electronics," describing the job opportunities in electronics today, and how your courses can prepare me for them.

Your book on "How To Get a Commercial FCC License."

I am especially interested in:

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

Name

Address

City

State

Zip

Age

☐ Check here for G.I. Bill Information

EX-30

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

Radio-TV Experimenter

120
Cleveland Institute of Electronics

WARRANTY

of success in obtaining a Government FCC License

The Cleveland Institute of Electronics hereby warrants that upon completion of the Electronics Technology, Broadcast Engineering, or First-Class FCC License course, you will be able to pass the FCC examination for a First Class Commercial Radio Telephone License (with Radar Endorsement);

or upon completion of the Electronic Communications course you will be able to pass the FCC examination for a Second Class Commercial Radio Telephone License;

and in the event that you are unable to pass the FCC test for the course you select, on the very first try, you will receive a FULL REFUND of all tuition payments.

This warranty is valid for the entire period of the completion time allowed for the course selected.

Dr. G. O. Allen
President
**BUILD 20 RADIO CIRCUITS AT HOME with the New Improved PROGRESSIVE RADIO "EDU-KIT"®**

**A Practical Home Radio Course**

You DON'T HAVE TO SPEND HUNDREDS OF DOLLARS for a RADIO COURSE

<table>
<thead>
<tr>
<th>Included</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 RECEIVERS</td>
<td>Detailed practical methods of home training</td>
</tr>
<tr>
<td>3 TRANSMITTERS</td>
<td>Practical experience in construction of circuits</td>
</tr>
<tr>
<td>SQ. WAVE GENERATOR</td>
<td>Master RF power and strength</td>
</tr>
<tr>
<td>SIGNAL INJECTOR</td>
<td>Learn to play with high frequency</td>
</tr>
<tr>
<td>AMPLIFIER</td>
<td>Power amplifier techniques</td>
</tr>
<tr>
<td>CODE OSCILLATOR</td>
<td>Build your own oscillator</td>
</tr>
</tbody>
</table>

**FREE EXTRAS**

- SOLDERING IRON
- ELECTRONICS TESTER
- PRINTED CIRCUITRY
- PRINTED CIRCUITRY
- VALUABLE DISCOUNT CARDS
- FELT-TIP PEN & HIGHLIGHTERS
- TELEVISION BOOK & RADIO TROUBLE SHOOTING
- MEMBERSHIP IN RADIO TV CLUB
- SCHOLARSHIP TO AMATEUR LICENSE TRAINING
- ADDITIONAL INFORMATION DESCRIBING "EDU-KIT".

**THE KIT FOR EVERYONE**

**THE KIT IS COMPLETE**

- You receive an array of instructional materials necessary to build twenty different radio and audio circuits. Each circuit is carefully designed to operate, so you can see how each circuit is used in practical application. You also receive a complete set of tools needed to build the EDU-KIT. The "EDU-KIT" includes Code Instructions and the Progressive Radio Circuit, servicing with the Progressive Signal Filter, and the Progressive Radio Circuit, servicing with the Progressive Signal Filter, and the Progressive Radio Circuit, servicing with the Progressive Signal Filter, and the Progressive Radio Circuit, servicing with the Progressive Signal Filter.

**FREE MONEY BACK GUARANTEE**

Please rush your Progressive Radio "EDU-KIT" to me, as indicated below:

- Check one box to indicate choice of model
  - Regular model $26.95
  - Deluxe model $31.95 (Same as regular model except with superior parts and tools plus valuable Radio & TV Tube Checkers)

- Check one box to indicate manner of payment
  - I enclose full payment. (Add 25¢ for "EDU-KIT" post paid)
  - Send me an O.D. I will post pay

- Send me FREE additional information describing "EDU-KIT".

**NAME**

**ADDRESS**

**CITY & STATE**

**ZIN**

**_EDU-KITS_® INC._ 1186 Broadway, Dept. 552NN, Hewlett, N. Y. 11557**