Cassie — sweetest sound in cassettes (see page 57)

OCTOBER-NOVEMBER
75¢

Science and Electronics

WHITE'S RADIO LOG

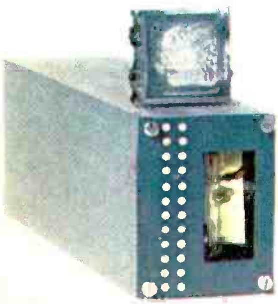
- AM Stations
- Worldwide Shortwave
- Police/Emergency

Happiness is having our

PICTURE POWER PAIR

project 1: Speed Flash
dial X and fire

project 2: Robot Slave
light when and where
you need it



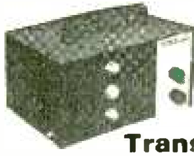
Plus

Photography Speed Lites —
what makes the
pro units tick

Dazzle your friends with lightworks.

Sound n' Color

The new dimension to music pleasure. EICO All Electronic Solid State Audio-Color Organs transform sound waves into moving synchronized color images. Connect easily to speaker leads of hi-fi or radio. From $29.95



Translators

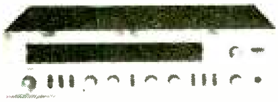
The electronics you need to create audio-stimulated light displays to your own imagination. Adjustable Light Display Unit for Strobe Lites, any lamp configuration (Xmas trees, patio lights, etc.). From $24.95 kit, $39.95 wired.

Strobe Lites

High intensity bursts of white light from Xenon tube flash in cadence with each beat of audio. From $24.95 kit, $39.95 wired.

Build the Stereo Kits praised by experts.

All amplifier power ratings according to IHF standards. Cortina® designed and manufactured in U.S.A. and guaranteed by EICO.

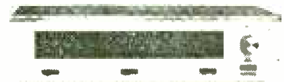


70-Watt AM/FM Stereo Receiver including cabinet. Cortina 3770, $189.95 kit, $279.95 wired.

70-Watt FM Stereo Receiver including cabinet. Cortina 3570, $169.95 kit, $259.95 wired.

150-Watt Silicon Solid-State Stereo Amplifier including cabinet. For the audio perfectionist. Cortina 3150, $149.95 kit, $225 wired.

70 Watt Silicon Solid-State Stereo Amplifier including cabinet. Cortina 3070, $99.95 kit, $139.95 wired.



FM Stereo Tuner including cabinet. Cortina 3200, $99.95 kit, $139.95 wired.

EC 1100 FM WIRELESS MIKE $9.95

Build for fun and use with Eicocraft jiffy project kits.

The newest excitement in kits. 100% solid state and professional. Expandable, interconnectable. Excellent as introductions to electronics. No technical experience needed. Finest parts, pre-drilled etched printed circuit boards, step-by-step instructions. 26 kits to select from, $2.50 to $9.95. Just released: EC 2600 "Super Snoop" $8.95. EC-2700 Police & Fire Converter (lo band) $7.95. EC 2800 Aircraft Converter $7.95. EC-2900 Police & Fire Converter (hi band) $7.95. EC-3100 2-Station Intercom (with cases) $10.95. EC-3200 "Do-It Yourself" PC Etching Kit $4.95. EC-2300 Audio Preamplifier $8.95. EC-2400 Bullhorn $8.95. EC 2500 Fuzzbox $8.95.

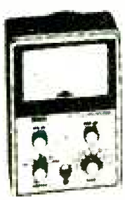
EC 1004 TREASURE FINDER $9.95

Shape up your own car/boat with EICO 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 comprehensive Tune-up & Trouble-shooting Manual. EICO 888, $49.95 kit, $69.95 wired.

The first and only solid state test equipment GUARANTEED FOR 5 YEARS

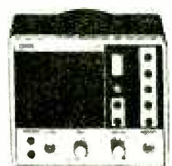
Only EICO brings you laboratory precision and long life at lowest cost.



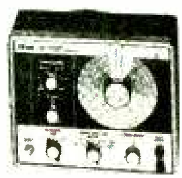
EICO 240 Solid-State FET-TVOM
$59.95 kit, $79.95 wired

EICO 379 Solid-State Sine Square Wave Generator
$69.95 kit, $94.50 wired

EICO242 Solid-State Deluxe FET-TVOM
$69.95 kit, $94.50 wired



EICO 150 Solid-State Signal Tracer
$49.95 kit, $69.95 wired



EICO 330 Solid-State RF Signal Generator
$59.95 kit, $84.50 wired

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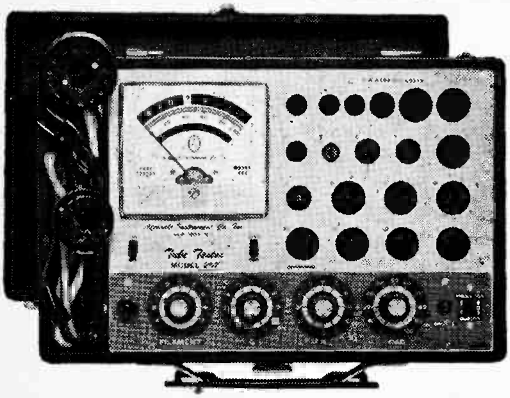
The New 1970 Improved Model 257 **A REVOLUTIONARY NEW**

TUBE TESTING OUTFIT



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

ANNOUNCING...for the first time

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

COMPLETE WITH ALL ADAPTERS AND ACCESSORIES, NO "EXTRAS"

STANDARD TUBES:

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

BLACK AND WHITE PICTURE TUBES:

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

COLOR PICTURE TUBES:

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

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

NOTICE

We have been producing radio, TV and electronic test equipment since 1935, which means we were making Tube Testers at a time when there were relatively few tubes on the market, way before the advent of TV. The model 257 employs every design improvement and every technique we have learned over an uninterrupted production period of 34 years.

Accurate Instrument Co., Inc.

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PAY POSTMAN NOTHING ON DELIVERY

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

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

ACCURATE INSTRUMENT CO., INC. Dept. 755
2435 White Plains Road, Bronx, N.Y. 10467
Please rush me one Model 257. If not satisfactory I agree to pay at the terms specified at left. If not satisfactory, I may return for cancellation of account.

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Address ____________________
City ____________ Zone ________ State ________

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Science and Electronics

Volume 28 Number 5

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POSITIVE FEEDBACK

Julian M. Sienkiewicz
EDITOR-IN-CHIEF

HERE'S to a fine gentleman and an excellent organization! We are toasting none other than Pete Kreer and REACT—Radio Emergency Associated Citizens Teams. Pete Kreer, a Chicago advertising executive, is the man responsible for thinking up and giving impetus to the organization CBers lovingly refer to as REACT. At the present time, REACT is sponsored by General Motors Research Laboratories as a public service with Pete at the helm as National Director. This mighty duo, combined with enthusiastic Citizens Banders throughout the nation, has created a public service organization that not only fills voids where public emergency services fail or cannot serve, but represents the entire Citizens Band group with a mighty voice at FCC headquarters in Washington. Case in point is the new ruling by the FCC that Channel 9 become the emergency calling channel for the Citizens Band radio service. Admittedly, REACT did not do it alone, but this Editor believes that this organization had the largest and most influential voice.

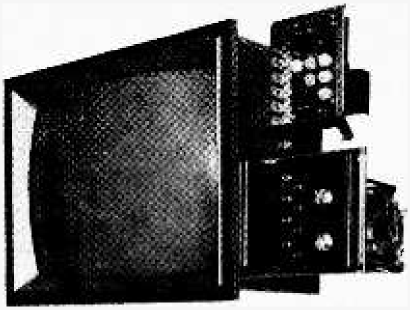
However, a problem now falls before us. CBers have been accustomed to using Channel 9 as a general calling channel throughout the nation. Motorists, businessmen in general, and the often-deigned chit-chatters have always used Channel 9 as the one channel to get into the action. This no longer can be done on Channel 9. Therefore, REACT National Headquarters has come up with a plan to use Channel 11 as the national calling channel for all legal situations other than emergencies. Many reasons can be given for this selection, but this Editor feels that the most important reason is that more people have Channel 11 crystals, with the exception of Channel 9, than any other channel crystal. Another good reason is that antenna systems, no matter how well they cover the entire spectrum of the 23 CB channels, serve most efficiently at a particular frequency. Antenna systems, therefore, should be tuned to Channel 9, the emergency calling channel, for best standing-wave-ratio figure of merit. To take advantage of this efficiency, the nearest general-purpose calling channel would be Channel 11. That in itself

(Continued on page 99)

New Heathkit® Solid-State

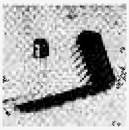
Design and performance features add up to one-of-a-kind superiority.

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



Compare these features:

- Modular plug-in circuit board construction.
- MOSFET VHF tuner and 3-stage IF.
- Adjustable video peaking.
- Sound instantly, picture in seconds.
- Built-in Automatic Fine Tuning.
- Pushbutton channel advance.
- Tilt-out convergence and secondary controls.
- Hi-fi sound outputs — for amplifier.
- Virtually total self-service capability with built-in volt-ohm meter, dot generator, and comprehensive manual.
- Premium quality bonded-face etched glass picture tubes.
- Choice of 295" or 227" picture tube sizes.



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

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

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

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

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

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

Automatic chroma control eliminates color variations under different signal conditions.

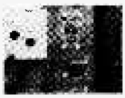
Adjustable noise limiting and gated AGC keeps pulse-type interference to a minimum, maintains signal strength at constant level.

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

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

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

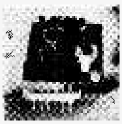
Adjustable tone control lets you choose the sound you prefer ... from deep, rich bass to clean, pronounced highs.



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

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

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



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

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

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

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

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

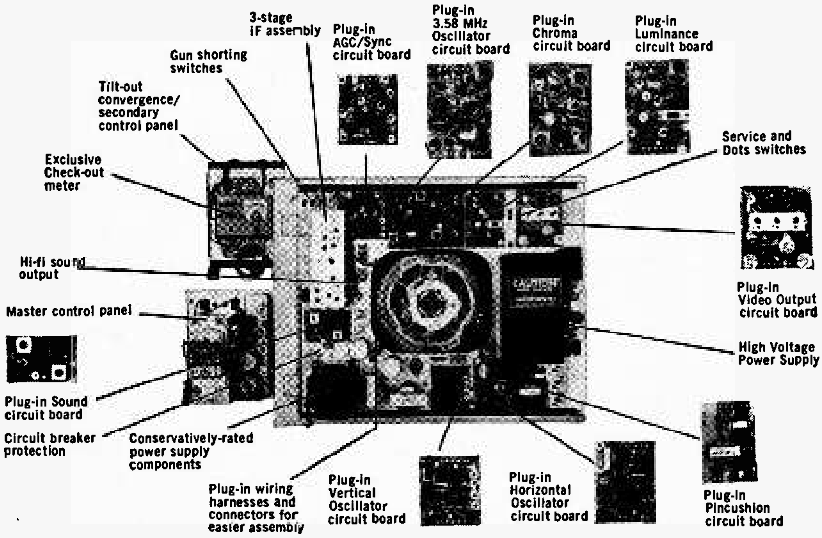
Kit GR-370, all parts including chassis, 295" picture tube, face mask, UHF & VHF tuners, AFT & 6x9" speaker, 127 lbs. **$559.95***

Kit GR-370MX, complete GR-370 with RCA matrix picture tube, 127 lbs. **$569.75***

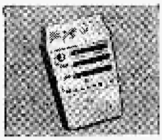
GR-270 AND GR-370 SPECIFICATIONS — PICTURE TUBE SIZE: GR-370 Approximate Viewing Area: 295 Sq. In. GR-270 Approximate Viewing Area: 227 Sq. In. **DEFLECTION:** Magnetic, 90 degrees. **FOCUS:** Electrostatic. **CONVERGENCE:** Magnetic. **ANTENNA INPUT IMPEDANCE:** VHF 300 ohm balanced or 75 ohm unbalanced. UHF: 300 ohm balanced. **TUNING RANGE:** VHF TV channels 2 through 13. UHF TV channels 14 through 83. **PICTURE IF CARRIER:** 45.75 MHz. **SOUND IF CARRIER:** 41.25 MHz. **COLOR IF SUBCARRIER:** 42.17 MHz. **SOUND IF FREQUENCY:** 4.5 MHz. **VIDEO IF BANDWIDTH:** 3.58 MHz. **HI-FI OUTPUT:** Output impedance — 1 k ohm. Frequency response — ±1 dB 30 Hz to 10 kHz. Harmonic distortion — less than 1% at 1 kHz. Output voltage — 0.3 V rms nominal. **AUDIO OUTPUT:** Output impedance — 4 ohm or 8 ohm. Output power — 2 watts. **POWER REQUIREMENTS:** 110 to 130 volts AC, 60 Hz, 240 watts. **NET WEIGHT:** GR-370, 114 lbs.; GR-270, 101 lbs.

Modular Color Television!

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



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

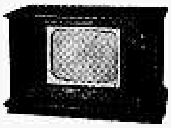


Add extra convenience and versatility to your new GR-270 or GR-370 Solid-State Color TV with this new ultrasonic remote control kit. Lets you turn the set on and off, adjust volume, change VHF channels and adjust color and tint from the comfort of your chair. Assembles and installs complete in just a few hours and the built-in meter on the receiver makes final adjustment a matter of minutes.
Kit GRA-70-6, 6 lbs. $84.95*

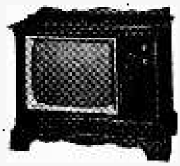
Choose One Of These Handsome, Factory Assembled Cabinets

3 models in 295 sq. in.

Luxurious Mediterranean Cabinet . . . factory assembled of fine furniture grade hardwoods and finished in a flawless Mediterranean pecan. Statuary bronze trim handle. 30-1/32" H x 47" W x 17¾" D. **Assembled GRA-304-23**, 85 lbs. $129.95*



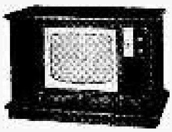
Deluxe Early American Cabinet . . . factory assembled of a special combination of hardwoods & veneers and finished in classic Salem Maple. 29-21/32" H x 37¼" W x 19¾" D. **Assembled GRA-303-23**, 67 lbs. $114.95*



Contemporary Walnut Cabinet . . . factory assembled of fine veneers & solids with an oil-rubbed walnut finish. 29-17/32" H x 35-13/16" W x 19⅞" D. **Assembled GRA-301-23**, 56 lbs. $74.95*

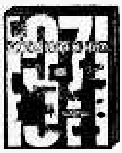
3 models in 227 sq. in.

Exciting Mediterranean Cabinet . . . assembled using fine furniture techniques and finished in stylish Mediterranean pecan. Accented with statuary bronze handle. 27-31/32" H x 41⅞" W x 19-9/16" D. **Assembled GRA-202-20**, 70 lbs. $114.95*



Contemporary Walnut Cabinet and Base Combination. Handsome walnut finished cabinet sits on a matching walnut base. Cabinet dimensions 20-31/32" H x 31-7/16" W x 18⅝" D. Base dimensions 7¾" H x 27¾" W x 18⅝" D. **Assembled GRA-203-20 Cabinet**, 45 lbs. $49.95* **GRS-203-6** above cab. w/ matching base, 58 lbs. $59.95*

Handy Roll-Around Cart and Cabinet Combination. Features the GRA-203-20 walnut cabinet plus a walnut-trimmed wheeled cart with storage shelf. **Assembled GRA-203-20 Cabinet**, 45 lbs. ....$49.95* **GRA-204-20 Roll-Around Cart**, 18 lbs. . . .$19.95* **GRS-203-5, Cart & Cabinet Combo**, 58 lbs. $59.95*



NEW

FREE 1971 CATALOG!
Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, guitar amplifiers, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

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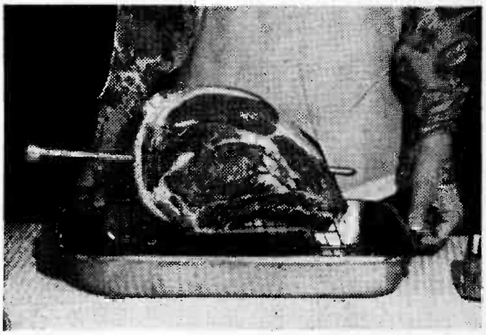
Benton Harbor, Michigan 49022

☐ Enclosed is $________________, plus shipping.
Please send model (s) ________________
☐ Please send FREE Heathkit Catalog. ☐ Please send Credit Application.
Name ________________
Address ________________
City ________________ State ________ Zip ________
*Mail order prices; F.O.B. factory. Prices & specifications subject to change without notice. CL-387R

NEW

Meanwhile, Back at the Range . . .

Here's something the Little Woman will appreciate! Called Thermal Magic by its inventor, Energy Conversion Systems, it's a cooking pin that causes meat to cook from the inside at the same time it's cooking normally from the



Energy Conversion Systems Thermal Magic

outside. You can fiddle around with Thermal Magic—insert the pin halfway and produce roast beef done both rare and well. Cooking time is reduced by one half, and juices are retained, reducing shrinkage and eliminating the need for basting. Price is $9.95, and you can send for information to Energy Conversion Systems, Inc., 623 Wyoming S.E., Albuquerque, N.M. 87112.

Mike Joins War Against Pollution

Something ingenious from Ingenuics, Inc. is a new microphone which features switchable control of environmental sounds. Mike has distance discrimination network which permits a choice of accepting or rejecting background noises and other audio pollutants that you

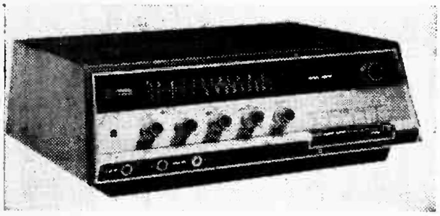
Ingenuics Environ Microphone

PRODUCTS

bump up against in recording and broadcasting. The "T" shape of the microphone comes from two cartridges whose outputs are reversed from *add* to *subtract* when it's switched from Super Omni mode to Noise Cancel mode. The company calls their new microphone the Environ, and if you want to order it, it's Model 2N1. Price is $189.00 FOB from Ingenuics, Inc., 16000 Industrial Dr., Gaithersburg MD 20760.

AM/FM-Stereo Deluxe

H. H. Scott has introduced an elegant new AM/FM-stereo receiver, the 3800. Scott's Perfectune indicates stereo and best reception tuning. The 3800 features instant-acting electronic protection circuits and electronically regulated power supply involving a circuit breaker—no output fuses to burn out. The IF section has a quartz crystal lattice filter, which, they say, never needs alignment and gives selectivity of 40 dB. Controls include dual bass and treble, stereo balance, input selector, tape monitor, speakers *on/off*, power *on/off*, volume, volume



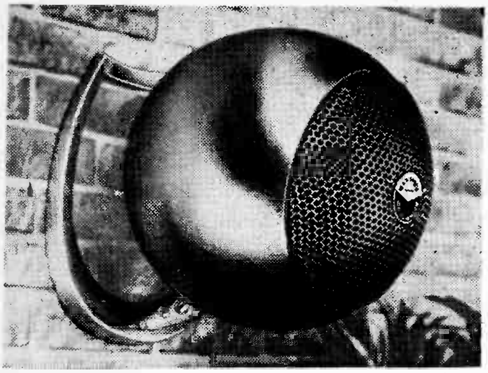
H.H. Scott 3800 Receiver

compensation, muting, noise filter, automatic tuning indicator, stereo indicator light, precision signal strength meter, front panel stereo headphone output, tuning, stereo/mono mode switch. Total power is +1 dB, 210 watts @ 4 ohms, IHF dynamic power 85 watts per channel @ 4 ohms, continuous power 53 watts per channel @ 4 ohms. Frequency response is +1 dB 15-30,000 Hz. Price of the 3800 is $399.95 and you can write for more specs to H. H. Scott, 111 Power Mill Rd., Maynard MA 01754.

Music of the Sphere

Maximus Sound Co. calls these new speakers "Round Sound Machines." They are recommended for the patio or pool as well as indoors. The heavy-gauge steel sphere, 8 inches in diameter, houses a high compliant air suspension driver. It's quite weatherproof and will deliver 20 watts of music power and has a frequency range of 55-15,000 Hz. The Round Sound Machines are available in decorator colors. Each speaker is mounted on a universal swivel base so it can be hung on a wall, a tree,

**************** *more* NEW PRODUCTS

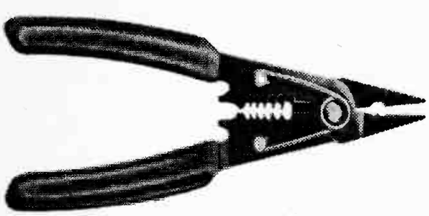


Maximus Round Sound Machine Speaker

a post, or just standing on a bookshelf. The Round Sound Machine will sell for $49.95 and you can write for literature to Maximus Sound Div. of American Recreation Group, Inc., 809 Stewart Ave., Garden City NY 11530.

Shape Up Your Tool Box

Man's been making tools for a couple of millions years but he keeps coming up with improvements. Here's one from Techni-Tool, which they call the Plike. It's a combination wire cutter stripper, terminal crimper, and wiring plier. Plike will accommodate stripper solid wire from 12 to 22 AWG and stranded wire

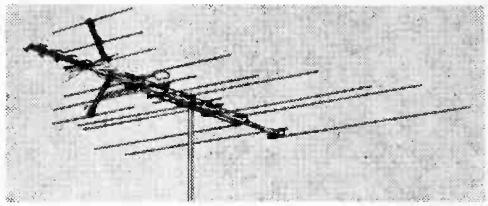


Techni-Tool Plike Combination Tool

from 14 to 24 AWG. The terminal crimper handles all standard solderless connectors, while the plier jaws are of the serrated flat nose configuration. Price of Plike is $2.75, and for further information and free catalog, write Techni-Tool, Inc., 1216 Arch St., Philadelphia PA 19107.

Permacolor

No, it's not a hair dye. Permacolor is a new line of TV FM outdoor antennas from RCA Parts and Accessories. The name derives from the line's new feature—permanent connections between the elements and the feed lines, thus eliminating reception problems caused by poor electrical connections. The Permacolor line includes a full range of UHF/VHF/FM combinations, as well as VHF-FM models, for application in virtually every reception area from

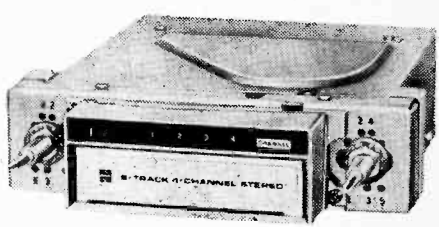


RCA Model 4BG23 Permacolor Antenna

metropolitan to deep fringe. The combination models feature an improved UHF corner reflector which also augments VHF reception, plus a wide-band, bow-tie UHF dipole. Snap-off elements are provided on most models for adjusting the Permacolor antenna to local FM and UHF reception requirements. Their permanent connections are achieved through a flexible strap riveted to the element and the feed line. The antennas are finished in blue and gold vinyl, and the price of one, model 4BG23, for example, is $42.50. For further information write RCA Parts and Accessories, 2000 Clements Bridge Rd., Deptford NJ 08096.

Car Stereo Tape Is No-Steal

A new 8-track car stereo tape player from Panasonic, Model CX-451, is designed to go into the glove compartment when not in use, thus greatly lowering the risk of theft or vandalism. The tape player can be installed in every make of car by means of adjustable shafts. The CX-451 uses Panasonic's 2-stage preamp, dual channel amplifier, and a vertical head movement system for hi-fi performance. Unit has variable tone control for balancing treble and bass, a program selection button with illuminated channel indicator for manual



Panasonic Daytona CX-451
Car Stereo Tape Player

operation, and an automatic channel changer for continuous listening. Price of Model CX-451 (also known as the Daytona) is $84.95. For more details write to Panasonic, Matsushita Electric Corp. of America, 200 Park Ave., New York NY 10017. ■

Meters Hurtz

Recently I have heard shortwave radio stations announcing their frequencies in meters. How may I convert meters into megahertz or kilohertz?

—*A.B., Winnipeg, Manitoba*

There was a time that all radio frequencies were referred to interms of wavelength (meters). Why anybody does today is amusing. To convert meters into kHz or MHz is easy. Frequency in kHz (kilohertz) or kilocycles per second is equal to:

$$\text{kHz} = \frac{300{,}000}{\text{meters}}$$

And frequency in MHz (megahertz) is equal to:

$$\text{MHz} = \frac{300}{\text{meters}}$$

For example, 300 meters divided into 300,000 is equal to 1000 kHz. And, 2 meters divided into 30 is equal to 150 MHz. Gee, that didn't *hurtz* at all!

Build-It Nut

Can you give me a list of magazines which have plans for shortwave radios that almost anyone can build?

—*I.W., Yonkers, N.Y.*

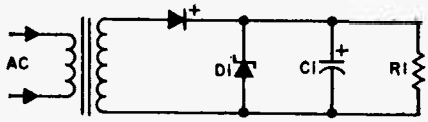
You'd have to be out of your skull to build a shortwave receiver from scratch. Especially if you desire to become a serious shortwave listener. The day of building a shortwave receiver is gone. If you must assemble your own unit and want quality results, we suggest you contact the Heath Company, Benton Harbor, Mich. 49022 and EICO Electronics, 283 Malta St., Brooklyn, N.Y. 11207, and ask for their catalogs. If you insist on building a quality receiver, in spite of all obstacles that may fall before you, then we suggest you get a copy of "Radio Amateur's Handbook" which is on sale at most local parts stores that cater to the amateur radio hobbyist. In it they give the plans for many ham receivers that can be adapted to the shortwave bands.

They're All the Same

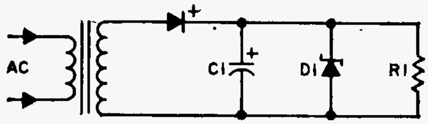
Are these two circuits the same (see diagrams A and B). I get conflicting answers from sources I have checked.

—*J.T.H., Pitsburgh, Pa.*

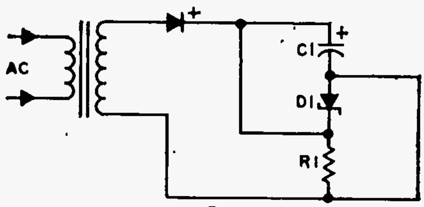
Yes, diagrams A and B are exactly the same. The Zener diode D1 and filter capacitor C1 are connected in parallel. These diagrams could be redrawn as shown in diagram C and all three would still be the same—*identical.* One word of advice, stay away from those "advice" sources who disagree with us on this question.



A



B



C

Just Wrap Some More

I have construction plans on how to make a 15-meter "flea-watter" transmitter. What would I do, besides changing the crystal, to convert the transmitter to 40 meters?

—*R.D., Chagrin Falls, Ohio*

Use coils with about twice as many turns. You'll have to experiment with turns and turn spacing until you hit it right. Have fun!

Zap, Zap, Zap . . .

I have been looking for a strobe circuit which is capable of operating on house current and which will drive a regular 100-watt household light bulb at a variable strobe rate.

—*L.B., Houston, Texas*

An incandescent lamp won't work in a strobe circuit because it won't brighten or black out fast enough. You need a gas-filled tube which requires high voltage to fire it. Why don't

(Continued on page 16)

ASK ME ANOTHER

(Continued from page 14)

you get a copy of ELEMENTARY ELECTRONICS March/April 1970 issue and check "Penny-pincher's Stroboscope" on page 29. It's an easy-to-build project that may fill your needs.

The Police Stole "1"

What is television Channel "one" used for? I've heard so much about it and how hard it is to get a TV receiver with channel "one" on it.

—J.B., Oklahoma City, Okla.

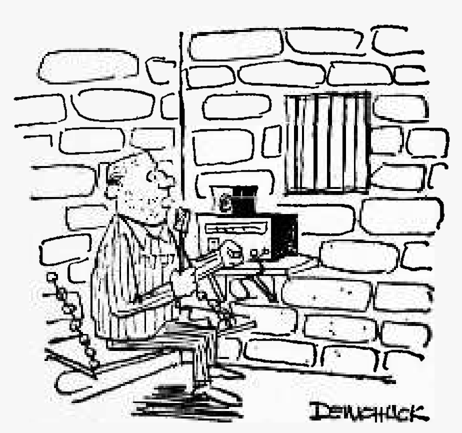
There *ain't* no such channel. When the TV channels were first allocated, there was a Channel 1. Then, the frequency space of Channel 1 was reallocated to the 30-50 MHz land mobile radio services (police, etc.). Why the channels weren't renumbered is a mystery. If you had a receiver that could tune through the 48-54 MHz range, you might hear "Car 54, where are you?", but you wouldn't see it.

Going CB

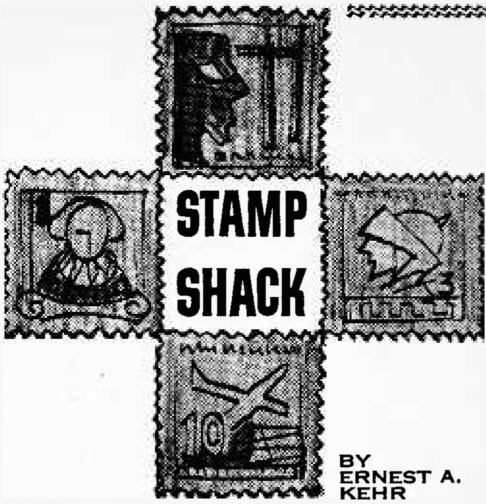
I am just starting in CB radio and would like to know which is the best CB set. This is very important to me, so please give a factual answer.

—G.J.G., Kensington, Conn.

It all depends upon what you're looking for, a base station or a mobile unit or both. Also, how much scratch ($) do you have? There are several really good ones just as Lincoln-Continental, Cadillac, and Imperial are great cars. If you can afford to spend a lot of money for a base station take a look at the Browning Golden Eagle, Regency Imperial, and Tram Titan II. Johnson makes some excellent CB sets and Lafayette imports some dandies. Why don't you take a peek at our 1970 CB YEARBOOK—we include test reports which are quite conclusive! ■

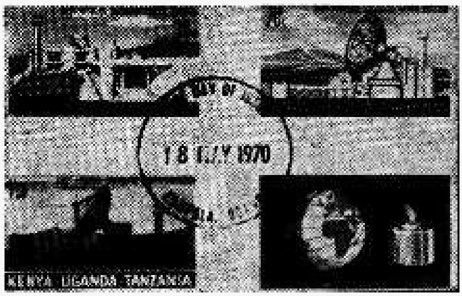


"Help, I'm being held prisoner . . ."



BY ERNEST A. KEHR

● ● The first time we visited East Africa, tribesmen still sent messages through the jungles by banging primitive drums. It was a spectacular feeling, then, to see the final touches being put on a $7 million Earth Station that will enable tomorrow's citizenry to communicate with any part of the world in a matter of minutes. The modern installation was commemorated by four stamps issued in East Africa while we were there, even though the station is not expected to operate until later this year. Designs of the stamps, each printed in natural color, (30, 70 cents, 1½ and 2½ shilling) show various pictures of the facility plus a symbolic one linking earth with Intelsat II.



Kenya-Uganda-Tanzania
East African Satellite Earth Station Issue
30¢, 70¢, 1.50 and 2.50 Values

● Construction and operation of the facility was entrusted to the East African External Telecommunications Company, Ltd., and is located on Mount Margaret, only 27 miles north of Nairobi in Kenya's Rift Valley.

● The main feature of the station, which will be in touch with a satellite launched to a geostationary orbit, 22,300 miles over the Indian Ocean, is a fully steerable microwave "dish" 97 feet in diameter. This is a high precision aluminum-coated parabola antenna weighing

200 tons and from which messages and telephone calls will be beamed on a sky journey and back to earth in less than a quarter of one second. It is controlled by a complex system which enables it to accurately point at the satellite at all times.

● Apart from the equipment housed in the aerial tower, most of the communications equipment is housed in the control building from which the national network is to be fed. The whole represents the most modern and sophisticated of today's telecommunications instruments.

● This East African Earth Station and the Satellite will provide a capacity of 1,200 voice-channels and visual waves from the United Kingdom in the west, and Japan and Australia, in the East. The bulk of these will be used for telephone service and serve the complete needs of Kenya, Tanzania and Uganda which comprise East Africa in the wide-band media. It provide a vastly improved service compared with the present High Frequency Radio circuits, which are subject to the normal vicissitudes of this facility.

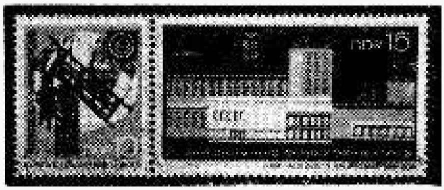
● While in Kampala, Uganda, we visited the telephone office and discovered that overseas calls had to be wait-listed because of difficulties in getting through to destination. All of that will be eliminated once the Earth Station in neighboring Kenya opens and is linked with Uganda; the only consideration will be that of taking into account the time differences between East Africa and the other continents.

● ● At the same time, Korea, which also is linked with the Intelsat III, issued a single 10-won pale and bright blue stamp showing its Earth Station at Kum San. Shown in this design, created by Kang Choon Hwan, a local artist, is the antenna beamed at the satellite against a modern map of the earth. This installation, which already is in operation, was jointly financed by the Korean Ministry of Communications, the Export-Import Bank and the Philco-Ford Corporation, which was commissioned to construct it.

Korea Intelsat III Issue

● ● From East Germany, which is not a member of the Universal Postal Union, but whose mail, nevertheless, is accepted for international transportation through Communist nations which do hold membership, comes word that it has marked the 25th anniversary of the German Democratic Republic's Radio Service. Two stamps were issued as part of the observation; one depicts a high-power transmitting antenna head place against a background of the globe, the other shows the administration-studios building of the DDR Radio Organization in Berlin.

● Radio service was available throughout Germany for more than half a century. But only five days after the conquest of Hitler's Nazism, the Red Army, upon taking possession of the Eastern Zone, occupied the Berlin broadcasting studios. At 10 p.m., on May 13, 1945, the first Soviet programs were transmitted from the appropriated facilities, which then were called the German Democratic Republic Rundfunk (radio.)



East Germany Universal Postal Union Issue

● Located as it is, this operation has become a propaganda instrument of no small importance. Programs are beamed not only to East Germany, but to other parts of Europe and the world—in a variety of languages intended to spread the messages of East Germany to listeners Communists hope will join their cause.

● ● It's somewhat late, but only recently did we learn of a special exhibition staged at the headquarters of the International Telegraph Union, in Switzerland. Prepared by an unidentified staff member who also is a philatelist, it contained stamps and postal markings authorized by many of the world's member nations for use on May 17, 1969, which was designated as ITU Day. The show was formally opened by W. J. Wilson, Chairman of the ITU's Administrative Council. Writing in "LaSuisse," a journalist said, "This perfectly balanced and homogeneous exhibition does honor not only to the philatelic community of Geneva, but to philately throughout the world."

● ● Collectors who obtain covers with new United States and UN stamps postmarked on the date they are officially released will be interested in a new edition of "The Specialized First Day Cover Catalogue," annually published by the Washington Press, Maplewood, NJ 07040. This price guide costs $1 and provides some startling revelations as to the value of certain domestic stamps. While the majority of listed items are in the "under $10" range, there are a number whose worth is quoted in excess of $1,000 each. ■

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Performing transistor experiments on programmed breadboard—using oscilloscope

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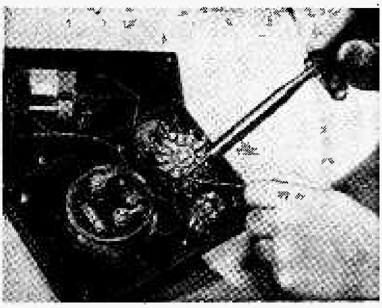
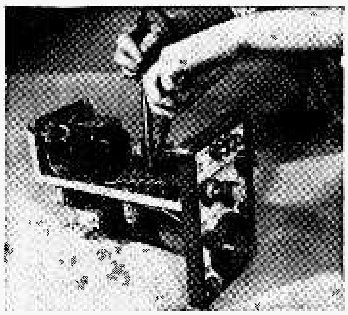
RCA

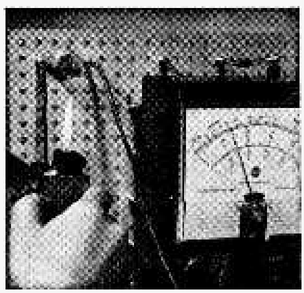
Construction of Multimeter.





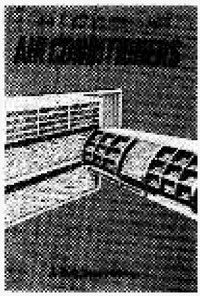
Construction of Oscilloscope.

Temperature experiment with transistors.



BOOKMARK
BY BOOKWORM

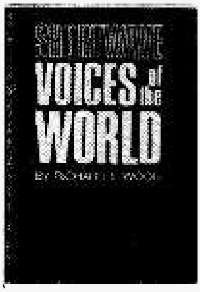
Keep It Cool! Here's an easy-to-understand guide—*How to Repair Home & Auto Air Conditioners*—complete with easy-to-follow, illustrated step-by-step instructions. Air Conditioner servicing is a breeze with this brand-new, simplified handbook. All phases of the subject are covered—from the electric wiring to refrigeration, and presented in down-to-earth language so the information can be put right to work. One doesn't have to be a refrigeration expert to get started—it's all here, from the basics on refrigeration to electrical controls and wiring. The authors tell how to determine what size



Soft cover
208 pages
$4.95

air conditioner is needed for a given room, how to compute BTU or tonnage needed, and the wiring required to handle the load. An entire chapter is devoted to the refrigeration cycle as it applies to air conditioners, with a simple yet detailed how-it-works explanation . . . plus all about the various refrigerants commonly used, too. Available from Tab Books, Blue Ridge Summit, Pa. 17214.

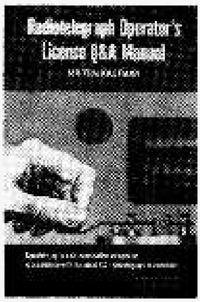
From One SWL to Another. Operating on the premise that it makes more sense for one literate knowledgeable author to explain shortwave listening—rather than depending upon the output of a hodge-podge of writers—world-renowned SWL Richard E. Wood has written a first-rate book. Titled *Shortwave Voices of the*



Soft cover
96 pages
$3.95

World, here is a book that takes the "gee-whiz" out of SWLing and puts the hobby in its proper sensible perspective. Dealing only with international broadcasters, Wood tells why certain nations spend millions of dollars and other countries ignore SW broadcasting. How the frequencies and schedules are arranged, the problems of jamming, broadcasting in the tropics, and of greatest importance—how to report and get back meaningful verification QSL cards. The book is superbly organized with many illustrations of stations and rare verifications. You can tell that the author has gone "all-out" to get his enthusiasm and knowledge on paper. Copies are available in many radio stores, or direct from Gilfer Associates, Inc., P.O. Box 239, Park Ridge, N. J. 07656.

Pick A, B, C or D. *Radio Telegraph Operator's License Q and A Manual* provides all the necessary study material, arranged by FCC Test Elements, for successful completion of the FCC examinations for any of the three classes of Radiotelegraph Operator's license as well as for endorsements for ship radar and aircraft radiotelegraph operation. Written by the well-known authority, Milton Kaufman, the book answers the need for a complete, up-to-date guide in this important field. Following the FCC Study Guide faithfully, the book presents the essentials clearly and logically. Each Element contains a series of pertinent questions and concise answers. Most of the answers are followed by more detailed explanations in discussion sections, which contribute considerably to the reader's comprehension of radiotelegraphy in general as well as further clarifying specific questions. Eliminating the need for



Hard cover
400 pages
$11.95

other references and making this a self-contained volume, these discussion sections save valuable time. Published by Hayden Book Company, Inc., 116 West 14th St., New York, N.Y. 10011.

● **Kwicky Reviews**

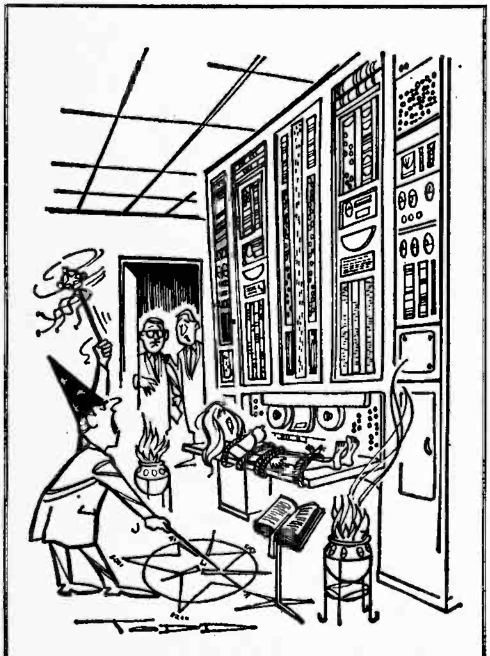
● *SWL Antenna Construction Projects* by Edward M. Noll—a great beginner's guide to the basics and construction of SWL antennas—both outdoors and indoors. (Published by Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, Ind. 46268; soft cover, 128 pages, $2.95.)

● *How To Use Test Instruments in Electronics Servicing* by Fred Shunaman—a practical handbook on test equipment applications for the novice or experienced serviceman and technician. (Published by Tab Books, Blue Ridge Summit, Pa. 17214; soft cover, 256 pages, over 200 illustrations, $4.95.)

● *Introduction to Solid-State TV Systems—Color and Black & White*—by Gerald L. Hansen—a comprehensive text covering the theory of television systems. Written for students of technical institutes, colleges and high schools. An excellent reference text not bogged down in mathematics. (Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. 07632; hard cover, 449 pages, $15.00.)

● *The Radio Amateur's Handbook, 12th Edition,* revised by Robert Hertzberg, W2DJJ—an up-to-date information-packed guide to everything the beginning ham needs to know, from the fundamentals of electricity to getting his first rig on the air. (Published by Thomas Y. Crowell Co., 201 Park Ave. So, New York, N.Y. 10003; hard cover, 374 pages, $5.95.)

● *FET Applications Handbook* by Jerome Einbinder—a technical source book on practical design data of FET circuits, updated and expanded second edition, over 250 circuit drawings and graphs. (Published by Tab Books, Blue Ridge Summit, Pa. 17214; hard cover, 352 pages, $14.95.) ■



"This is terrible, Thurber. We'll have to report this . . . unless, of course, he comes up with the correct answer."

By ARTHUR S. COOKFAIR

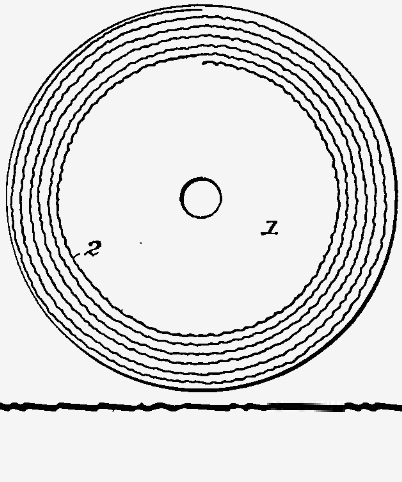
FAMOUS PATENTS

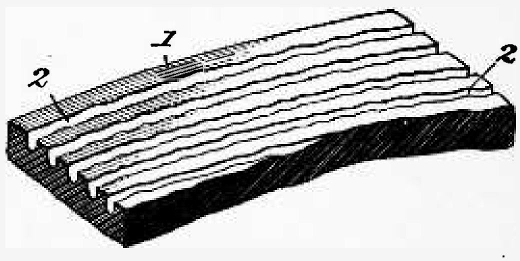
No. 548,623
EMILE BERLINER'S FLAT DISK RECORD

In the jargon of 20th century America, where disk-jockey shows crowd the airwaves and a phonograph can be found in almost any home, the word "disk" has become a symbol of recorded sound. From Rachmaninoff to the Rolling Stones, from Caruso to Crosby, the sounds of our century are stored on thin black platters. The ubiquitous *disk* has become so much a part of the modern scene that the latest dictionaries list "phonograph record" as one of the acceptable definitions of the word.

But it wasn't always so. Before the turn of the century, when *talking machines* were the latest in scientific gadgetry, records were made in the shape of cylinders. The "record" Edison used in his first crude phonograph was a cylinder, three and one-half inches in diameter, wrapped in tinfoil. Like many another great invention, the first model appeared to be little more than a toy. Edison patented the basic invention in 1877, but his versatile mind was soon diverted into other channels. For nearly ten years he set the phonograph aside while he concentrated on research on the electric light.

Time Waits for No One! But the invention was too important to be ignored and others quickly picked up where Edison had left off. Among the first experimenters to improve on Edison's phonograph were Charles Summer Tainter and Chichester Bell (a cousin of Alexander Graham Bell.) By 1887, Tainter and Bell had developed the "graphophone" ("phonograph" with the syllables reversed), the first commercial talking machine. The records were cardboard cylinders coated with hard wax.





Berliner's original concept for the flat disk can be seen from the drawings in his patent. Left, the disk arrangement is apparent, and, right, a sectional view reveals the grooves.

Sound impressions were made with a cutting stylus that moved up and down, following a helical groove, to form what is now known as a "hill and dale" track. Unfortunately, there was no process for mass reproduction of cylinder records. Each one was an "original," cut individually at a live performance —hardly an economic method for an industry that was destined to sell millions of copies of a single record.

It was apparent that if records were to become cheap enough to make them available to the average person, a process of record duplication would have to be found. The key to the problem came in the form of a flat *disk* record developed by a young immigrant, Emile Berliner. Attracted by tales of the "Land of Opportunity" Berliner had migrated from his native Germany in 1870, at the age of nineteen. Although his formal education had ended with high school, he was not content to stop learning. Working as a clerk in a store by day, he spent his evenings in his Washington, D.C. room, studying acoustics and electricity. The first results of his self-education in science came in 1877 when he invented and patented a carbon granule microphone. The sale of this invention to Bell Telephone Company provided Berliner with both money and leisure time to devote to research.

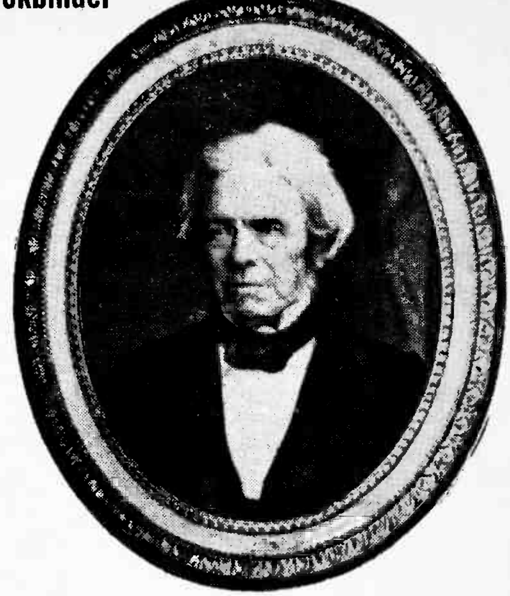
It's in the Cut. Berliner's approach to sound recording differed in two important ways from the Edison and the Bell-Tainter systems. Instead of the hill and dale track, he used a side-to-side cut, known today as the "lateral cut". He abandoned the cylinder records in favor of a flat disk.

Berliner received several patents on his talking machine (he called it a "gramophone") the first of which was granted in 1887. In 1895, he was granted U.S. Patent 548,623 for a method of making duplicate records from a metal stamper or master record plate, by pressing it into the surface of a heated hard rubber disk—the beginning of mass production of records.

Perhaps it was his lifelong interest in music that led Berliner to study sound recording. The result of his effort—the disk record—has helped to provide music for millions. Today's gigantic recording industry is the result of the efforts of Edison, Bell, Tainter, and hundreds of others; but the industry's symbol is Berliner's disk.

Copies of Berliner's Flat Disk Record patent are available for fifty cents each from the U.S. Patent Office, Washington, D.C. 20231. In ordering, give the number of the patent—No. 548,623. ■

Michael Faraday—the apprentice bookbinder who ushered in the electrical age!



GREAT MEN OF SCIENCE

... *Apprentice Bookbinder.*

Michael Faraday penned the titles as an afterthought. Maybe it would cause his letter of application to be read.

Sir Humphry Davy, known throughout the world in 1810, barely glanced at the signature and title. But he was intrigued by the unconventional application.

There was no resumc. Simply notes taken at some of Davy's public lectures. A brief memo indicated that Michael Faraday, Apprentice Bookbinder, would be most honored to enter Davy's employment.

He got the job.

Rather, he got a job. Not the post he wanted as assistant to Davy, but that of handyman with responsibility for sweeping floors, cleaning desks, filling inkwells—at a cut in salary.

Son of an impoverished blacksmith, Michael had seldom had a full stomach during childhood. He had known the meaning of physical hunger. Now he was intellectually hungry. So he accepted Davy's offer with delight.

As youth-of-all-duties in laboratory and household, the blacksmith's son proved surprisingly competent. His schooling, received a few months at a time, had ceased at 13. By all logical standards he should have spent his life as a barely-literate workingman.

Chance or fate or the gods ruled otherwise.

When he began hunting full-time work just one opening was available. It was at the stall of George Riebau, bookseller and stationer at #2 Bandford Street in London.

Riebau put the bright-eyed boy to running errands. When he showed ability and initiative he was given an opportunity to become an apprentice. Though this meant he would eventually earn a good living as a bookbinder, the economic advantages didn't appeal to Faraday. He was thrilled with the fringe benefits of work as an apprentice; his master actually let him read some of the books brought to the shop for binding!

He was especially enthralled with long articles on electricity in *The Encyclopedia Britannica* (then published in many thin sections), plus a volume of *Conversations on Chemistry.*

These books whetted his appetite. He began attending lectures by scientists. Eventually he dared to write Sir Humphry Davy asking for work—and got it.

By the time he was 22, the one-time apprentice had accompanied Davy on a long European tour. They visited the continent's chief scientific centers, had formal and informal meetings with great discoverers.

Back in London the youthful assistant technician (as he was called by 1815) decided that he could support a wife on thirty shillings a week. He married Sarah Barnard, who devoted her life to him.

(Continued on page 102)

LITERATURE LIBRARY

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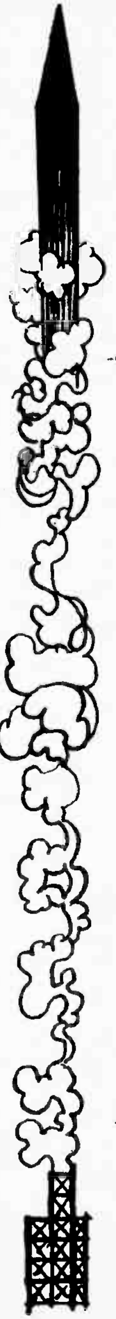
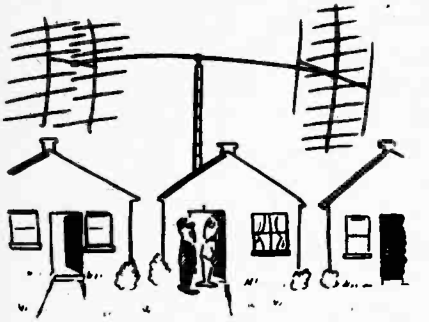
QUEST FOR SPACE

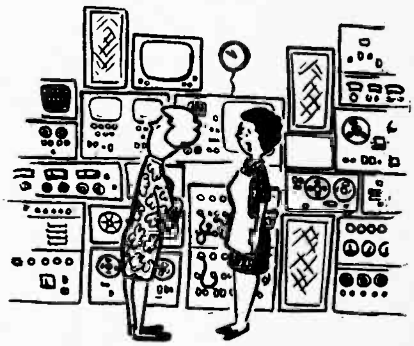
by Jack Schmidt



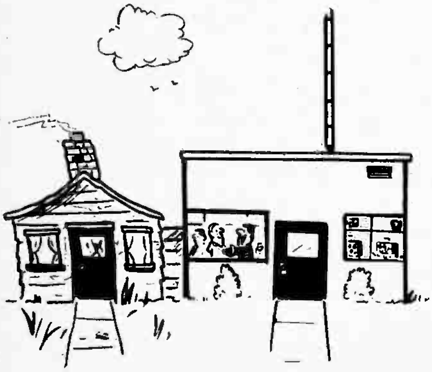


"... well, it's about your antenna!"

"... just a minute, Fenstrom ..."



"It all started with a walkie-talkie!"



"Now you've seen my studio, let's step over to the house!"

"Can't tonight, Mary. Fred just fired his laser—inside the house!"

go with... SPEEDY-FLASH

Stay with the action—fast cycling keeps you snapping

by Herb Friedman, W2ZLF/KBI9457

It always happens! Sis blows out the birthday candles, and then the whole party has to count ten while you wait for the ordinary electronic flash to recharge before you can take the next picture. It's even more embarrassing at a wedding. You shoot the couple just as they are declared man and wife, and then

SPEEDY-FLASH

they must stand by for their first kiss as your electronic flash recharges.

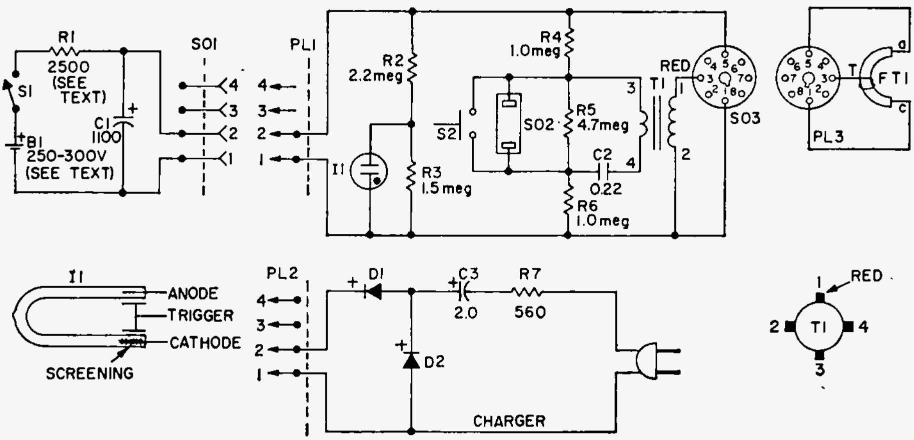
Fact is, the early models of electronic flashes (improperly called *strobes* by many photography buffs) were called *speedlights*, and for good reason. Unlike a flashbulb, a speedlight produces all its light in about 1/1000 second. Then too, speedlights recharge almost instantly; in fact by the time the photographer has racked the film advance, the speedlight is recharged and is ready for the next picture.

The secret of success in what appears to be almost instant recharging of the speedlight is the use of a high-voltage battery of the magnitude of the one we used in our *Speedy Flash*. Since it's the high voltage, at very low current, that fires the lamp, it takes just two or three seconds to recharge the storage capacitor. Low voltage supplies, on the other hand, take from 15 to 25 seconds to recharge the capacitor, depending on the

PARTS LIST FOR SPEEDY FLASH

B1—300-V photoflash battery, Everyready 493 or equiv.
C1—1100-uF, 350-V electrolytic capacitor, Sprague 36D112F350 (Newark Electronics 18F2511 @ $7.38)
C2—0.22-uF, 100-V ceramic capacitor
C3—2-uF, 250-V electrolytic capacitor (see text)
D1, D2—300-PIV, 400-ma (or higher) silicon diode rectifier
*FT1—MFT-110 flash tube (do not substitute—see text)
I1—NE-2 neon bulb
PL1, PL2—4-pin cable connector (Amphenol 91-MPM46 or equiv.)
PL3—Octal plug (Cinch-Jones 8B8 or equiv.)
R1—2500-ohm, ½-watt resistor (see text)
R2—2.2-megohm, ½-watt resistor
R3—1.5-megohm, ½-watt resistor
R4, R6—1-megohm, ½-watt resistor
R5—4.7-megohm, ½-watt resistor
R7—560-ohm, 2-watt resistor
SO1—4-pin socket for PL1, PL2 (Amphenol 78-PCG4 or equiv.)
SO2—2-prong, non-polarized socket (Cinch-Jones 2R2)
SO3—Octal socket (Ampehnol 77MIP8 or equiv.)
S1—Spst toggle switch
S2—Spst normally-open pushbutton switch (Switchcraft 201 or equiv.)
*T1—6-kV trigger transformer TT-6 (do not substitute—see text)
**1—7-in Telephoto reflector
1—Minibox, 2¾ x 2⅛ x 1⅝ in.
1—Bakelite utility case with aluminum panel 4 x 2⅛ x 1⅝ in. (Lafayette 99E80780 or equiv.)
1—Rowi or equiv. photo accessory case 7¼ x 5 x 2¾ in.
Misc.—Banana plugs, reflectors, RTV cement, hardware, wire, solder, ect.

* MFT-110 flash tube and TT-6 trigger transformer available from Custom Components, Box 153, Malverne, NY 11010. Total cost for both $10.95 plus 75¢ postage and handling in U.S., $1.75 to Canada, no orders outside North American continent. NY State residents must add sales tax.
** Available from Edmund Scientific Co., 555 Edscorp Building, Barrington, New Jersey 08007-catalog #71,224 @ $2.95, Ppd.



Charger, for C1 when Speedy-Flash isn't used for several days, isn't isolated from 117VAC line so take care be sure PL2's plugged into SO1 before connecting to AC.

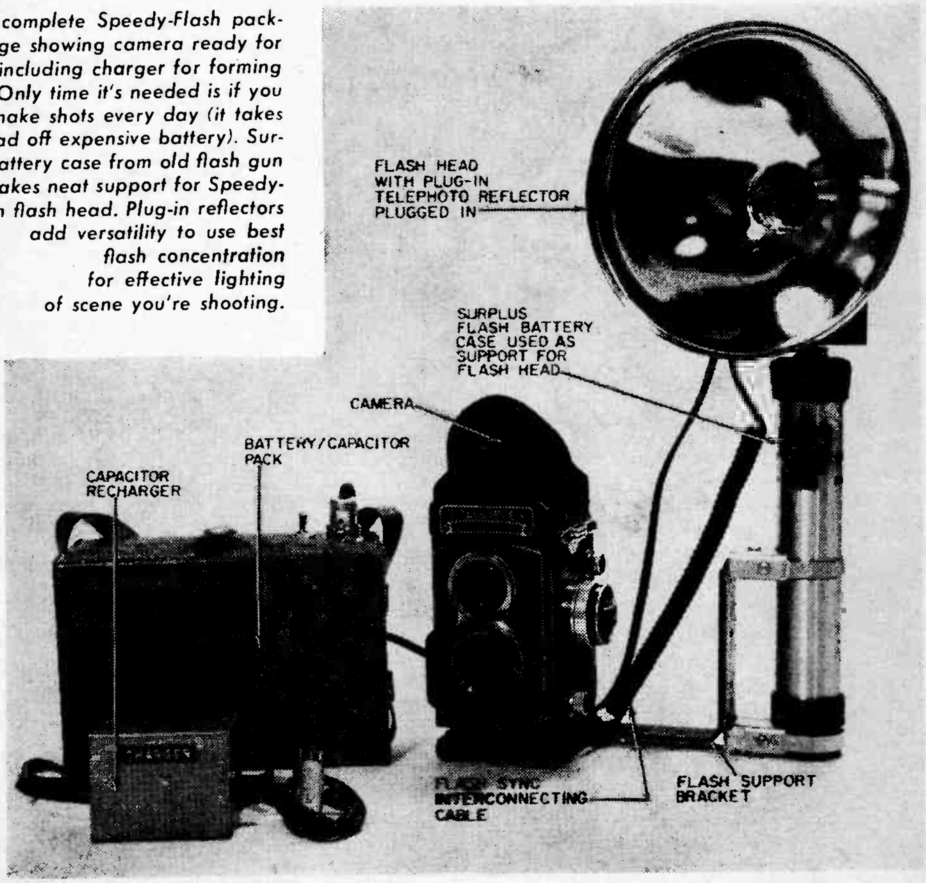
condition of the battery's charge.

Our *Speedy Flash* has another very useful feature, interchangeable flash heads. This was common to early professional speedlights that somehow lost favor along the way. By using several sizes of interchangeable flash heads the photographer can more or less tailor the light to his specific needs. For example, he can plug in just the flashtube less reflector for bare-bulb, non-concentrated lighting; or he can mount the flashtube in a plug-in 3-cup aluminum saucepan size reflector and have a standard coverage reflector with an ASA25 guide number of approximately 56. If he places the flashtube in a cheap deep-dish reflector, similar to the one shown in the photos, he can have a *telephoto* electronic flash packing all its light into the correct angle for the 135-mm lens of a 35-mm camera, and then be able to work with an ASA25 guide number of approximately 110. Naturally, the exact guide numbers depend, to a large extent, on the particular reflector used and how the flashtube is mounted in the reflector.

Speedy-Flash consists of three units. The battery capacitor pack (carried on a shoulder strap); the flash head, which takes plug-in flashtubes; and a charger, a device used for reforming the storage capacitor so the battery doesn't have to literally spill its guts out trying to reform a capacitor that hasn't been used for weeks or months.

Construction is not critical, especially if the general layout we used is followed. Most important, none of the wires between storage capacitor C1 and flashtube FT1 should be smaller than #18 gauge (you can use zipcord). Number 16 wire is even better since the larger the wire the lower the voltage loss. Then when C1 discharges it gives a little more light output.

We built the flash-head in a 4 x $2\frac{1}{8}$ x $1\frac{5}{8}$-in. Bakelite utility case. No parts are mounted on the aluminum cover plate supplied with the utility case. All wiring must be inside the Bakelite case for maximum safety. Mount octal socket SO3 as close to



Here's complete Speedy-Flash package showing camera ready for action including charger for forming C1. Only time it's needed is if you don't make shots every day (it takes a load off expensive battery). Surplus battery case from old flash gun makes neat support for Speedy-Flash flash head. Plug-in reflectors add versatility to use best flash concentration for effective lighting of scene you're shooting.

one of the ends as possible. Though only three connections are needed for flashtube FT 1, the 8-pin octal socket is used because the unused terminals provide convenient tie points for other components. Install SO3 so the keyway points to the side of the case. Place a large blob of silicon rubber (RTV) adhesive inside the case adjacent to pin connection 3 of SO3 on the Bakelite bottom of the case and press trigger coil T1 into the blob. Make sure the *red* terminal of T1 is directly opposite pin connection 3 of SO3.

T1 is a special high-voltage trigger transformer and no other type should be substituted. The flashtube may not fire at low battery voltage with a trigger transformer having different characteristics. For that matter, don't substitute a different flashtube than the one listed, either.

When the adhesive holding T1 is completely set, install the remaining flash head components. For maximum convenience, the connecting cable should be about 50 inches long, and should be firmly secured to the inside of the case. If available, use a good-quality strain relief for this purpose. Connecting plug PL1 should be a 4-pin type even though only two pins are used. The reason for this is because when inexpensive miniature plugs are used, the extra pins, when seated in the socket, provide a firm, rigid seating and tend to hold the plug tighter in the socket.

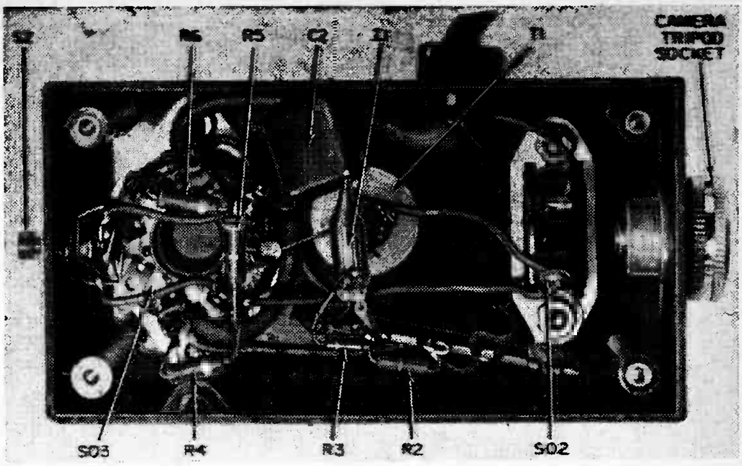
Ready Light. The ready light for the next flash pilot, I1, is an NE-2 neon lamp wired to the terminal strip using full length leads. To avoid shorts, place a piece of sleeving on each lead. Run the leads straight up from the tie strip and then fold the lamp over at right angles. Drill a ¼-in hole in the cover plate that will allow viewing the ready light.

Finally, install a standard camera tripod socket on the bottom of the case so the flash head can be mounted on a flash bracket, or an accessory shoe bracket, or the battery holder from a conventional flash gun like the one shown in the photos.

Full 300 volts from battery specified and large, 1100-μF capacitor produces more than adequate light at fairly high recycling time so you can make really speedy action shots. Portable photo accessory case makes for easy shoulder-strap carrying of power unit. If you have a different sized case that's surplus, use it. You may prefer using different battery; that's OK, just remember, it's the higher voltage we used that makes fast recharging of C1 possible. Current drain is small so battery lasts a long time.

The Flash Tube. The flash tube is connected to pins 1, 3, and 5 of octal plug PL3. First, and most important, identify FL1's cathode terminal. Note that FL1 is an U-shaped glass tube with a lead sticking out each end of the glass U tube. A third lead connects to a metal band encircling both the open ends of the U. By careful observation of both ends of the U, you will also note that the lead on one end is at-

Undercover work in flash head detailing location of various parts. Note ready light supported by its leads to position it near viewing port drilled in metal cover of bakelite housing. S2 let's you fire flash manually if needed.



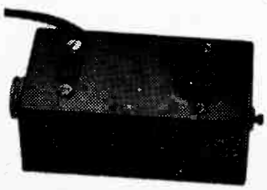
tached to a small piece of screening inside the tube. The lead attached to the screen is the cathode and connects to the B- through pin 1 of PL3. Anode of FT1 connects to the B+ through pin 5, while its trigger lead, the third lead, connects to pin 3.

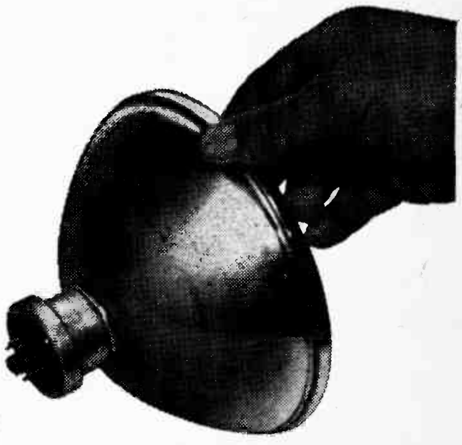
In order to use just a bare flash tube (FT1) without a reflector, it should be mounted in an octal plug, or the salvaged octal base from an old tube. If you use either the saucepan type standard reflector, (actually a 3-cup aluminum saucepan with a hole drilled in the middle of the dome for flashtube socket) or a deep-dish type telephoto reflector (see Parts List), mount a Cinch-Jones 8PB-8 octal plug in the center of the reflector and then install F1.

High Voltage Battery. Battery B1 and capacitor C1 are housed in any standard photo accessory case. The one used for *Speedy Flash* is a Rowi, measuring 7¼ x 5 x 2¾ in. Capacitor C1 is secured to the case with a heavy blob of silicon rubber (RTV) adhesive. Battery B1, a 300-volt Eveready 493, comes equipped with banana jacks. You may substitute a 250-volt photoflash battery if you want to lower the battery cost (it lasts for hundreds of flashes, depending on its age). Or you can series-connect any other type of battery to obtain the high voltage between 250 and 300 volts (e.g., four 67½-volt miniature batteries could be used).

Resistor R1 is used only to quench the flash tube. When the tube fires the voltage across C1 falls and the tube turns off. Though it appears R1 does nothing, it actually supplies current limiting for C1. R1 can be any 4- to 10-watt resistor rated from 500 to 5000 ohms. The higher the resistance the longer the battery life, because C1's charging current is held to low values. However, the higher the resistance the longer the time to charge C1. A good compromise for R1 is 2500 ohms. It charges C1 in about 2 seconds as indicated by the ready light. A 5000-ohm R1 will take about 5 seconds to recharge, whereas a 500-ohm R1 will recharge before you can wind the film.

C1 Charger. No, the purpose of the charger isn't to recharge battery B1; the charger is used to reform C1 after it has been idle for more than 7 days. We housed the charger shown in the photo in a 2¼ x





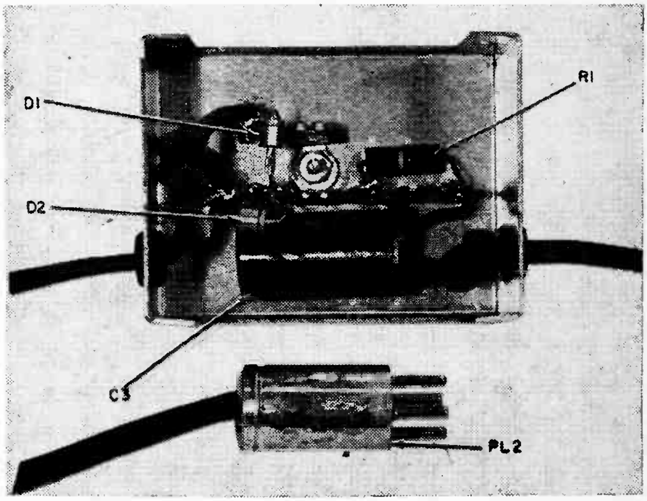
He's plugging in telephoto reflector to flash head. This plug-in arrangement gives user many options to get best lighting for his shot.

SPEEDY-FLASH

1⅝ x 2⅛-in. Minibox. The charger is connected directly to the AC power line without any isolation from a power transformer, and, therefore, no ground connections should be made to the metal cabinet. The charger is a half-wave voltage doubler. Make certain to connect PL2 to SO1 before connecting the charger to the power line.

AC Operation. In anticipation of the question, yes, the charger can be substituted in place of the battery to make an AC-powered speedlight. You'll have to change C3. An 8-*u*F will provide a 7-second charge time and 15 minutes. *S1 must be off when using the charger.* Now disconnect the charger, plug a flash tube into the flash head and plug PL1 from the flash head into SO1 on the battery pack. Because C1 is charged, the ready light I1 will probably go *on* when the flash head is plugged in. Fire off the flash with open-flash button PB1. To use the flash, simply set S1 to *on;* the flash will be ready to go before you can reach for the shutter release.

Although the average flash uses a polarized flashcord socket, this isn't necessary for *Speedy Flash.* Synchronized connection socket SO2 is non-polarized and the flashcord can be plugged in irrespective of polarity.



Photog's charger doesn't have feet but it gets him where he wants to go insofar as good pictures are concerned. This charger's used to form capacitor C1 after Speedy-Flash has been idle for more than a day. It provides heavy initial current without excess drain on high voltage battery. You can also use it for AC operation without battery—see text.

25 *u*F will give approximately 4 seconds of charge time. Remember that R1 must still be used in series with C1. Also, to double the Speedlight's watt-second rating, a second storage capacitor can be connected in parallel with C1.

Using the Super Speedlight. Plug the charger in to SO1, apply power to the charger and allow C1 to "form" for at least

One note of caution: high-voltage flash batteries often sit on the shelf for months at the electronics dealer's, and may be half dead due to shelf-life deterioration by the time they get to the user. It is, therefore, suggested that if possible you obtain the battery from a photo equipment dealer known to have a professional clientele (pros use high-voltage flash equipment). ■

Ma Bell's hiss may cause your phone miss

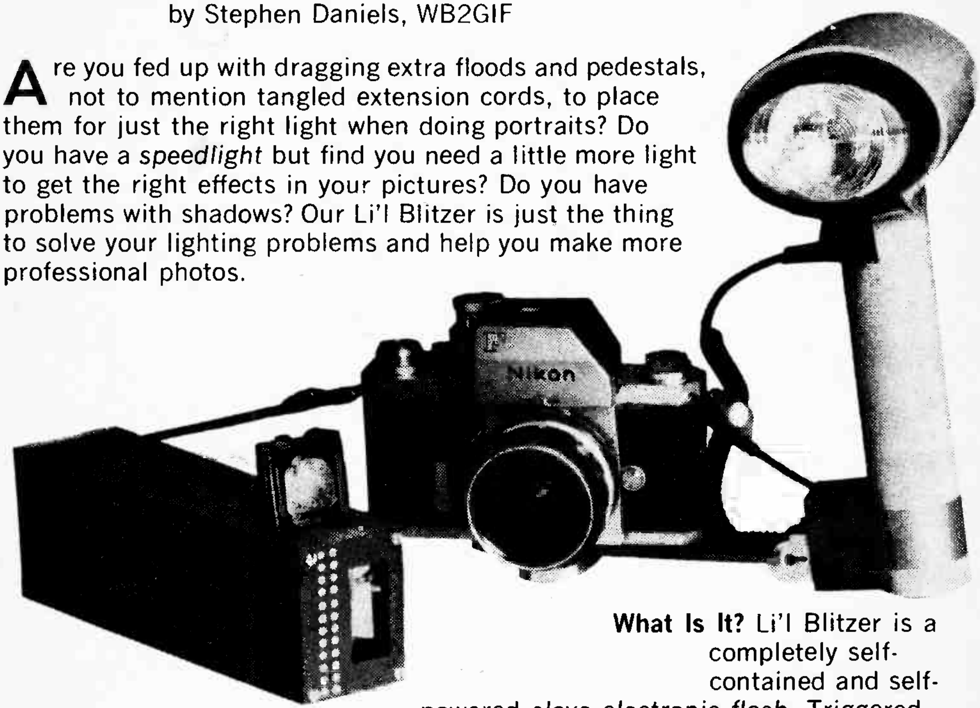
If someone tells you your phone troubles are a lot of air, believe him! Many overhead cables are pressurized with dehumidified air to prevent water or moisture damage when punctured. As air escapes, a hiss is generated that may be heard from the ground by using a long pole equipped with a microphone. But down with long poles and up with young ladies packing microphone guns. The gun is nothing more than a parabolic reflector with a mike at its focus. The gun-toting miss aims the device at the suspected overhead line detecting leaks with ease.

A slave flash to wash out shadows and make your photos like the pros

LI'L BLITZER

by Stephen Daniels, WB2GIF

Are you fed up with dragging extra floods and pedestals, not to mention tangled extension cords, to place them for just the right light when doing portraits? Do you have a *speedlight* but find you need a little more light to get the right effects in your pictures? Do you have problems with shadows? Our Li'l Blitzer is just the thing to solve your lighting problems and help you make more professional photos.



What Is It? Li'l Blitzer is a completely self-contained and self-powered *slave electronic flash*. Triggered through its solar cell (SC1)/silicon-controlled rectifier (SCR) circuit by light from the master flash, it provides that extra illumination needed to make your photos look like they were taken by a pro! It's a relatively inexpensive photo accessory you can easily build that will repay you many fold by improving your photographic techniques.

How It Works. A transistorized oscillator (Q1), energized by a 6-VDC battery (B1) develops the high voltage AC through transformer T1. Transformer T1 is a 117 VAC to 12.6 VCT filament transformer whose normal primary and secondary windings have been operationally reversed for this application. The 12.6 VCT secondary is used as a primary and the 117 V primary becomes the secondary in Li'l Blitzer's oscillator. Thus the 6 VDC from B1 is stepped up many times to produce required high voltage. This high voltage AC is rectified to high voltage DC required to charge storage capacitor C1 by diodes D1 and D2. When the charge voltage approaches approximately 350 volts, NE-2 neon bulbs I1, I2, and I3 fire. This stabilizes the charging voltage and also serves as a *ready light*. All but I1 are covered to avoid confusion. Resistors R3 and R4 from a voltage divider to charge C2 to approximately 150 VDC. *(Turn page)*

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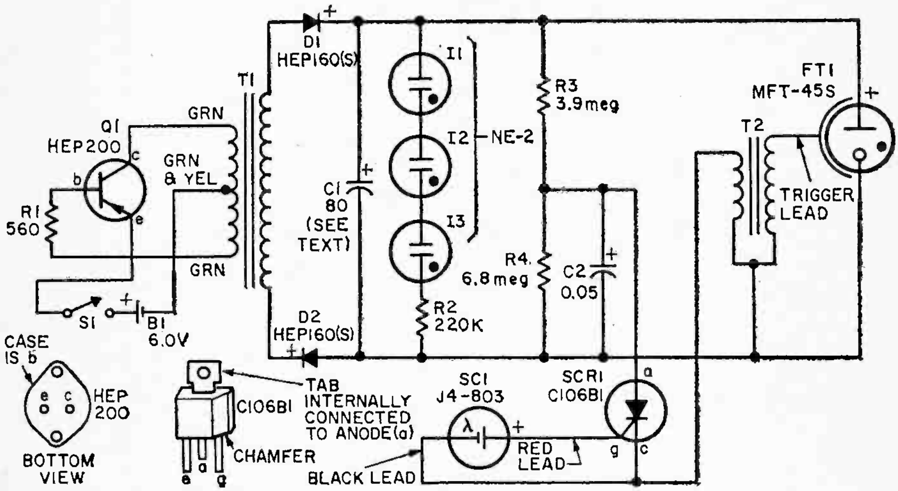
Silicon solar cell SC1 generates a voltage pulse when exposed to the flash of the *master electronic flash.* This triggers SCR1, discharging C2 through the primary of *trigger transformer* T2 and produces a pulse of approximately 4 kV that ionizes the gas in flashtube FT1, firing it.

Thus is produced the auxiliary flash used as secondary lighting for the scene being photographed. Reaction time of the SCR with respect to the initial flash from the master flash lamp is extremely fast; therefore it's not necessary to synchronize the flashes from the master and slave flash lamps. (You might even call them self-synchronizing.)

Construction. The author housed Li'l Blitzer in an attractive, practical metal cabinet. Unfortunately the size he used is not readily available from parts supply houses. Since component placement is not too critical, and you may have to make substitutions for other components (e.g., T1, C1, etc.), it's not absolutely necessary to use the housing tabulated in our Parts List. You can build your unit in any size to suit your particular desires. In any event the size of the housing will be determined basically by the physical size of C1 you use.

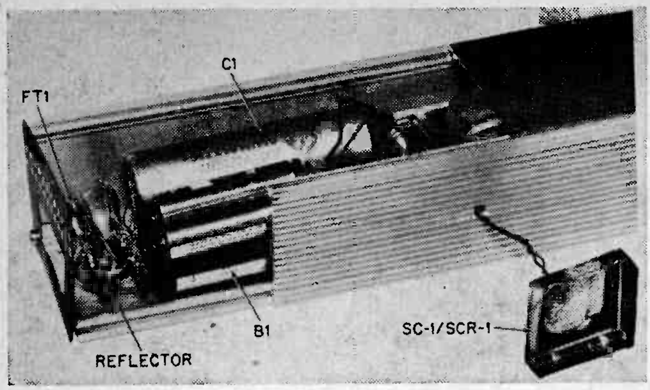
The Mini-Cool box shown in the photos is 8 x 2 x 2½-in. and is easy to use since the four sections that make up the box are extrusions that slide into one another forming a fairly rigid rectangle. This permits mounting all components except for S1 on the base of the box. In detailing construction we will assume you're using the Mini-



PARTS LIST FOR LI'L BLITZER

B1—6-V battery, 4 AA cells in series
C1—80uF, 450-V electrolytic capacitor (C-D BR 80-450 or equiv.)
C2—0.05 uF, 600-V dipped paper or mylar capacitor
D1, D2—1000-PIV 1-A silicon diode, Motorola HEP 160 (S)
*FT1—Flashtube, Mura MFT-45S
I1, I2, I3—NE-2 neon bulb
R1—560-ohm, ½-watt resistor
R2—220,000-ohm, ½-watt resistor
R3—3,900,000-ohm, ½-watt resistor
R4—6,800,000-ohm, ½-watt resistor
S1—Spst slide switch (Calectro E2-110 or equiv.)
SC1—Silicon solar cell, 1.4 V @ 25 mA output from bright sunlight (Calectro J4-803 or equiv.)
SCR1—Silicon-controlled rectifier (GE C106B1 or equiv.)
T1—117-VAC pri, 12.6 VAC CT sec @ 100 mA filament transformer (Calectro D1-750 or equiv.)
*T2—Trigger transformer, 4 kV (Mura TR2 or equiv.)
1—8 x 2 x 2½-in. Mini-Cool aluminum box (see text)
1—Battery holder (Calectro F3-059 or equiv.)
1—Battery connector (Calectro F3-052 or equiv.)
1—1⅞ x 6⅛-in. piece perfboard
1—4-point tie strip (Calectro F3-214 or equiv.)
Misc.—Wire, solder, solder lug, hardware, pres-on letters (Datak or equiv.), push-in pins, pen holder swivel, tripod socket, floodlamp clamp and swivel, etc.

*These two items available from Bowman Leisure Inc., 155 E. 1st Ave., Roselle, N.J. 07023. Total cost for both $5.00 plus $1.00 for handling and mailing in USA. Add $1.75 for shipments to Canada.



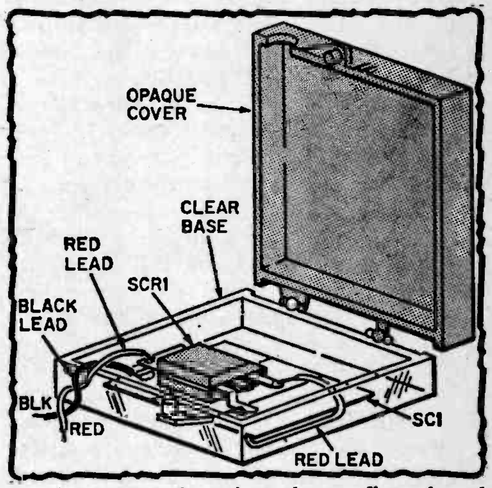
Two-conductor cable connecting SCR1, SC1 to perfboard may be any length you wish. Studio photographers'll perch this sub-assembly on tripod in immediate vicinity of main flash source; this guarantees positive snyc between Li'l Blitzer, main flash assembly. Li'l Blitzer draws 'bout 175 mA from B1, so you might want to substitute line-operated 6V supply in its place especially if you're doing lots of indoor portraiture work.

Cool box used by the author.

In our unit a 1⅞ x 6⅛-in piece of perfboard was used to mount and wire all of the components except for S1, SC1, and FT1. When mounting the board on the cabinet base raise it above the metal with spacers so that none of the wiring can be shorted by the metal of the cabinet. Switch S1 is mounted on the rear end of the box. Flashtube FT1 is mounted on a tie strip (4 point with center mounting foot. A scrap of aluminum or stainless steel is curved slightly and held in place behind FT1 by a solder lug mounted on the same bolt that holds the tie strip in place. Notch out the end to clear wire connections to FT1.

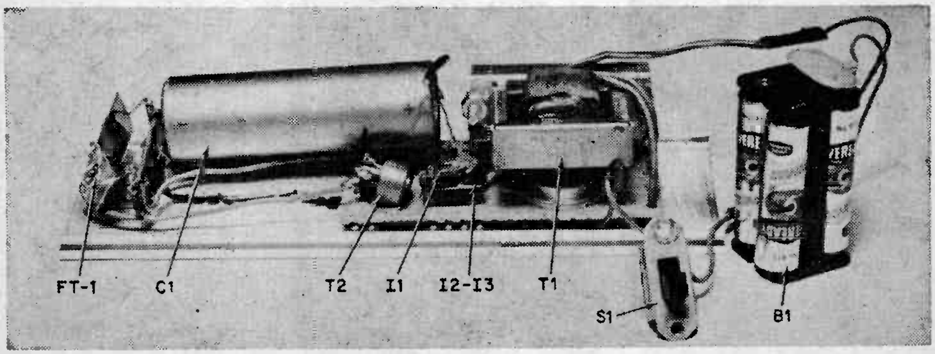
Mount all parts as shown in our photos. We suggest you use push-in terminals for mounting and connecting the resistors, capacitors, neon bulbs, etc. for neater and stronger construction. At the time our model was built the author didn't have them available but we strongly recommend that you use them.

Position I1 so that it can be easily seen through the hole marked *indicator*, I2 and I3



can be mounted against the perfboard and wrapped in black insulating tape. After all you're interested only in the glow of I1 to indicate the unit is ready to be flashed.

Solar cell SC1 can be mounted on a swivel joint to permit facing it strategically to pick up only the flash from the master flashtube. A good, inexpensive, easily avail-



Major components of slave flash are depicted in this pix. Make certain you mount FT-1 so wires cannot short to metal case. Mount I1 to case's side so you can see it.

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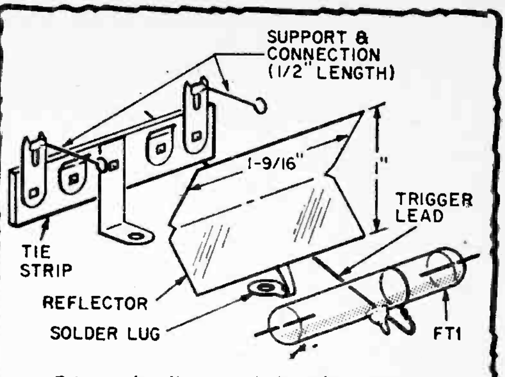
able swivel joint for this purpose is the pen holder swivel used for holding a pen on a desk set. You can salvage one from a desk set base or you'll find them in many shops selling handicraft supplies.

Speaking of swivel joints, a larger one, as used on photoflood or trouble lamp clamps, along with the clamp, makes an excellent holder for Li'l Blitzer. It'll stay put in any position you point it and if SC1 is also swiveled you are free to position the unit so that the flashtube and reflector will spot the light exactly where you want it and still be able to point the SC1 towards the master flash.

First step in perfboard assembly is to mount Q1 and then transformer T1. We used an aluminum channel 3/8 x 7/8 x 2 3/8 in. (HWL), formed from a scrap of metal, to support T1 (see photo). If you prefer, T1 can be fastened directly to the perfboard. Next mount diodes D1 and D2 and established power supply buses. The neon lamps can be mounted against the perfboard except for I1; leave its leads fairly long so it can be positioned for easy viewing. Trigger coil T2 can be held in place with cement (RTV or Duco, etc.). The high voltage output trigger lead to the flashtube should be roughly 5-in. long and should be insulated with a length of spaghetti tubing. Once FT1

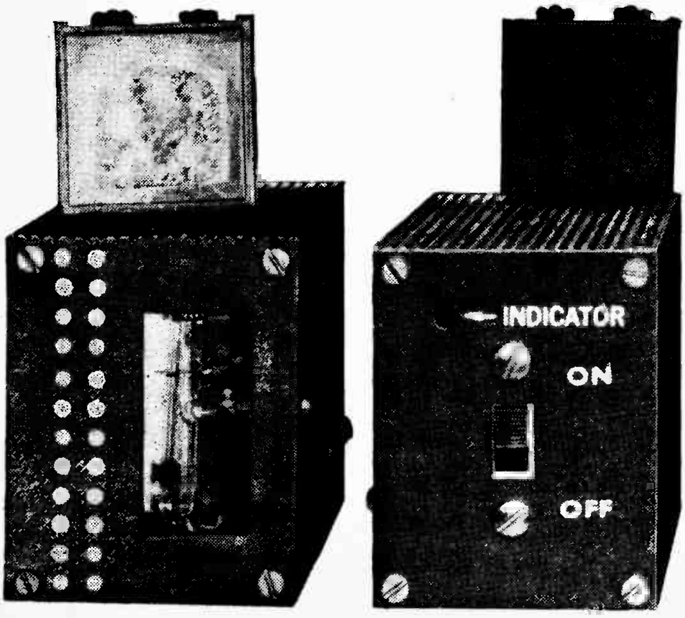


Trigger lead's routed directly to transformer T2 on perfboard. Don't skimp on wire quality; high voltages're present.

is in position the end of this lead should be formed into a single loop slipped over the tube near its center.

Flashtube and Reflector. Once you've mounted and wired all the components on the perfboard you can mount the board assembly in Li'l Blitzer's housing and then you're ready to tackle mounting FT1 and its reflector. A 4-point tie strip that has a mounting foot centered between the end points is used to hold the flashtube. Clip off the two inner lugs leaving those on the extremities for connecting to and supporting the flashtube. Use stiff wire (at least 16 gauge) to act both as a connection and a support. Make a small loop at the tube end

(Continued on page 98)



Li'l Blitzer's fore, aft views displayed. Left pic of unit shows flash tube vertically mounted; horizontal mounting, use is also permissable. Photo on right shows where lamp I1 lives in unit. Before you take Li'l Blitzer on assignment, shoot at least one roll of black 'n white film with Li'l Blitzer working as fill light. Stop down your camera lens one f/stop per frame as you shoot test subject. Develop film in normal manner; pick frame giving you best contrast ratio.

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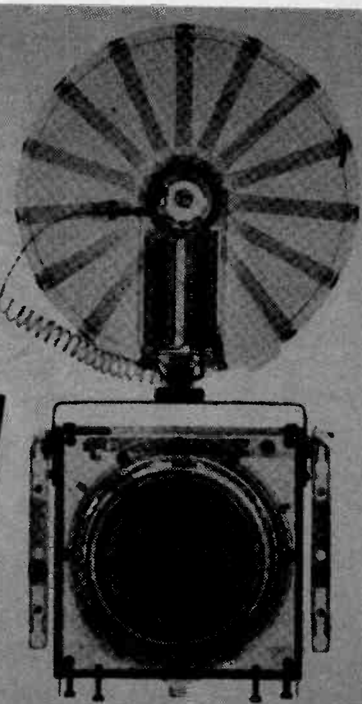

by Jim Kyle, K5JKX

Discover why an electronic flash is a fotog's best friend! Now get to know how they work and how to make one!

WHAT does a drop of milk look like at the instant it splashes on a tile floor? How does a cat manage to always land on its feet when dropped? Does an egg bounce before it breaks?

Not very long ago, answers to these questions and many more like them involving split-second phenomena simply couldn't be answered.

Today you can buy an electronic flash for your camera at less than $20.00 and take quick-as-a-wink photos which reveal the answers. You can build an electronic flash unit at even less expense.

Just a few short years ago, electronic flash equipment was used only by professional photographers and cost hundreds of dollars. Now, however, most cameras having a flashbulb attachment can be connected to a *speedlight* to produce frozen-action photos.

What is this miracle of modern photography, and how does it achieve its results? How can your build your own? On what features should you concentrate, regardless of building or buying? We're going to look into these and several other questions—but first let's go back a few years and study a little history.

The First Flash Photo. The first photograph made with light from an electronic flash was taken by W. H. Fox-Talbot, a British scientist and one of the inventors of practical photography using light-sensitive paper. The electronic flash feat was accomplished about 1850. Fox-Talbot put a piece of newspaper (probably *The London Times*) on a whirling wheel, and took his picture by the light from a spark flashed across a gap connected to a Leyden jar.

What made this so remarkable is the fact that in those days film and plates photographically were so slow that outdoor daylight exposures required many minutes, and indoor studio photography was nearly impossible. Yet Fox-Talbot flashed a spark by storing energy in his Leyden jar and produced a split-second picture.

Dr. Harold E. Edgerton, the man credited with inventing modern electronic flash units, in recounting the accomplishment of Fox-Talbot, adds: "Fox-Talbot would enjoy seeing a modern installation." The same basic Fox-Talbot principle is used today in elec-

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tronic flash photography. In modern flash units a xenon-vapor flashtube replaces the crude spark gap, and a high-capacitance energy-storage capacitor replaces the Leyden jar, but the principle remains unchanged.

In Between. However, the route from Fox-Talbot's flash experiment to today's electronic speedlights wasn't as direct and straight a path as you might expect in spite of the similarity of principles. First came flash powder, during the period between Talbot's flash and modern electronic flash units, then flashbulbs.

From the 1860s until 1931, the professional photographer's standby for indoor photography was a pyrotechnical substance known as flash powder. While most photographers had their private recipes for flash powder, all of them incorporated powdered magnesium—often mixed in combination with a little sugar. When the powder mixture was touched off by a spark, it would ignite into a huge flare to provide light for the picture.

Flash powder had several disadvantages, not the least of which was the fact that immediately after the flash of light the room filled with a powdery white smoke as blinding as a London fog. When the smoke settled after a period of many minutes, it left a white powder residue that resisted all efforts to remove it.

Another disadvantage was the explosiveness of the powder. Many old-time photographers were missing at least one or two fingers, courtesy of their flash pans.

All of these problems with powder led to the introduction of the flashbulb. Originally, the flashbulb consisted of a sheet of magnesium foil sealed into a bulb filled with oxygen. As time passed the foil sheet was changed to a mass of shredded foil, and the bulb kept shrinking in size until today's flashbulbs were evolved. The excellence of flashbulbs is proved by the large volume of bulbs still being consumed in spite of the increase in popularity of electronic flash units.

But flashbulbs too have several disadvantages for many photographers. One is that a bulb can be used only once. Also, too many good pictures were missed because the interesting action occurred while a used flashbulb was being exchanged for a new one. In addition, the one-time-use bulbs are expensive.

Still another disadvantage is the relatively small amount of light available. True, flashbulbs at 10-foot distances can be four times as bright as sunlight—but for color shots of action events much more light than this is needed.

Not too many photographers consider the slow response of flashbulbs a major disadvantage; flashbulbs can be used at exposure times as short as 1/1000 second. However, Dr. Edgerton found 1/1000 of a second far too long an exposure for some of the work he had to do.

Dr. Edgerton's Baby. Dr. Edgerton, together with Kenneth Germeshausen and Herbert Grier, was researching methods of achieving extremely brief exposure times when he arrived at his design for the *repeating flashbulb*. The major difference between Edgerton's unit and Fox-Talbot's original flash device is that Edgerton's uses a gas-filled tube rather than an open spark —but that difference has an astonishing effect!

The first announcement of the repeating flashbulb was made about 1937. At that time the only working models were those built at M.I.T. by Edgerton, Germeshausen and Grier. Not until 1940 did the first widespread use of the new device by press photographers come about.

Once press photographers got hold of the repeating flashbulb, they really went all out for it. That same year, a walloping 27% of the entries in the annual exhibit of the New York Press Photographers Association were photos made with the repeating flashbulb, or *speedlight*. This despite the fact that the equipment weighed hundreds of pounds and cost hundreds of dollars.

Just as this new device began to enjoy widespread acceptance in all phases of professional photography, along came World War II and civilian use of speedlights came to a virtual halt.

However, the war accelerated the development of electronic flash equipment, just as it did so many other electronic devices. By the war's end, mammoth installations weighing up to two tons that developed as much as 57,600 watt-seconds of energy were being installed in B24 bombers for reconnaissance photography. Night photos

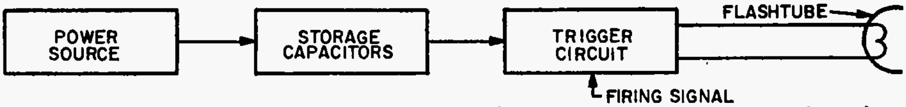

Fig. 1. Basically all electronic flashes are comprised of four major units connected as shown in block diagram. Depending on particular unit, each may have either a simple or complex individual circuit. Needs of flash tube, dependability determine complexity of circuit.

were made from altitudes up to 20,000 feet with this gear. Immediately after the war this same equipment made it possible to take action color photographs that were impossible to make with previously designed units.

Just a little more development was required to make the speedlight suitable for the vast army of amateur photographers—and this was achieved in the years between 1951 and 1954. The weight, size, and cost of the equipment were all reduced, while retaining the performance characteristics which had made speedlight such a favorite of the professional shutter snappers.

So What Is It? The basic circuit of a speedlight has undergone hardly any change since Dr. Edgerton's earliest designs. In all cases, a high-voltage power supply charges an energy-storage capacitor. The energy stored in the capacitor is then discharged through a flashtube upon demand. This discharge creates a brief, brilliant burst of light from the flashtube.

The amount of light produced in each burst depends on many things. Assuming the flashtube and reflector are not changed, the light output is determined only by the amount of energy stored in the capacitor. This energy is easily measured in *watt-seconds* and very early in the game watt seconds came to be an accepted unofficial standard for comparison.

However, flashtube and reflector characteristics have at least as much effect upon the light output as does the stored energy. Modern authorities recommend rating on the basis of *effective-beam-candle-power-seconds* or EBCPS. Most photographers stick to watt-seconds.

The simple basic circuit (Fig. 1) for electronic flash units appears in several variations. Most fundamental concern is the manner of firing the flash. The *low-pressure* type flashtube will flash whenever voltage is applied. The more common *high-pressure* tube withstands operating voltage without flashing; when desired, the flash is triggered by applying a pulse of extremely high voltage to a *trigger electrode* wound around the outside of the flashtube itself. This triggering pulse ionizes the gas inside the flashtube, causing it to break down and conduct, which results in the flash.

In the early days, many circuits using the low pressure flashtube were employed. However, virtually all present-day units use high-pressure tubes with trigger electrodes, since the trigger pulse allows much more precise synchronization of the flash.

Another variation in circuitry involves the voltage to which the capacitor is charged. Until the 1950s all flashtubes required several thousand volts for proper operation —most popular voltage was 2500 to 3000 volts. This high voltage created insulation breakdown problems in the connecting cables, as well as raising the cost of the unit. Primarily the development of low-voltage flashtubes was the breakthrough of the early '50s. This permitted using relatively inexpensive electrolytic capacitors and less costly power supplies for electronic flashes.

The first low-voltage tube developed required 900 volts. This was still uncomfortably high voltage for electrolytic capacitors, but satisfactory operation was achieved by connecting capacitors in series in order to withstand the voltage. Almost immediately thereafter a 450-volt flashtube was released. The majority of amateur-oriented speedlight equipment still employs flashtubes operating in the 400 to 525 volt range. Today there are flashtubes available that operate on voltages as low as 150 VDC. However, since energy increases as the *square* of the voltage, but is directly proportional only to capacitance, you still get most efficient operation with the highest practical voltage.

Theory in a Nutshell. Now that the history is out of the way, let's take another look at the typical speedlight and how it works.

The speedlight circuit, regardless of power or voltage, consists of four major sections. These are 1) the power source, 2) the storage capacitors, 3) the trigger circuit, and 4) the flashtube itself.

Power Source. The power source steps up the initial supply voltage to the value required by the flashtube. The initial supply voltage may be as little as 3 volts, derived

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from a pair of flashlight cells connected in series. It may be ordinary 117-VAC power, or may be a 500-volt dry battery. The flashtube voltage may be anything between 150 and 3000 volts, but 450 to 510 volts is the most widely used range.

Storage Capacitors. The storage capacitors store the energy developed in the power source, until it's dumped through the flashtube to produce the flash. Storage capacitors make it possible to store energy at a practical rate, and dump it all in a small fraction of a second to produce a brief, high-energy burst of light. This is the reason why the flashtube produces its high intensity light. Storage capacitors may range in size from 4 μF to more than 1000 μF, depending upon the power desired. At voltages below 525, electrolytic capacitors are normally employed; above this level, oil-filled paper capacitors are used.

Trigger circuit. The trigger circuit produces the pulse required to dump the energy stored in the capacitors into the flashtube. Depending on the type of flashtube used, and the designer's preferences, this circuit may contain only a single relay, or may be a maze of thyratron tubes, resistors, and capacitors. In newer designs, silicon-controlled rectifiers are being employed.

Flashtube. The flashtube consists of a Pyrex or quartz tube, filled with an inert gas, and has electrodes sealed into each end. The tube may be any shape desired; most are either helical or U-shaped. While this sounds simple enough, the preparation of electrodes and glass is a tedious process to assure proper sealing. Light output, light color, and flash duration can be adjusted by the choice and pressure of gas.

Power Source. The purpose of the power source, as previously stated, is to produce the required output voltage from the available power input. The complexity of the power source depends on the complexity of the job.

One of the simplest possible power sources is a dry battery producing the desired output voltage directly. The Heiland Strobonar VII, introduced in 1954, was one of the first commercial units employing this principle. This unit used a special 510-volt battery that weighed only 3 lb. While at that time the battery cost nearly \$16.00, this cost amounted only to 1¢ per flash when used by a professional or commercial photographers who take a large number of pictures before depleting battery output.

An earlier version of the same idea was popularized by the Sprague Electric Co., the capacitor manufacturer. Their circuit used five 90-volt radio B batteries in series. Cost was considerably less but bulk was considerably greater. The author owned and used both of these units. Performance was similar; the only reason for choosing one over the other was weight or bulk. Fig. 2 shows the circuit for a power source of the Sprague version.

For more sporadic flash sessions, a portable power source employing flashlight bat-

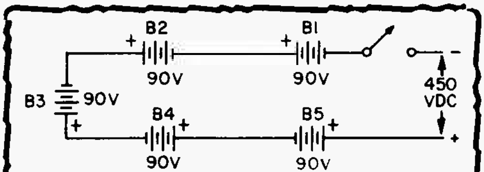
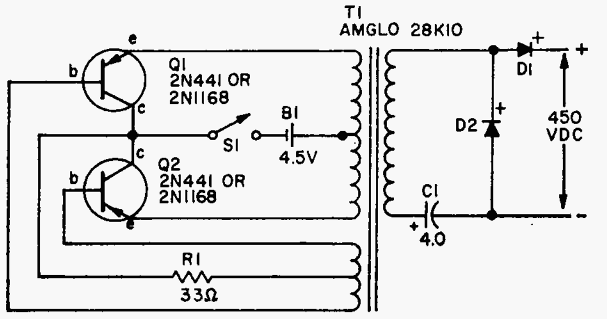


Fig. 2. Simplest power source is a 450-volt battery that will charge a 100-watt-second storage capacitor in less than 4 seconds.

Fig. 3. This transistorized power source produces 450 volts output from three D-size dry cells. It's capable of charging 60-watt-second storage capacitors in ten seconds. It's not necessary to insulate the transistors from the heat sink because of the common collector circuit. This is the Amglo model D-450 commercially available power source that is factory-assembled, ready for use. It's easy to build if you want to try one.



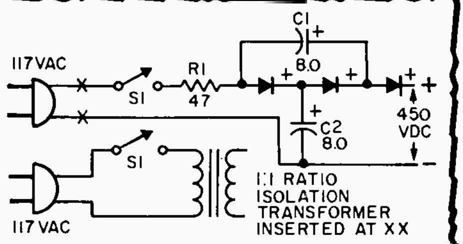


Fig. 4. Least expensive method to attain 450 volts for charging storage capacitors is to use voltage tripler circuit shown here. You should use a 1:1 ratio transformer between line and the voltage tripler to isolate the supply. Diodes D1, D2, and D3 are all 700 PIV, 750 mA silicon rectifiers.

teries as input power has long been popular. Transistorized power supplies are a natural for this application. Fig. 3 shows the transistorized circuit recommended by the Amglo Corp., a leading flashtube manufacturer. It provides 450 VDC from three D size cells as input power. This circuit, according to Amglo, will charge storage capacitors of up to 60 watt-second capacity within 10 seconds.

When portability is not a requirement, a conventional supply operating from the 117-VAC power lines will do admirably. When high voltage output at lowest possible cost is a requirement, the transformerless, voltage-tripler circuit shown in Fig. 4 can supply a capacitor charge for up to 200 watt-seconds of storage, and recharge the capacitor to full capacity within 10 seconds. To avoid the possibility of shock it is recommended that a 1:1 ratio isolation transformer be used on the input from the 117-VAC source.

As a further precaution while on the subject of safety, never forget that all *speedlights* use voltages and currents which have the potential to kill. In particular, be certain that all wiring is adequately insulated for voltages involved, and that all capacitors are fully discharged when working with a unit. A 50-watt-second speedlight stores enough energy to literally vaporize the tip of a common screwdriver!

All power supplies discussed so far have been for the 450-volt operating range. For 900-volt designs, substitution of a different transformer will suffice. For flashtubes requiring 2500 volts, the circuit shown in Fig. 5 may be used. With this power source and 75 watt seconds of storage capacity, flash speeds ranging from 90 to 700 microseconds can be achieved.

In many applications, portable operation is desirable as an extra, but for indoor use primary power source can be AC. Fig. 6 shows the circuit of the Amglo DAC-450 power supply, which charges to 110 watt-seconds capacity and also features automatic recharge of the storage batteries when the supply is operating from AC power lines.

Energy-Storage Capacitors. Next to the flashtube proper, the energy storage capacitors are the most important portion of the entire speedlight. While almost any kind of power source can be employed, the storage capacitors must meet certain rather strict requirements to provide reasonable flash performance.

Prime requisite of the energy storage capacitors is that they have high capacitance since the greater the capacitance the more energy they can store. The watt-second rat-

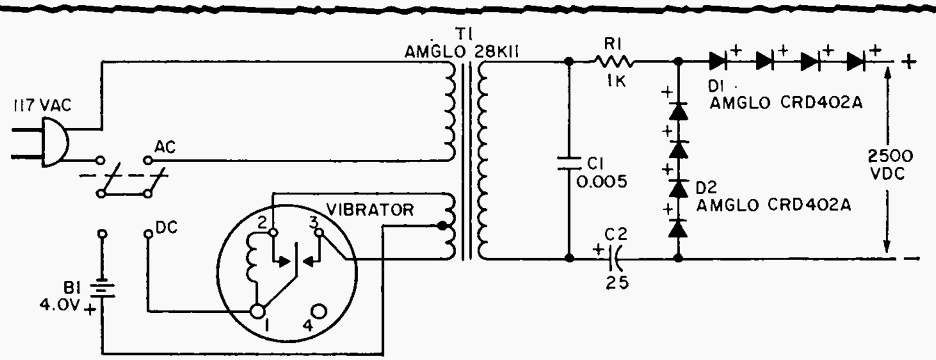


Fig. 5. This 2500-volt power source uses either 117 VAC or 4 VDC from a self-contained battery as its primary power. The battery drives a vibrator to convert the DC to "AC", which is then stepped up to high voltage through T1 power transformer and rectified to DC at 2500 V to charge storage capacitors. Wire should be insulated for 20,000 V. Cathode ray tube wire such as Belden type 8869, or auto ignition high voltage wire is ideal.

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ing of a speedlight is determined by the operating voltage and the storage capacitance, according to the equation:

$$\text{Watt-seconds} = C \times E^2,$$

where C is in μF and E in volts.
Thus a 500-μF capacitor charged to 400 volts will store:

$$500 \times 400 \times 400/2{,}000{,}000,$$
$$\text{or 40 watt-seconds}$$

This relationship shows that a higher voltage provides more energy than proportional increase in capacitance would achieve. Should the voltage in the example above be doubled to 800 and the capacitance halved to 250 μF, the stored energy capacity would be 80 watt-seconds. This is the reason why designers like to operate *speedflash* at as high a voltage as practical—but 500 volts is about the limit for reasonably-sized and priced speedlights, which is determined by use of electrolytic capacitors.

Special Capacitors Preferable. Commôn garden variety electrolytic capacitors are not suitable for energy-storage use. The capacitors used for this purpose must be especially designed for rapid discharge operation. In speedlight circuits conventional capacitors will have exceptionally short life.

Capacitors may be connected in several combinations to provide a wide range of operating characteristics. The series connection shown in Fig. 7A results in a total capacitance half that of each capacitor, capable of withstanding double the voltage and having double the energy storage capacity. In addition, the duration of the flash is cut in half. The parallel connection (Fig. 7B) produces double the capacitance with voltage capabilities unchanged and flash duration doubled; energy-storage capacity is also doubled. In either circuit application,

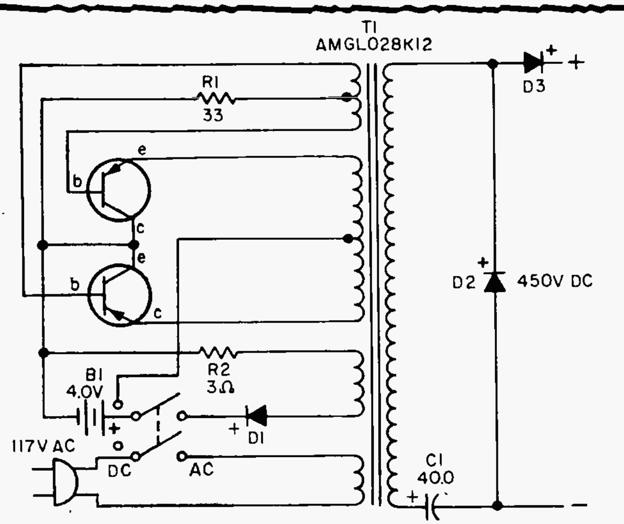


Fig. 6. This 450-volt power source features operation either from 117-VAC power lines or self-contained ni-cad battery. When powered by AC line, B1 is automatically trickle-charged and transistorized power circuit is disconnected. AC is stepped up by power transformer T1 and rectified to DC by diodes D3 and D2. Except for addition of 4-volt battery and its charging circuit this power source is same as shown in Fig. 3.

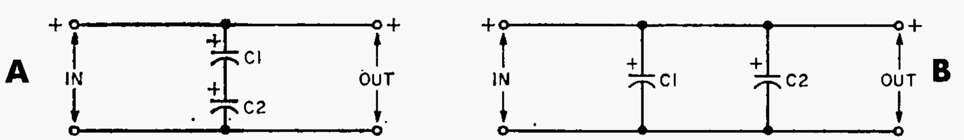


Fig. 7. Capacitors may be either in series or paralleled to double energy storage capability. Storage charge time will also be doubled when doubling energy storage capability. Schematic A shows capacitors in series. This hookup cuts total capacity in half, but at the same time permits double basic working voltage of individual capacitor to be applied across series hookup. Schematic B has capacitors in parallel, doubling total capacitance without changing working voltage capability. See text for a discussion of relative merits of each arrangement.

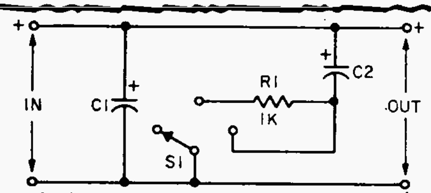


Fig. 8. Schematic shows how to achieve dual charging capability by addition of a capacitor. Capacitors C1 and C2 are identical in capacitance and voltage ratings, dictated by design requirements of power source. If C1 and C2 have a capacitance of 525 μF at 450 VDC, low position (one capacitor) provides 50-watt-second capacity and high position provides 100-watt-second capacity.

two capacitors take twice as long to charge as one.

Therefore, the choice between series and parallel connection is determined primarily by two factors; flashtube operating voltage, and the duration of flash desired.

Another desirable feature is the possibility of adjusting energy-storage by switching in additional capacitors. Such a circuit is shown in Fig. 8, and can be accomplished only by using capacitors connected in parallel. Resistor R1, shown at the mid-position of the *low-high* power selection switch, is required to limit current since the abrupt connection of a fully discharged capacitor across a fully charged one causes destructively intense current flow in both capacitors. At the very least, the switch would be damaged; it's possible the entire unit could be destroyed. When switching from half to full power, the switch should be left in the mid position for about one second, to allow equalization. The unit should never be switched back to half power with C2 still charged.

Whenever working with the energy-storage capacitors, care must be taken to prevent skin contact with the live parts of the circuit. All capacitors should be discharged—but not by shorting them. A 1000 to 5000 ohm, 10 to 25-watt resistor should be used to discharge the capacitors. This will remove total charge yet prevent destructive current levels. Fig. 9 shows how such a safety resistor can be connected into a circuit with an interlock to the main power switch. In addition to this type of connection, a similar resistor, with insulated clip leads attached, is convenient when working with flash units. Clipping the resistor to live terminals (one terminal at a time, with extreme caution) discharges the capacitor and makes the unit safe. The re-

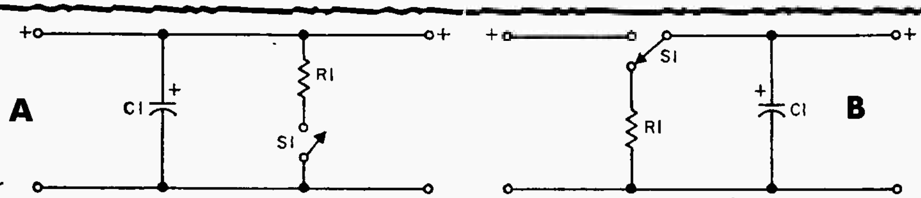


Fig. 9. Resistors to discharge high voltage capacitors should be included, wired in such a manner that they perform their job whenever case is opened. Schematic A shows basic interlock switch that is open circuit when the case is closed but closed circuit whenever case is opened. In schematic B we have combined an interlock circuit with the power on/off switch for the dry battery pack detailed in Fig 2. With this circuit, capacitor is always discharged when battery power is turned off. Best dry-battery economy is accomplished with Schematic A.

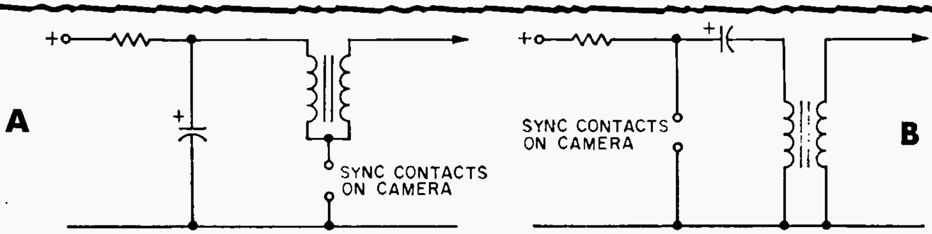


Fig. 10. Two standard trigger circuits shown above. Major difference between schematics A and B is that circuit of schematic B permits current flow through trigger transformer while trigger capacitor is recharging. Although schematic B is more widely used in photographic applications, it's not as suitable for high repetition triggering. Values of the various components referred to in the text will depend on supply voltage.

QUICK AS A FLASH

sistor may be left connected to assure safety from shock while you work in the circuit.

Trigger Circuits. The trigger circuit controls the timing of the flash. Since almost all modern speedlights use high-pressure flash tubes, which require ionizing trigger pulses, we'll discuss these circuits first.

Nearly all such trigger circuits are derived in one way or another from the basic circuit shown in Fig 10. Fig. 10B shows a variation of this circuit frequently encountered. The transformer in this circuit may be either a special photoflash trigger transformer (suitable units are made by both Stancor and Amglo), or a model-airplane spark coil (if you can locate one). The trigger circuit is functionally similar to the speedlight discharge. The capacitor charges slowly through the resistor to about 200 volts. When a flash is desired, the charged capacitor is discharged through the transformer primary. A trigger pulse of some 4 to 50 kilovolts (depending on transformer and circuit used) is produced in the secondary. This trigger pulse, applied to the flashtube trigger electrode, causes breakdown of the gas in the tube and allows the main energy capacitor to discharge through the flashtube.

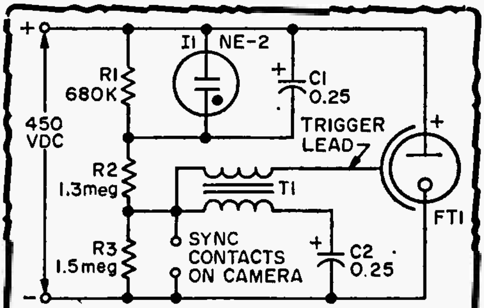


Fig. 11. Here's a typical 450-volt flash-head trigger circuit. Resistors R1, R2, and R3 make up a high-impedance voltage divider. When storage capacitors are charged, voltage drop across R1 charges capacitor C1, which, in turn, discharges through neon bulb I1, firing it, making I1 a ready indicator. When camera shutter sync contacts are closed, C2 is discharged through primary of T1 and produces trigger pulse for firing flashtube FT1.

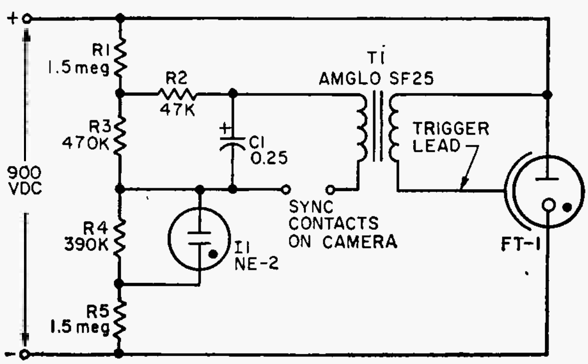
Fig. 11 shows the Amglo 450-volt lamphead circuit. This is the basic trigger circuit with a neon flasher ready light added and the flashtube shown connected. Fig. 12 is the 900-volt circuit, which is similar except for resistance values, and Fig. 13 is the 2500-volt circuit.

Note that all these trigger circuits apply a relatively high voltage to the associated camera flash contacts since the trigger capacitor must discharge through these contacts. This high voltage can damage the camera and perhaps cause mild shocks to the user.

These undesirable conditions can be avoided by connecting a thyratron tube (V1) into the circuit as shown in Fig. 14. This circuit is for a 450-volt power source and can be substituted for that shown in Fig. 11. The only change necessary to adapt the circuit to higher operating voltages would be to increase the value of resistor R4.

In this circuit, a moderately-low resistance path through the synchronizing con-

Fig. 12. Circuit for operation from a 900-volt power source is very similar to that for lower voltage one discussed in Fig. 11. Isolation of sync circuit from high-voltage circuit is major difference. Other differences are elimination of one capacitor and steady indication rather than blinking indication of ready light when storage capacitors are recharged. Flashtube FT1 must be rated at or above 900 volts. Since dangerous voltages are prevalent in this circuit, care must be taken and all wire insulation should be rated above 1000 volts for safety's sake.



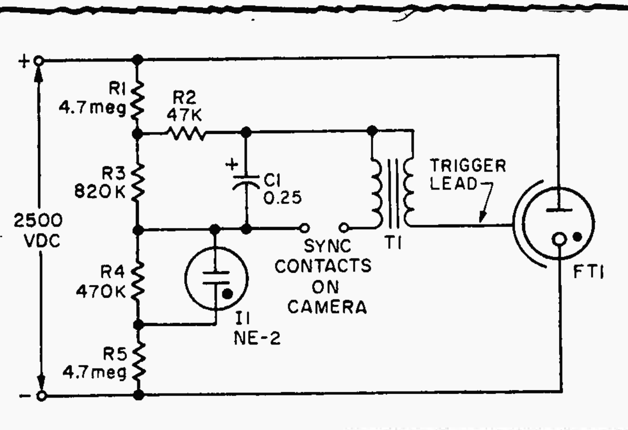


Fig. 13. With the exception of different values of some resistors, a flashtube rated at 2500 volts and T1 trigger transformer to match voltage requirements of flashtube, there's little difference between this 2500-volt trigger circuit and the one in Fig. 12. Precautions mentioned in previous figures regarding the handling of high voltages are more necessary with this circuit because of considerable increase in voltages, which in this unit are comparable to those employed in the electric chair when executing a guilty criminal.

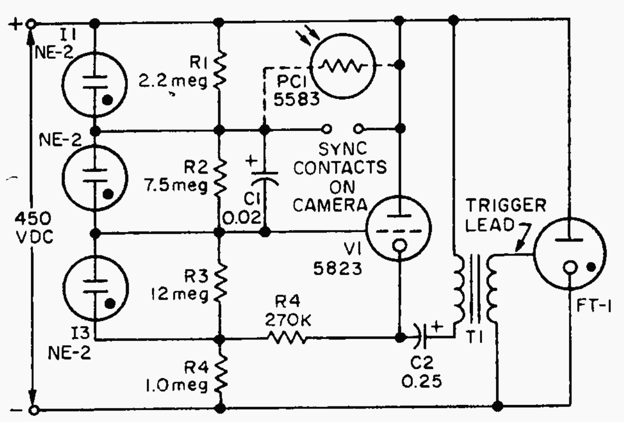


Fig. 14. It's possible to reduce the damage to camera sync contacts by 100 times or more just by adding a few components. Thyratron V1 acts as an electronic switch. When C1 discharges between grid and cathode of V1, tube shorts, and, in turn, discharges C2 through primary of T1, thus developing high voltage on its secondary to fire flashtube. By adding photocell PC1 the unit can be used as a slave flash. Although all three neon tubes (I1, I2, I3) serve to regulate thyratron voltage, only I1 is used as a ready indicator (see Li'l Blitzer elsewhere in this issue).

tacts will fire the flash. Such a path can be provided also by a photocell, as shown in dotted lines. Such a *slave flash* will respond within 1/100,000 second to the original flash, at distances up to 100 feet, thus providing the serious photographer with an advantageous accessory.

An SCR substitute for the thyratron is shown in Fig. 15. A General Electric C-20B or equivalent SCR is recommended. Resistor R4 serves as a sensitivity control.

By replacing the SCR in Fig. 15 with a light-activated SCR, such as the GE 4JL8B or equivalent, you provide *slave* operation. Resistor R4 should be adjusted in this application to the lowest point at which the unit does not trigger itself off.

If low-pressure or self-ionizing flashtubes are used, no special trigger circuit is necessary. Instead, an isolation relay capable of switching the required energy is used (see Fig. 16).

The Flashtube. The flashtube, of course, is the heart of the unit. Flashtube characteristics determine operating voltage, flash duration, and color of light.

The flashtube consists of a sealed tube containing a gas and two electrodes, with a third trigger electrode mounted outside the tube. The type of gas used in the flashtube determines the color of the flash. Xenon gas is most popular since it produces a flash having a color closely approximating noon sunlight, and, therefore, is suitable for color photography. Neon gas will produce a flash rich in red and infrared, while argon gas will produce a bluish-violet flash that's rich in ultraviolet. The various gases may be mixed to produce light of almost any desired characteristics.

Operating voltages are dependent on several factors. The higher the gas pressure within the tube, the greater will be the voltage required to produce a flash. Additionally, the greater will be the voltage at which the tube will flash without application of a trigger pulse. Most low-voltage flashtubes (150 to 900 volt ratings) are filled at 60-

QUICK AS A FLASH

200 mm pressure, while high-voltage tubes are filled at 200-400 mm.

Flashtube Life. Flashtube duration depends upon operating voltage, size of the storage capacitors, and external circuit design. Flashtubes have longest operating lives when used to produce relatively slow flashes in the range from 1/300 to 1/1000 second duration. However, even when producing 1/25,000 to 1/100,000 second flashes, flashtubes designed for such brief flash service give up to 10,000 flashes (the life of the flashtube is defined by the number of flashes it produces before its light output is reduced to half of its original value). When operated with slow flashes and less than maximum power input, flashtube life is extended into millions of flashes.

Rolling Your Own. If you're interested in building your own electronic flash unit, you can do so easily (see "Speedy Flash" elsewhere in this issue). Virtually all the circuits shown so far in this particular dissertation are compatible with each other. You can select a power source, a hookup for energy storage capacitors, and a flash-head circuit and combine them into your own design.

The only point which may give you problems in the design phase is determination of the power rating you desire. For most uses, a 50-watt-second unit is adequate. Many of the less expensive factory units available today produce only 20 to 25 watt-seconds. Since effective-beam-candle-power-seconds are the actual measure of light produced, rather than watt-seconds, most guide-number determinations are based on EBCPS. Roughly EBCPS equals 15 times the watt-second rating. This figure may vary as much as four times in either direction because of differences in reflectors, but provides a starting point for design.

Of course the power source characteristics must be checked. If portability is a requirement you would find an AC-only unit useless. Similarly, if all work is to be done indoors there's no need to become involved with the battery replacement or recharging problems that go with portable units.

Adaptability to slave flash accessories and other such features should also be considered before making any final decisions. ■

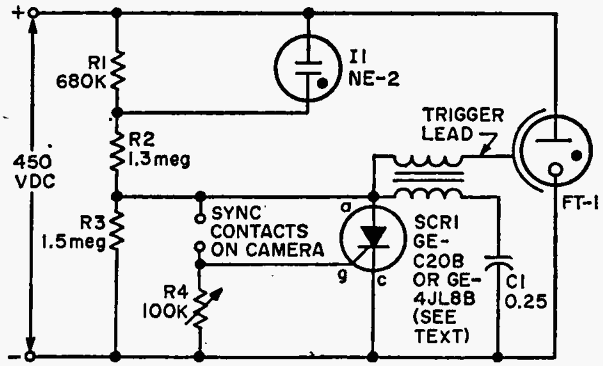


Fig. 15. You can use a silicon controlled rectifier (SCR) in place of a thyratron to provide a solid-state trigger circuit. Here you see an SCR added to the 450-volt supply shown in Fig. 11. Adjustable resistor R4, added along with SCR1, are only components necessary to modify circuit for solid-state trigger control. By substituting a GE type 4JL8B for the SCR shown in circuit, unit can be modified to act as slave flash without any further changes. By adding SCR1 and R4 circuitry to those shown in Figs. 11, 12, and 13, or any similar circuit, you have a means of providing low current or slave control triggering.

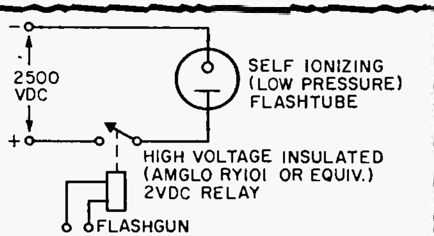
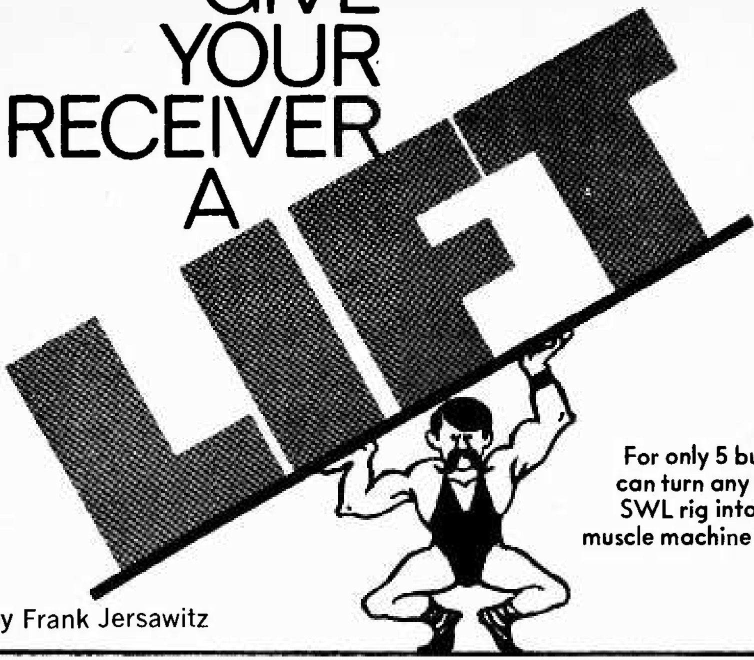


Fig. 16. Self-ionizing (low pressure) flashtubes can be triggered by this very simple circuit. All that's needed is a low-voltage relay actuated by existing sync mechanism and battery for standard flash bulbs. Relay closes high voltage to flashtube, thus isolating camera sync contacts from high voltage.

GIVE YOUR RECEIVER A



For only 5 bucks you can turn any scrawny SWL rig into a hairy muscle machine with Vari-C

by Frank Jersawitz

THERE are many transistorized SW receivers available today in the price range from less than $15 to several hundred dollars. The author owns one of these low priced versions that, after a little diddling turned in a pretty good record in receiving DX.

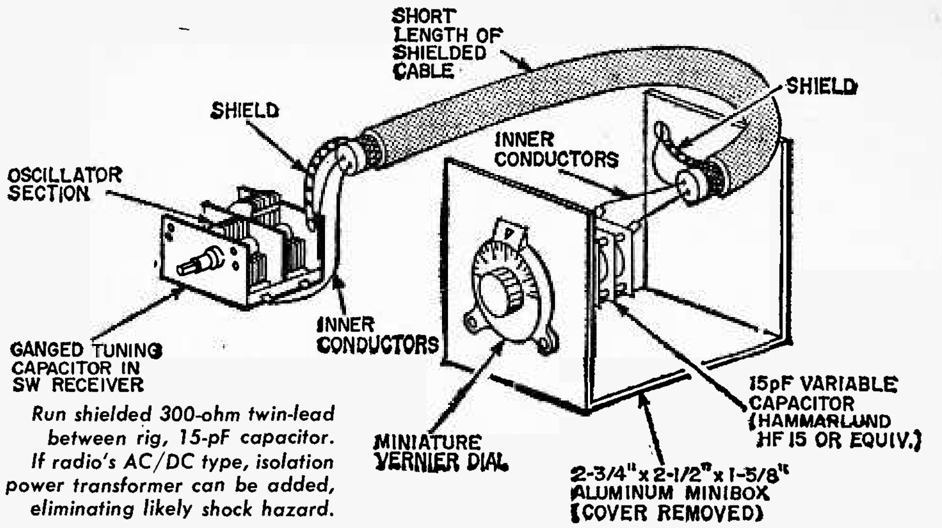
One reason for this success with a low priced receiver is the fact that the listening point is located in a rural community away from big city areas that are congested with electrical interference from machinery, appliances and an overabundance of radio stations in the immediate vicinity. Also, the house is atop a hill at least 100-ft. high, with the antenna somewhat higher than this since its installed on the roof. All are conditions known to be ideal for SWLing.

Of course, knowing a thing or two about what it takes to wring the most out of a set helps too. Following are a few tips that have helped tremendously and are in easy reach of the average experimenter.

Grounding. One major aid to improve reception is to use a good earth ground. If your set doesn't have a ground terminal, check out the circuit for the common ground bus and connect a lead to this bus and thence to a cold water pipe. Or, run a ground wire to a rod sunk at least 4-ft. into the earth. To be effective the ground wire must make a good contact with the water pipe or ground rod. You can buy a ground clamp designed to dig past the dirt and oxidation on the pipe or rod, thus ensuring a good ground connection.

Using An Outside Antenna. Certainly a properly erected antenna, the higher the better will bring stronger signals to the set's input. In the event your set doesn't have a terminal to connect an external antenna, you can connect the lead-in to the whip antenna built into the set, with an aligator clip. This will make it easy to disconnect so you can take the set with you on an outing or to the beach.

Boosting Sensitivity. Next, let's consider a way to improve the sensitivity of the receiver. In all probability, because the set is an economy model and was rushed through the production line to keep down the cost of manufacture, the IF transformers may not be peaked for maximum tuning to track with the output of the set's mixer oscillator. A simple aligning tool, similar to GC type 5000, long enough to reach the tuning screws and small enough to fit into the openings for them, will help to overcome this deficiency. Initially, just tune the set to a weak BCB signal (if the set tunes the BCB) and then slowly rotate the adjusting screws,



Run shielded 300-ohm twin-lead between rig, 15-pF capacitor. If radio's AC/DC type, isolation power transformer can be added, eliminating likely shock hazard.

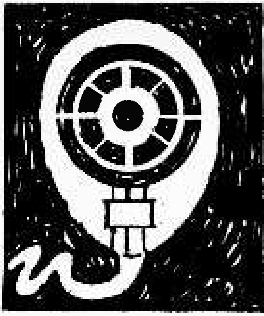
back and forth from their original position, for maximum signal level. Then tune in a weak SW signal, such as the weakest WWV transmission, and recheck these adjustments. If your set boasts an S meter, all the better; make your adjustments for maximum S reading on the meter.

If you really want to go all out for increased sensitivity, try building the *Station Blazer RF Preamp* detailed in the April/May 1969 issue of SCIENCE AND ELECTRONICS. For an investment of about $6 and a few hours in construction time it'll take any SW receiver out of the mediocre class. And, if your set lacks audio oomph to drive a speaker to your satisfaction, you might try adding a packaged transistor audio amplifier and separate speaker. How about building the *Universal Utility Amplifier* described in the November/December 1969 issue of ELEMENTARY ELECTRONICS? If you don't want to build, you can buy low cost, factory built, transistor amplifier from most parts suppliers.

Adding Bandspread. One other disadvantage of the lower priced SW receivers is a lack of bandspread tuning, a most useful assist in separating closely spaced stations at the higher frequencies. With a little patience, and a few parts and tools you can also add this feature to most economy model SW receivers. All you need in the way of parts is a 15-pF variable capacitor, an inexpensive vernier dial, a small aluminum box and a short length of low capacity, shielded two conductor cable. Once you've mounted the capacitor and dial in the aluminum box as shown in our drawing, you're ready to hook it up. Locate the oscillator section of the tuning condenser gang in your SW receiver and connect this externally mounted variable capacitor in parallel with this section of the set's tuning gang. Ground one end of the shield from the interconnecting cable to the common ground bus in your SW receiver and the other end of the cable shield to the box used to house the external 15-pF capacitor. Connect one end of the two conductors of this shielded cable to the two connections of the oscillator section of the ganged tuning capacitor in your receiver, and to the two connections of the 15-pF variable capacitor in the aluminum box. Keep this piece of cable as short as possible.

To use the bandspreading feature you've just added to your set start off by setting the new capacitor's dial to zero and tune the receiver in the normal way. Once you tune in a station (in all probability you'll get several stations interfering with one another in a congested portion of the band), you then use the bandspread dial to improve the signal by separating these stations near the same frequency. With a little practice you'll soon learn how best to use the band spread to your advantage.

Now that we have given you tips on how to get into the swing of things better with your economy model SW receiver—go to it, have more fun out of SWL. ■



HAM TRAFFIC DE W7DQS

by MARSHALL LINCOLN

Business and Hamming Don't Mix

IT was hard to believe my ears. What I was hearing couldn't be happening on a ham frequency, could it? Other listeners assured me it really was happening—it wasn't just a bad dream.

There they were—two young fellows who somehow had passed amateur exams, but seemed to have no idea of the function and purpose of ham radio. They were deliberately and unashamedly providing on-the-spot broadcast "news coverage" by means of ham radio for a broadcasting station!

One fellow freely admitted he was operating "portable" at the commercial station's studio, and the other fellow was driving around town, apparently with a "news man" from the station. This mobile amateur operator would make brief transmissions describing certain events which he saw, and this information would be repeated on the air by the commercial station's announcer a couple minutes later.

As if this wasn't bad enough, those of us listening soon heard the mobile operator tell the portable operator to "get the tape recorder ready." Then the mobileer began what was obviously intended as a transmission to be replayed over the commercial station!

Just then another ham who also had been listening to this wild goings-on broke in and notified the two would-be news broadcasters that they were violating amateur regulations. The ham operating the portable ham rig at the broadcast station then became violently angry and severely criticized this breaker on the air, with language bordering on profanity, for breaking in!

"What's wrong with what we're doing? We're just two hams talking to each other and describing what we see. What's wrong with that?", was the general substance of his indignant reaction.

The breaking operator patiently, but firmly, explained that the *intent* of their operation was obviously more than a mere innocent visit between two hams.

Of course these two fellows had that in mind right from the start. The astounding thing is that they had the brass to pretend to be innocently conducting an amateur QSO to cover up the obviously illegal use they were making of ham radio. They quickly modified their big plans for broadcast radio news coverage after they were caught in this illegal operation by an alert and concerned fellow ham.

Radio is so Easy. Fortunately, few hams would try such an openly brazen operation. However, the fact that it happened at all is evidence that the ease with which nearly everyone can use radio nowadays causes some persons to fail to think about the far-reaching effects of radio communciations—and the purpose of specific types of radio communications.

It doesn't take any brains to pick up a mike and push a transmit button. With commercially-built and tuned equipment available for use on ham frequencies, it's possible to operate on the ham bands with absolutely no technical knowledge. Unfortunately, this mental vacuum sometimes is accompanied by a lack of perspective in regard to the uses of radio communications. A radio frequency becomes nothing more than a gathering place for a gaggle of gossiping housewives or a gang of boys at the corner pool hall.

Conversations on the air become just as casual as conversations in person . . . and

(Continued on page 56)

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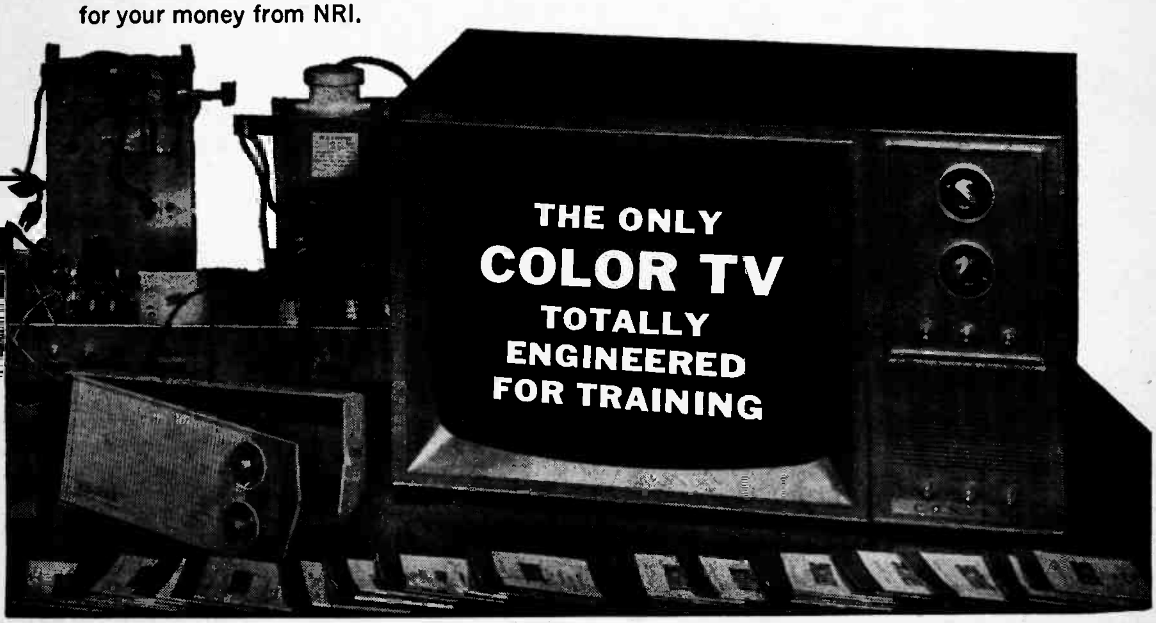


Ham Traffic

(Continued from page 51)

pretty soon idle rumor mongering, petty back-biting and foul language become a part of a QSO. One evil leads to another until soon a distasteful situation becomes a downright illegal one, as I have described.

Occasionally, ham frequencies are used in local areas by hams who also are in the commercial radio business. Sometimes you can hear these guys informally conducting a little commercial business mixed in with their ham "QSOs." This is strictly out of order on the ham bands. First, it's illegal, and second, it's just not in the spirit and purpose of ham radio.

Ham radio exists specifically as a technical training ground, a place for noncommercial technical experimentation, and a system of public service communications. It definitely is not intended for any commercial use.

The FCC has said repeatedly that hams may make "deals" on the air among themselves for buying, selling or trading ham gear from man to man, but that all other references to transactions involving exchange of money are forbidden on ham frequencies. Guys who want to set up business appointments, and make arrangements for work to be done on commercial radio installations should use a commercial radio channel, or the telephone.

Even if the guys who violate this provision don't care about jeopardizing their own ham licenses, it would be nice if they had respect for the rest of us who would rather use ham radio for its intended purpose instead of listening to business deals being cooked up.

Needless ID Yakking. For the 99.9% of the ham population who use ham radio for its intended purpose, there's still much to be learned to make our operations more efficient and useful.

One particular bit of sloppy operating that always makes me turn purple around the gills is excessive identification of stations.

Some guys and gals seem to think that every time they make a short transmission they must go through the entire ID procedure. Even in the "fastbreak" type of operation which is so useful, and easy to do on SSB and FM especially, these folks still fill the air with call letters every few seconds, it seems.

This is all so useless, and it makes ham QSOs sound like a series of computers talking to each other instead of a bunch of hams on first-name basis.

Wish these folks would learn: YOU ONLY HAVE TO IDENTIFY ONCE EACH TEN MINUTES, PLUS ONCE AT THE BEGINNING AND ONCE AT THE ENDING OF YOUR QSO. And you only have to identify *your station*. When you sign off, you need to identify *only one* of the stations to whom you were talking. And that's all, dad gum it!

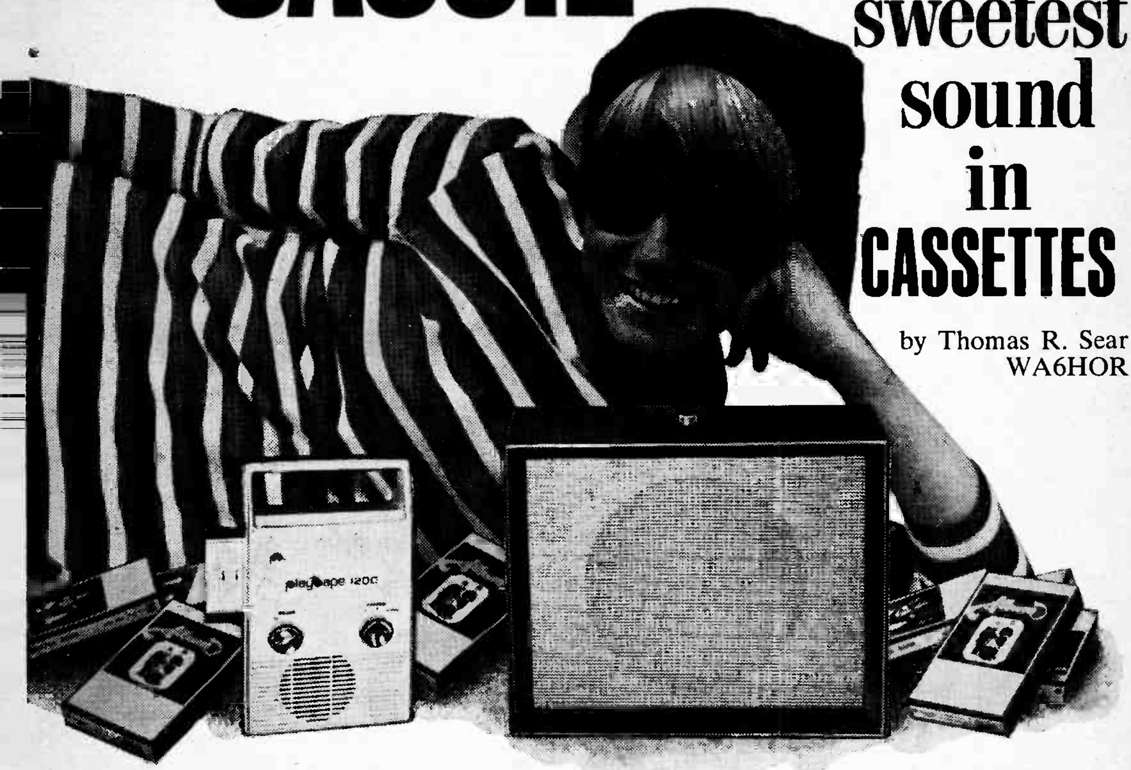
Sometimes it helps to use call letters at certain other times, even though not required by the FCC, to maintain order in an exchange involving several stations. But there's seldom any need to go through the full ID procedure with every transmission when using a rapid "dispatch style" of operating consisting of rapid brief exchanges like a normal face-to-face conversation.

Often this excessive ID has been picked up as a habit after hearing someone else do it. There is an important lesson to be learned there: be careful who you pick up your habits from! ■

The world's largest airliner, the gigantic Boeing 747, is the eye-catching illustration on the QSL card used by WA7BIY—who made the photo himself! "By" (for Byron) is a photographer for the Boeing Company, and frequently goes aloft to photograph the company's airliners. Many of the striking color photos you've seen in magazines of this new Boeing jet were made by him. He's also among those Boeing hams who have been allowed to operate ham radio on board a 747 while on test flight.

let CASSIE give you the sweetest sound in CASSETTES

by Thomas R. Sear
WA6HOR



SIX years ago no self-respecting audiophile seriously considered slipping the Beatles into his hip pocket. And no stereophile envisioned cramming all those Monkees into, say, a tote bag. But all you Beautiful People know how time eventually changes fiction into fact. Today it's easy to hold the Boston Symphony in your hand. Spouting off at the tonsils aside, you've got a lot to like with a new-as-tomorrow tape cassette.

Since its introduction in the mid-1960s, the tape cassette has achieved immense popularity among novice and experienced audiophiles. The ease of loading this ½-in. wide, self-contained marvel into its record/playback unit consistently earns hurrahs from anyone who has ever fumbled with a conventional, reel-to-reel tape recorder. But it turns out all's not perfect in cassette country.

Like a small battery-operated transistor radio, a cheapie cassette player's playback sound oftentimes leaves a little something to be desired. Seems the commemorative-stamp sized speaker found in the majority of cassette players stumble and fall way down in the bass-reproduction department. One solution might have us tack on a larger speaker having better frequency response. But did you ever try driving that hi-fi speaker of yours with a cassette player? It's all show and no go as the flea-powered player struggles against your mighty inefficient speaker.

Room-filling sound for little expense is surely the password for our

gives you the sweetest sound...

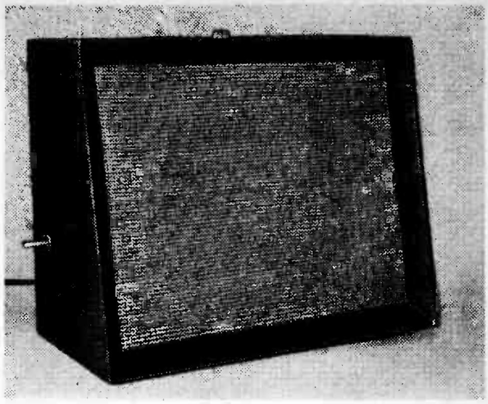
Cassie. She gives you the sweetest sound you've ever coaxed out of your cassettes! You won't have to sell your kazoo to build *Cassie*, either. Handily lifting Bacharach or Bach from soupy to silvery, *Cassie* tootles to a 20-buck tune. We think you'll be glad you found a couple of constructive hours and a finger for your solder gun trigger, after you've heard *Cassie* perform.

Our photos show *Cassie* in all its glory. You can easily see how speaker and internal amplifier fit into the cabinet, with neither cramped for breathing room. We did a bit of catalog page twisting and found a full-range 8-in. speaker tucked within a deluxe baffle for an unheard-of $6.95. And another six dollars and 95c later, we fished up an amplifier whose internals can easily drive the speaker.

Cassie can find happiness indoors with its own internal power supply, or outdoors by connecting a 12-volt battery to the terminals provided for this purpose. Making our *Cassie* even more electrically attractive are two inputs: one for high-level signals ordinarily cranked out by cassette players, another for low-level signals such as you'll find from phono cartridge, guitar pickup, or even a microphone.

These features make *Cassie* ideal for all those indoor or outdoor gatherings where you want your vocal cords or rock vibrations to carry a lot more zonk.

Prancing Through Cassie. The electrical body of *Cassie* consists of two major organs.



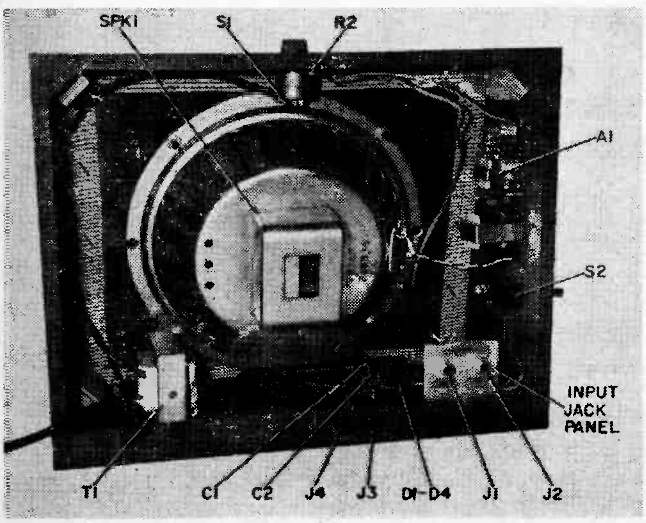
Cassie is a handsome addition to any system. Not only does it add tone quality to your cassette player, it's good to look at too.

One's a solid-state, store-bought, 1-watt power amplifier; the other's a home-brew 12-VDC power supply.

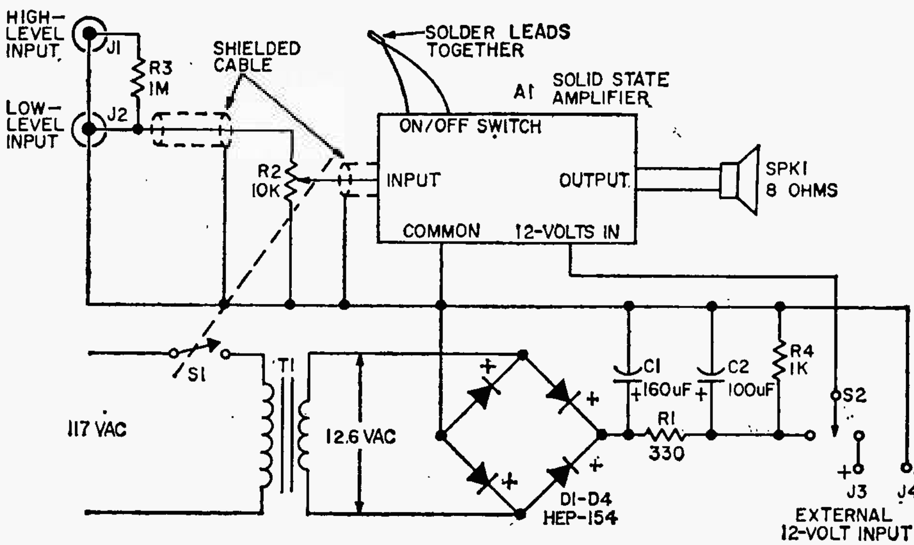
The power amplifier has a frequency response running out to 15 kHz. What's more, when presented with 4.5 millivolts at the head end, it'll zap its output into an 8-ohm speaker without busting a gut. And all this razzmatazz is yours with only 150 mils squeezed out of the power supply!

The 8-ohm speaker and enclosure were found hiding together in McGee Radio Co.'s catalog. You'll find it lurking as no. SLDC8S. The speaker's a no-nonsense coaxial job with a frequency-response curve considerably wider and flatter than the squawker found in most cassette players.

From Full Wave to No Wave. Taking a peek at *Cassie*'s schematic, you'll see that



Guts of Cassie layed bare here for all good constructors to see how easy it is to place all the units for easy accessibility without affecting speaker. Circuit board construction of amplifier and power supply lends itself to placement that fits spaces available. Controls are placed within easy reach from exterior.



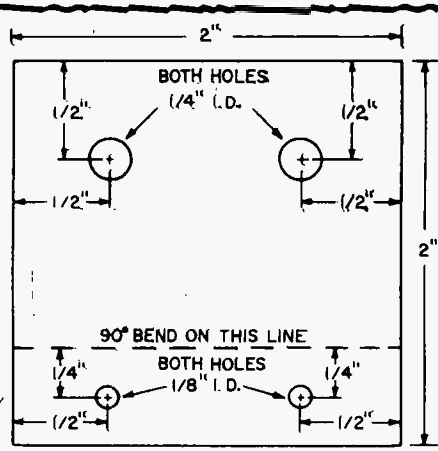
PARTS LIST FOR CASSIE

A1—1-watt, solid-state amplifier (Lafayette 99E90383 or equiv.)
C1—160-µF, 25 VDC electrolytic capacitor (Lafayette 34E85687 or equiv.)
C2—100-µF, 16 VDC electrolytic capacitor (Lafoyette 34E85547 or equiv.)
D1-D4—50-IV, 1-A silicon rectifier (Motorola HEP-154 or equiv.)
J1, J2—RCA phono jacks (Lafayette 99E62341 or equiv.)
J3, J4—Insulated banana jacks; red (Lafayette 32E64942 or equiv.), black (Lafayette 32E64959 or equiv.)
R1—330-ohm, ½-watt carbon resistor
R2—10,000-ohm, ½-watt carbon potentiometer (Lafayette 32E22528 or equiv.)
R3—1,000,000-ohm, ½-watt carbon resistor
R4—1,000-ohm, ½-watt carbon resistor
S1—Spst on/off switch (part of R2)
S2—Spdt toggle switch, center off (Lafayette 99E61558 or equiv.)
*SPK1—8-in., 8-ohm coaxial speaker with wall baffle
T1—Power transformer: primary, 117 V 50-60 Hz; secondary, 12.6 V @ 2 A (Stancor P-8130 or equiv.)
1—2-ft. length shielded wire (Belden 8431 or equiv.)
Misc.—knob, 6-ft. line cord with plug, wood screws, solder, wire, etc.

*SPK1 available from McGee Radio Co., 1901 McGee St., Kansas City, Mo. 64108 for $6.95 plus postage. Specify stock no. SLDC8S.

switch S1 is the power *on/off* switch socking 117 volts to transformer T1's primary winding. Transformer T1's secondary is connected to the power supply, which is four silicon diodes, two capacitors, and two resistors. Diodes D1 through D4 are connected as a bridge rectifier; the output from this bridge is smoothed by capacitor C1 to provide a relatively hum-free DC output of approximately 20 volts. Resistor R1 drops the DC output voltage down to the 12 volts required to breathe life into our power amp. Capacitor C2 provides additional filtering.

There's nothing spectacular about switch S2. A prune-juice-regular, three-position toggle switch, it selects either the output from the internal power supply, or an external 12-volt supply connected 'twixt jacks J3 and J4. The *center-off* position of S2 also provides you with a means of turning *Cas-*



Don't say we haven't told you all—here's how to make input jack panel.

sie on or *off* when an external source springs it to life.

Longnose Looping. Okay, it's time to dig out your dikes. But before you'll read more of our sage construction advice to the shop-worn, you'll need to perform a minor surgical operation on the power amplifier.

Solder the power *on/off* wires (coming out of the amp) together, and wrap them in a piece of electrical tape. These wires normally run to an external switch which performs the *on/off* function. In *Cassie's* case, however, we halt those jolts with our volume control-mounted switch. If you're still in the dark over which two wires to solder together, consult the directions accompanying your amp; it'll call out two leads marked "to on/off switch." After you've taped up the patient, place it aside.

Don't let that bright 'n' shiny speaker talk you into mounting it into the baffle while you're still in the early construction phases. Few speakers improve their tone when they're subjected to holey indignities like screwdriver blades, drill bits, and solder gun tips.

Prior to mounting the electronics within the speaker cabinet, drill a 7/16-in. hole on the left-hand side of it. This hole is for switch S2, and it's positioned about 3¼-in. up from the bottom and 1½-in. from the back of the speaker baffle. Also drill two ¼-in. holes spaced ¾-in. apart on the side of the speaker cabinet. That's where you'll mount jacks J3 and J4.

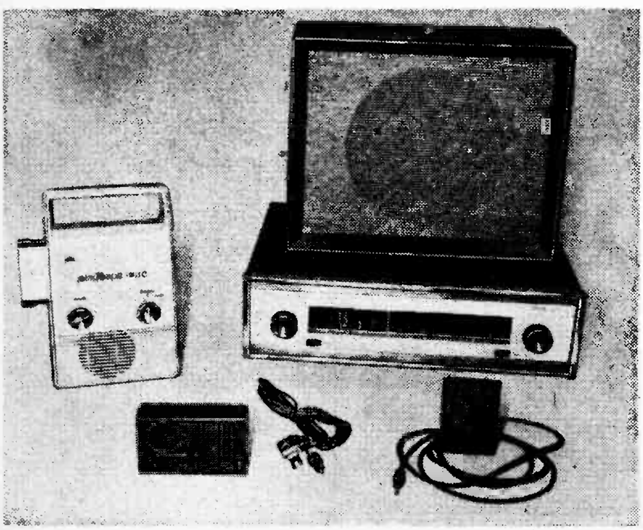
Cutting, bending, and drilling the input jack panel is the toughest job on *Cassie*. Take a 2 x 2-in. piece of aluminum stock, and drill two ¼-n. holes about an inch apart, as our diagram shows. Then drill two ⅛-in. holes about an inch apart at the opposite end of the aluminum plate. Scribe a line ½-in. in from this side and bend the metal so it forms a 90° angle along the line. This aluminum mashery becomes the mounting plate for your high- and low-level input phono connectors. Finally, attach this assembly with round-head screws to the cabinet base.

Screw both RCA phono jacks onto the mounting plate. After you solder a 1-megohm resistor between both center conductor pins, drill a hole for the volume control *on/off* switch assembly on top of the baffle and mount it in the newly-created hole. Be sure you orient the potentiometer terminals so they face the amplifier.

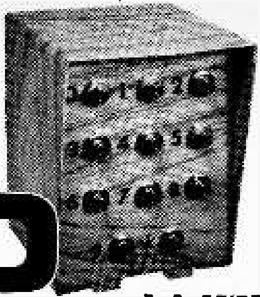
The power supply assembly can be tackled by any soldering iron wielder. The author built his volt smoother on a small piece of Bakelite, but we suggest you delve into your spare parts collection for a 3 x 2-in. hunk of perfboard. Before you loose your wonder-watter upon the components, remember that diodes and electrolytic capacitors are like polar bears. They lose their cool if jabbed too often with a hot iron.

Once you've wired the power supply, mount it to the speaker baffle's bottom with spacers between perfboard and mounting screws. Only four connections are made to one power supply—transformer T1's second-

(Continued on page 101)



Cassie's with it for other than cassette players. You can use it to sweeten up your tuner or build two of 'em for stereo. Too, it makes an OK phono amplifier when you feed it from a record changer. Need a small PA? That's right, just add a mic and you've got one rarin' to boost that weak voiced politico. In fact it fills the bill for just about any audio application where there's need to faithfully raise the signal level with low distortion and good frequency response.



DIGITALOCK

Our all-electronic sequence lock sends burglars to the poor house

by Edward A. Morris, W2VLU

WE'RE sure the odds are better than 1,500,000 to one against anyone—professional lock-tumbler twirlers included—successfully picking our *DigitaLock*. Sounds incredible, but here is a true, guaranteed non-pickable, all electronic lock. It's ready, willing, and always able to match wits against all who would defile your property. And, in case you think someone's caught on to *DigitaLock's* combination, it can be readily changed any time you wish for added protection!

Every day we run across situations where we want to provide access to people we know, and *no* access to folk we don't want to know. *DigitaLock* can turn your intrusion system *on* or *off*. Of course, this is the device's most obvious function.

Denying unauthorized persons access to restricted business areas is but another job our *DigitaLock* handles for any size organization, and for any specified amount of time.

It'll also work as an electronic pass key for club groups. Dues-paying Rabbits take note; you can now gain admission to the Hutch without a brass carrot!

Forget all those James Bond visions dancing about in your head, 'cause operating our *DigitaLock* is a snap. Punch in the correct 6-digit number sequence, depress a switch—presto, you're a keyless Houdini! DL's computer-like logic system opens only when the correct combination has been entered. Unlike other electronic locks you've seen, each button is depressed only once, and then released. It's not necessary to hold down all buttons simultaneously; this feature makes *DigitaLock* a one-handed operation.

You don't need to jimmy your bank account, either, for our DL will cost about 25 rolling stones. This project will pay for itself every time it's used; where a number of keys have to be changed periodically, you need

DIGITALOCK

only arm yourself with a screwdriver, and we don't mean the 86-proof version!

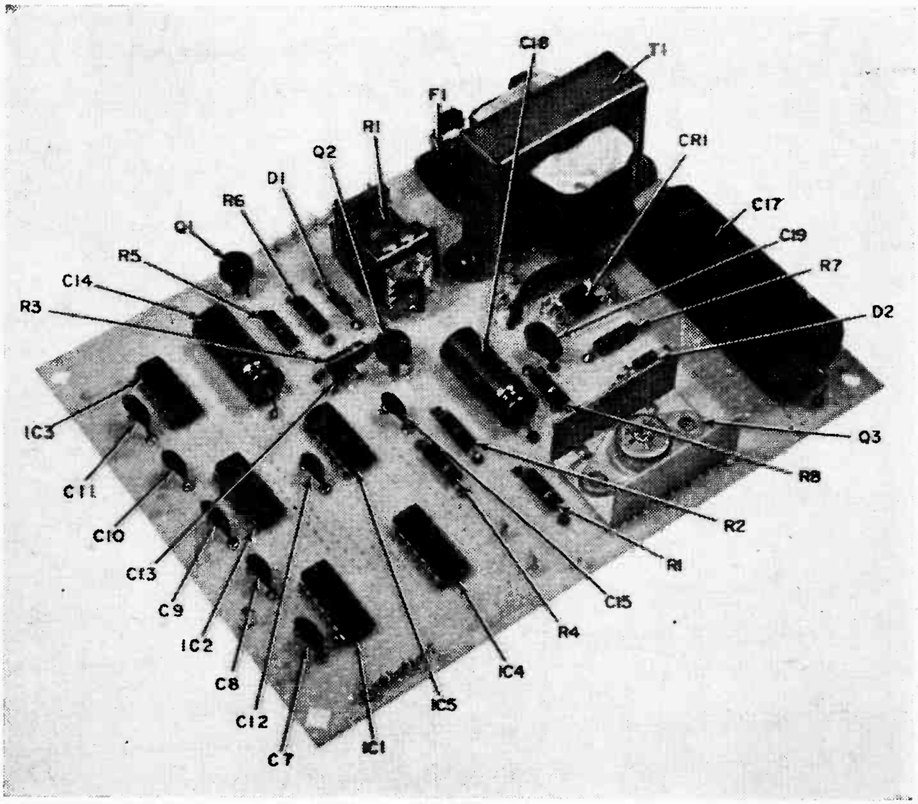
The lock's control logic is housed in a 3 x 5 x 7-in. aluminum box. The remote digit key sender may be located wherever it's needed, up to several hundred feet from the control box. *DL* is normally powered by 117-VAC line current, but worry not about your monthly electric bill, because consumption is about the same as a small night light. Brown-outs won't bother *DL*, as provision has been made for the inclusion of a backup battery power pack.

Maxwell's Smart Circuit. Circuit complexity was reduced, and reliability enhanced, through the use of five low-cost, plastic-encased integrated circuits. Combined, these ICs replace 41 transistors and 60 resistors for a total cost hovering under six bucks.

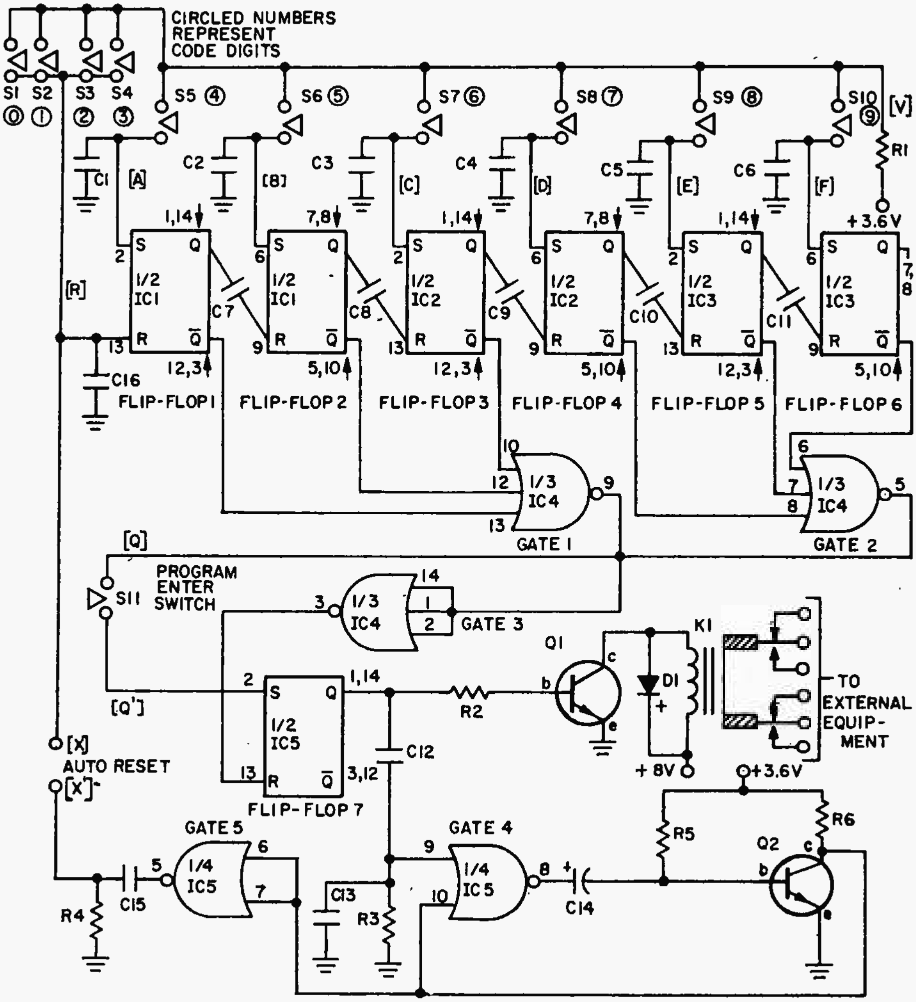
Before we tell you how to solder this or that part, and fasten down that gizmo, let's steal some build 'em time and take a good look at the real heart of the device, a basic NOR gate.

The NOR gate, short for NOT OR, is actually a simple device. When one, or all, of the gate's inputs receives a positive voltage (above 0.85 V in *DL*'s case), it merely sits like a bump on a log, refusing to pass a positive output. The gate's output only goes positive, or *high* (above 0.85 volt) when all inputs are *low*, or grounded (below 0.46 volt). Our figure shows a single 2-input NOR gate, its logic symbol, and equivalent schematic.

As useful as the basic NOR gate is by itself, it can be made to perform some neat electronic tricks, and even a couple of useful functions when several gates are interconnected together. Taking a look at our NOR circuit, you'll see a pair of gates cross-coupled to form a *Reset-Set* (RS) flip-flop. Unlike the simple Simon NOR gate we first



Follow this photo as parts placement layout guide. All wiring's underneath perfboard, point-to-point. Fuse F1 is partially hidden behind transformer T1; fuse holder's mounted to perfboard with 6-32 hardware. Wire, test power supply first.



Digitalock's flow diagram showing how code example 45-67-89 is wired. Bracketed letters A-F are connected to switches S1-10 in sequence, thereby determining code.

PARTS LIST FOR DIGITALOCK

C1-12, 15, 16—0.001-uF, 1000-VDC disc ceramic capacitor
C13—470-pF, 1000-VDC disc ceramic capacitor
C14, C18—250-uF, 6-VDC miniature electrolytic capacitor (Lafayette 34E85380 or equiv.)
D1—50-PIV, 1-A silicon diode (Motorola HEP-154 or equiv.)
IC1-3, 5—Quad 2-input NOR gate (Motorola MC724P)
IC4—Triple 3-input NOR gate (Motorola MC792P)
K1—Dpdt, 6-VDC subminiature relay (Potter & Brumfield KM11D or equiv.)
Q1, Q2—Npn silicon transistor, Motorola HEP-50 (Lafayette 19E54544)
R1—1500-ohm, ½-watt resistor
R2—470-ohm, ½-watt resistor
R3, R4—2200-ohm, ½-watt resistor
R5—100,000-ohm, ½-watt resistor (see text)
R6—1000-ohm, ½-watt resistor
S1-11—Spst push-to-make switch (Lafayette 99E62184)
TB1, TB2, TB3—7-point terminal strips (Lafayette 32E12206 or equiv.)
1—5 x 7 x 3-in. aluminum box (LMB 145 or equiv.)
1—2¾ x 3 x 4-in. cabinet (LMB 275N or equiv.)

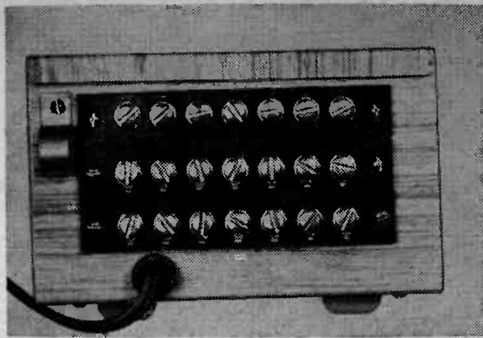
Misc.—Fuse holder for 3AG fuse, grommets, #6-32 hardware, line cord strain relief, line cord and plug, Vector H- or P-pattern perf-board, push-in terminals, solder, vinyl material, wire, etc.

saw, an RS flip-flop has a memory. It remembers which of its inputs, *Set* or *Reset*, last received a positive input.

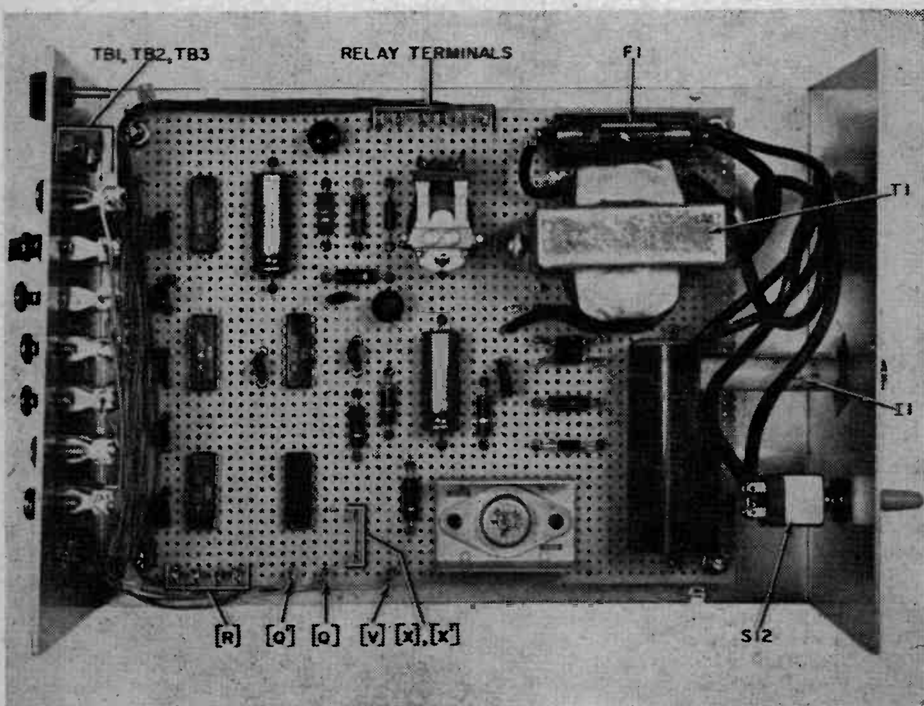
An RS flip-flop provides the user with two complimentary outputs. Called Q and $\overline{Q}$, one output is always in an opposite state to its sister output. For example, if the *Set* (S) input is momentarily driven with a positive current, the Q output will go to a positive state. It'll remain positive, even if you remove the input current source. That's what we mean when we say an RS flip-flop has a memory.

Now let's take this one step further. If a positive pulse is now applied to the *Reset* (R) input, the flip-flop switches states, so that now the $\overline{Q}$ output is high and the Q output low. Now that we understand the basic NOR gate and the *magna cum laude* RS flip-flop, we can go to the head of the class and take a look at DL's operation.

We Practice What We Preach. *DigitaLock's* operation really centers around flip-flops 1-6. Refer to our functional diagram to follow the action. Properly conditioning these inputs by driving them positive by your pushbutton combination, you'll find all the flip-flop's $\overline{Q}$ outputs will be in a *low* state. This condition is detected by gates G1, and 2, whose inputs are connected to the flip-flop's $\overline{Q}$ outputs. When the correct number sequence is entered by your switch combination, the output from gates G1 and 2 will go positive, eventually closing a relay which operates your external device.



Terminal strips TB1-3 can be lettered for identification of wires in both cable sets. Cable strap in left corner holds both 7-conductor cables in place.



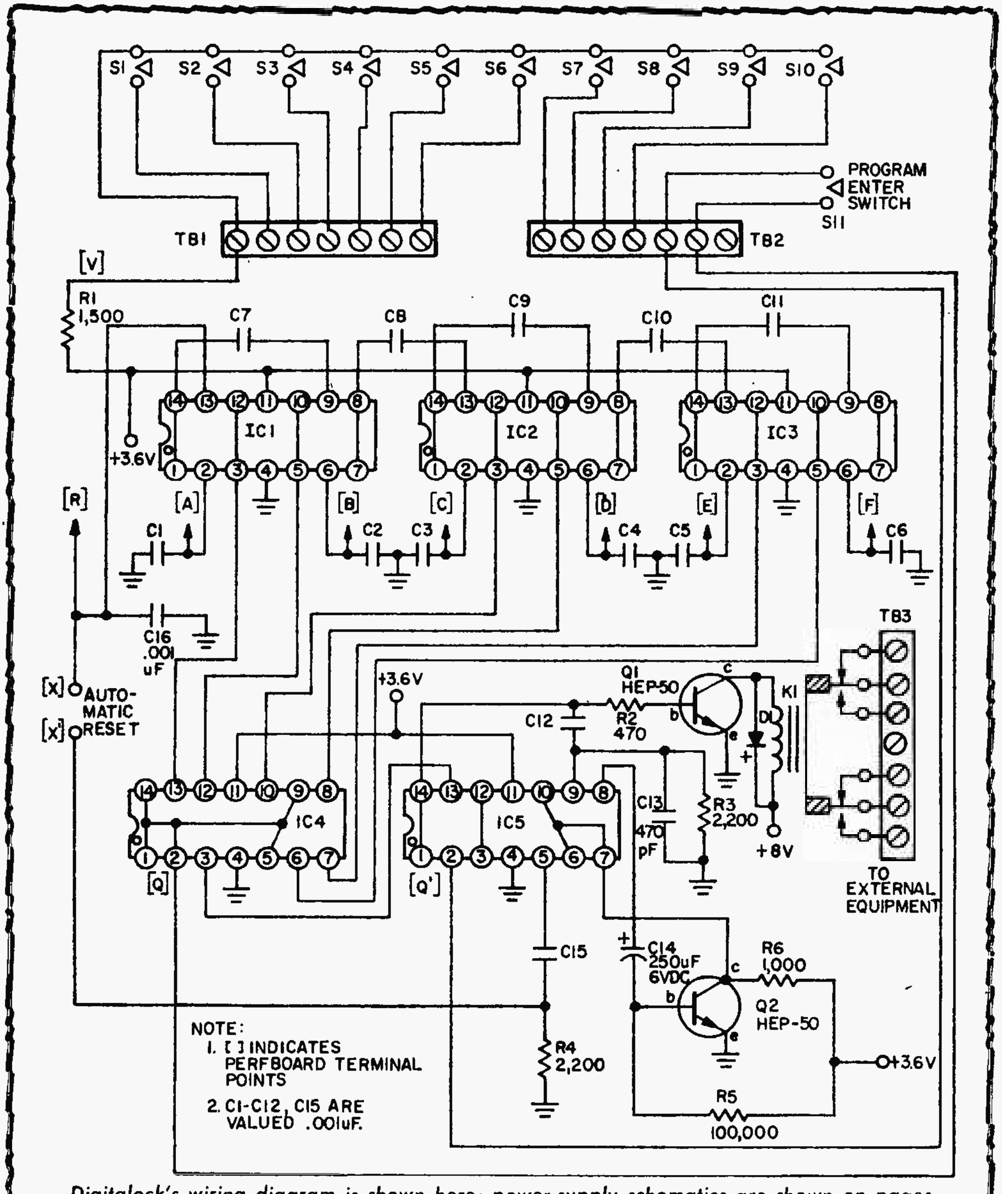
Perfboard terminal points are shown here, excepting points A-F, which were called out on page 63. Wires from all unused code digits terminate at terminal point R. Substitute spst switch for S12 if you don't build in standby battery pack feature.

Let's take another example. In our functional diagram, the correct combination, as shown, is: 45-67-89. This really means that switches S4 through S10 must be depressed *in that order* for the relay to work.

As you punch the correct buttons in sequence, each flip-flop is set, so its Q output goes high. This produces a positive pulse that is coupled to the *Reset* input of the next flip-flop, and drives that flip-flop's $\overline{Q}$ positive.

So, until flip-flops 1-6 have been driven positive in order, there will always be at least one flip-flop with its $\overline{Q}$ output remaining in a high state.

While any flip-flop $\overline{Q}$ outputs to gates G1 and G2 remain high, the gate's output will sit in a low condition. The lock remains closed. Safeguarding *DL* against accidentally opening doors 'n' safes, capacitors C1-6 and C16 bypass to ground switching transients



Digitalock's wiring diagram is shown here; power-supply schematics are shown on pages 66, 67. Two Belden type 8447 cables connect switches S1-11 with terminal strips TB1-2.

which could cause erratic operation of the flip-flops.

Okay, let's assume for the moment you've entered the correct combination. The output from gates G1, 2 will be positive. Depressing the optional *Program Enter* switch S11 will then set flip-flop 7. Flip-flop 7's Q output jumps to its high state and shoves positive current into relay driver transistor Q1.

Lo and behold, the relay K1 is energized! The relay's dpdt contacts are brought out through terminal strip TB3, and, in turn, control any external device or circuit you wish. Hanging in there like a faithful sheep dog, diode D1 protects transistor Q1 from breakdown voltages. These semiconductor-killing spikes are caused by the relay coil generating a reverse voltage whenever the coil is released.

When flip-flop 7's Q output goes high, it also triggers a monostable multivibrator consisting of gate G4 and transistor Q2. A monostable has two states, stable and untable. When triggered it switches from its stable state into its unstable state.

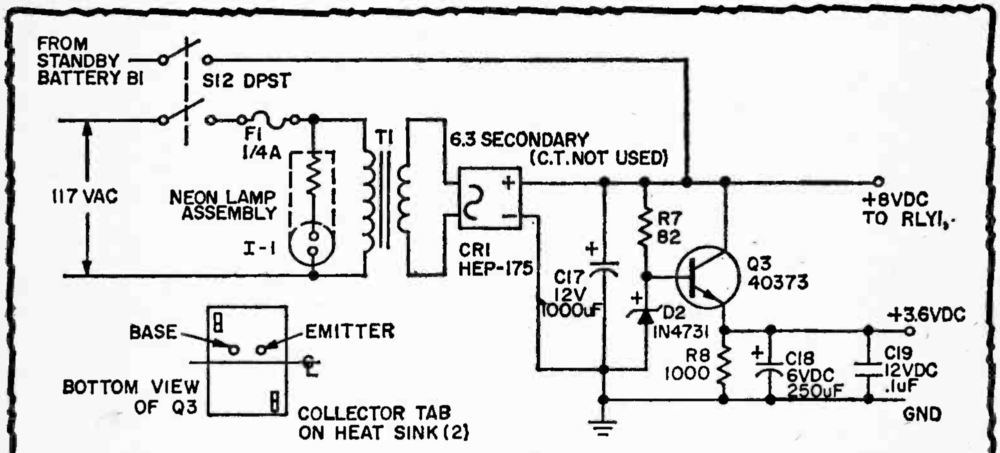
The amount of time that it spends in the unstable state is dependent on the RC time constants involved in its coupling network. Here, it's about 25 seconds, and is dependent on the values of capacitor C14 and resistor R5.

The monostable's output is fed to gate G5, lashed up as a simple inverter. If G5's input is high, its output is low. After the monostable flips back into its stable state, gate G5 shakes a leg, and, if terminals X and X′ are connected together, flip-flop 1 is automatically reset.

The $\bar{Q}$ output from flip-flop 1 does its positive thing, telling gate G1's output to swing low. Gate G3 picks up G1's output, inverts the signal, and supplies a positive voltage resetting flip-flop 7. Sounds like *DigitaLock's* circuit is busier than a one-armed paper hanger, but it's the most fool-proof way we know to de-energize K1.

Sometimes *DL's* auto-reset feature isn't a terribly important matter. By not connecting terminal points X and X′, its relay remains energized, allowing your external equipment to continue functioning. The circuit remains in this state until it's manually reset by depressing one of the switches *not* used to enter the combination. In our example, punching any switch labeled 1 through 4 (S1-S4) would de-activate *DigitaLock.*

Voltage for all integrated circuits amounts



PARTS LIST FOR DIGITALOCK POWER SUPPLY

C17—1000-uF, 12-VDC electrolytic capacitor (Lafayette 34E 75076 or equiv.)

C18—250-uF, 6-VDC miniature electrolytic capacitor (Lafayette 34E85380 or equiv.)

C19—0.1-uF, 12-VDC disc ceramic capacitor

CR1—50-PIV, 1-A full-wave rectifier module (Motorola HEP-175)

D2—4.3-V, 1-W, 10% Zener diode (Motorola 1N4731)

F1—¼-A, 3AG fuse

I1—Neon indicator lamp, amber lens, 117-VAC input, includes series resistor (Lafayette 34E5174 or equiv.)

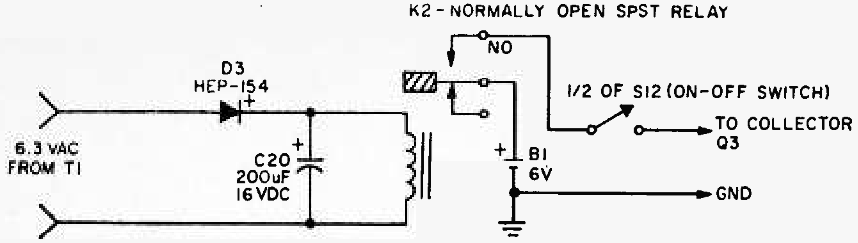
Q3—Npn silicon power transistor (RCA 40373)

R8—1000-ohm, ½-watt resistor

R7—82-ohm, ½-watt resistor

S12—Spst toggle switch (Lafayette 99E61624 or equiv.)

T1—Power transformer: 117-V, 50-60 Hz primary; 6.3-V @ 0.6 A secondary (Stancor P6465 or equiv.)



PARTS LIST FOR DIGITALOCK STANDBY POWER SUPPLY

B1—6-VDC, 4 D-size alkaline cells in series (Eveready E95BP or equiv.)
C20—200-µF, 16-VDC electrolytic capacitor (Lafayette 34E85562 or equiv.)
D3—50-PIV, 1-A silicon diode (Motorola HEP 154)
K2—Spst, 6-VDC relay (Potter & Brumfield RS5D or equiv.)

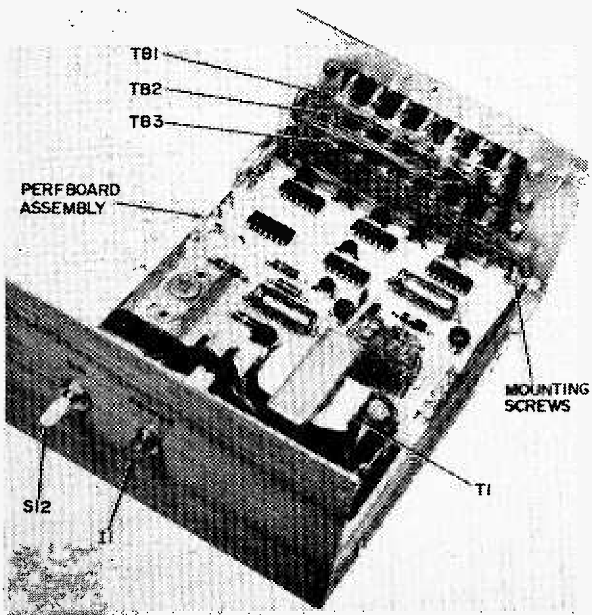
to a whopping plus 3.6 volts. This flea-power requirement is provided by a simple Zener-regulated, series-pass transistor supply. Transformer T1, a simple 6.3 VAC affair, sends its greetings to rectifier CR1.

The rectifier's output is filtered by capacitor C17. After Zener diode D2 regulates Q3's base voltage, the output volts appear at Q3's emitter and is sent to the ICs. Positive 8 volts is also supplied for the operation of transistor Q1 and K1.

Locking Down the Cabinetry. *DigitaLock's* mechanical layout can take any shape you desire. The author's layout shown serves best for most installations. As you can see, the device is built into two separate boxes. A small 2¾ x 3 x 4-in. cowl-shaped box houses the digit key sender. The control logic electronics find a home in a 3 x 5 x 7-in. box. Both containers are interconnected with a multiconductor cable.

Both prototype cases were covered with a vinyl contact material. The author thought that although the cases could have been spray painted, covering them with vinyl takes first place in the appearance department. Vinyl material needs no drying time, multiple coats, or special ventilation during application.

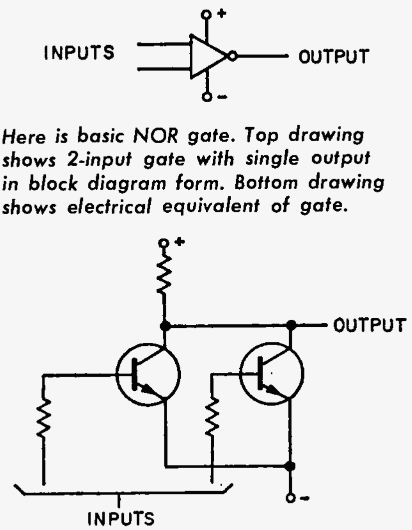
No matter what your outer covering preferences are, wash the case down with rubbing alcohol to remove surface dirt and oil film. This film will prevent any covering from forming a good, long-term bond with



This is what Digitalock should end up looking like. Mount perfboard assembly to chassis with 6-32 hardware. Use three nuts per screw; one nut fastens screw to chassis, other nuts hold perfboard to screw. Many variations on construction theme are possible with our DL. Switch S12, pilot-lamp assembly T1 can be mounted adjacent to terminal boards TB1-3. If you want to miniaturize DL, use two perfboard assemblies that are as wide as chassis is high. Mount both assemblies in vertical position with aluminum angle strips running along bottom of perfboard assemblies. This modification gives you room to mount switches S1-11 on chassis cover, if this modification of your DL warrants.

the aluminum surface of any box or chassis.

Should you go the scissor 'n' stick route, cover both case halves with a single section of material. Cut your vinyl pattern well oversize, and remove the protective paper backing. Apply it to each side of both cases. Fold it over the case's sides, trimming as needed with a sharp knife to remove excess material.



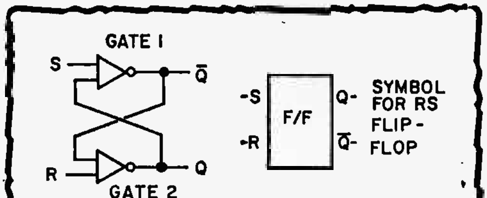
Here is basic NOR gate. Top drawing shows 2-input gate with single output in block diagram form. Bottom drawing shows electrical equivalent of gate.

Hold on podner, you're not finished yet! Press all those inevitable air bubbles out towards an edge, or puncture with a pin. Remove excess vinyl over the various holes and cutouts with your knife.

Dike Doings. To simplify *DigitaLock's* construction, you build and test the device in several stages. Most components (excepting capacitors C1, C6, C16) are mounted to your perfboard's topside. Vector H or P-pattern perforated board is particularly easy to work with; the hole pattern fits the integrated circuits' lead arrangement.

The author found miniature eyelets and push-in terminals were in his economic ball park, but you'll probably want to work solely with push-in terminals. Point-to-point wiring with #26 gauge wire was used throughout.

The first section you'll tackle is the power supply. Mount the transformer and fuse block with 6-32 hardware, then wire them as shown in our schematic wiring diagram.



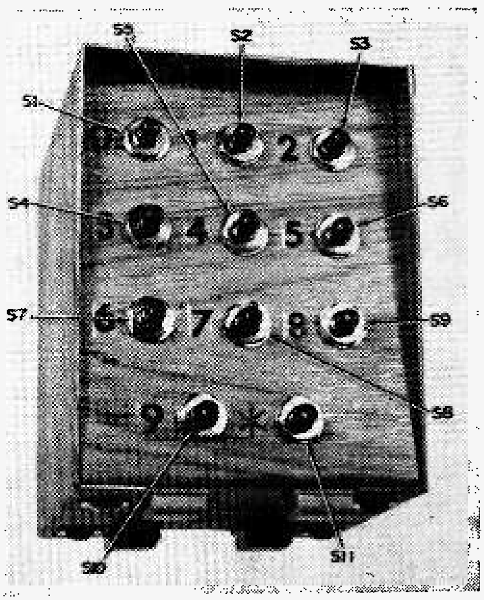
Pair of NOR gates cross-coupled form flip-flop with memory for last input.

The transistor specified for Q3 comes with a heat sink pre-attached. If your spare-parts box blesses you with a different type of transistor, make sure it's capable of dissipating at least 6 watts.

After the power supply wiring has been completed, and you've checked it for shorts, connect 117 VAC to the input. Eyeballing your VOM, you should see 3.6 volts on Q3's emitter, and 6 to 8 volts on its collector.

With the power supply squared away, we'll wire up flip-flops 1-6 and gates G1-3. You can lickety-split your way through your wiring chores if you solder jumpers across pins 1, 14; 3, 12; 5, 10; and 7, 8 on appropriate ICs. Wire the power and ground bus to pins 11 and 4, respectively, on all ICs. After you've soldered all coupling and bypass capacitors in place, connect the *Set* inputs of flip-flops 1-6 to terminals A-G.

(Continued on page 99)



Note rubber feet on bottom of switch box. DL's switch box can be waterproofed with Silastic compound if mounted out of house.

Goblins and spooks, beware! CBers and Hams are united!

by Lynn W. Bennett

It's Hallowe'en in Huntsville, Alabama!

An innocuous, privately-owned Oldsmobile, lights out, is parked unobtrusively on an elm-shaded street. Two men are in the front seat; one holds a mike.

Kids troop past in twos, threes, half a dozen - - - pirates, hobos, spacemen, ghosts and ghouls - - - - kids of early grammar school age, each clutching his treasure-laden bag of treats barely clear of the sidewalk.

The two men in the inconspicuous car comment occasionally on the cleverness of the costumes as they observe a scene being played in the thousands of American cities and towns. A CB transceiver beneath the dash is tuned low.

Another small band of outlandishly dressed kids passes.

Now, suddenly, the man holding the mike nudges his partner, points to four larger figures following stealthily in the shadows. These are not little "spooks," they are in the 18-19 age group; they carry no shopping bags, their "costumes" are black jackets and tight pants. They seem unduly interested in the younger kids as they lurk in the shadows marked only by glowing cigarette tips while the band of trick or treaters extracts tribute from an affable housewife under a porch light.

The word "stalking" hits both men in the car simultaneously. Words pour into the microphone. Huntsville's CB club, the Emergency Citizen's Band Monitors, Inc., "Spook Patrol" is in action.

CB in Action. At the club's headquarters (KOM6753) atop an 11-story office building in central Huntsville the message of potential trouble is received by ECBM's duty operator, relayed by telephone to police headquarters with, "This is REACT calling—", to clear the way. A radio-dispatched police cruiser is on the scene in minutes. The stalkers, who had never noticed ECBM's mobile unit under the elms, react to the sudden appearance of the police car by fading away down a side street. A possible unsavory incident has been averted by volunteer CBers.

(Turn page)

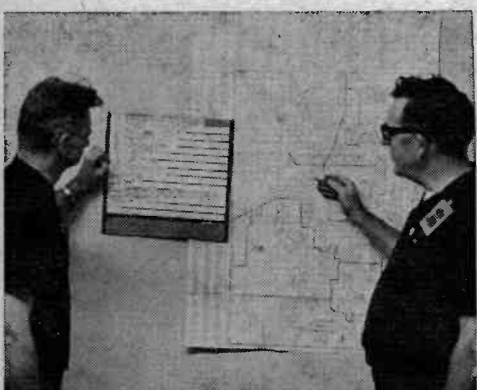
SPOOK PATROL

Augmentation of the police department by a civic-minded radio club is not new in Huntsville. The Spook Patrol was started about eight years ago by the Huntsville Amateur Radio Club, a HAM organization. This year's venture was a combined effort of the HARC, and the Emergency Citizens' Band Monitors. It was a very effective melange of HAM and CB. It is already scheduled for next Hallowe'en and will be listed in ECBM's annual publication, *Radio Calls,* on the Special Events page.

What a Combination! The Hams and CBers found themselves in the same bed as the result of a suggestion by a member of the Ham club who had joined the CB organization. He quickly learned that CB was ideal for fast, accurate communication within Huntsville's 107 square miles. He recalled the Hallowe'ens when he and his fellow Hams could reach halfway across the nation, but had difficulty reading loud and clear halfway across town.

In setting up Operation Spook Patrol, representatives of both clubs combined to offer their services to the police department through a member of ECBM, who is also Huntsville's Traffic Engineer. The town of 148,000 residents was divided into eight operational zones based roughly on ZIP code areas. A total of 35 mobile units was mustered—20 from the CB club, 15 from the Ham organization. These were assigned to the eight zones in accordance with population density and history of vandalism from previous Spook Patrol operations. In outlying "low-incidence" zones, one or two mobiles were assigned; in populous "high-incidence" zones as many as five mobiles went on patrol. When an area became more "active" than was anticipated, mobile units were shifted around to provide greater coverage where it was needed.

Mobile unit (above) calls Operation Spook Patrol's console operator (below) Tom Overall, KOM4664. Console is equipped with two FM (152-174 MHz) receivers to monitor police.



Ken Cowley, KQM6634 (left) and Ty Wilkinson scan a map of the Huntsville area and duty board listing all volunteer CB units.

It was emphasized by the police department that the Spook Patrol volunteers would not be armed, and would not actively attempt to stop vandalism or other unlawful acts. It was realized that their most effective weapon was a microphone and a good transceiver. These enabled them to virtual-

(Continued on page 101)

Science and Electronics LAB CHECK

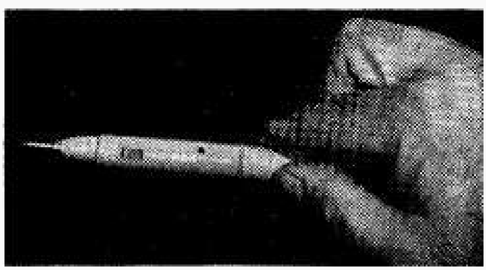
RCA MODEL WO-505A
5-in., Solid-State
Technician's Oscilloscope

FOR almost 20 years, RCA's 5-in. oscilloscope has been the hobbyist's and technician's favorite test scope. That popularity's heaped on an instrument all because of a simple device. The tech sees his measured voltage displayed on the CRT face, and he interprets his measurement with a direct-reading graticule position directly in front of the CRT proper. This seemingly insignificant feature allows the technician to eyeball his input voltage directly, just as he would with a voltmeter.

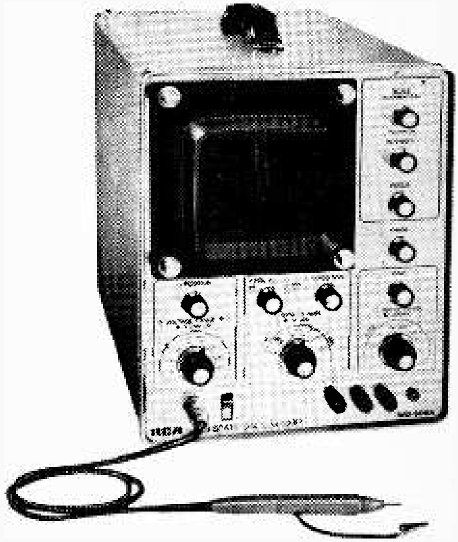
Without an RCA scope working for him, he has to count centimeters, or units of voltage, from an uncalibrated graticule—and then multiply this visual interpretation by a vertical attenuator voltage multiply factor. Under these conditions, Murphy's Law lurks just around the corner.

Before RCA went to work on their new scope, they sat down and decided which time-saving features were worth retaining from their previous scope offerings. After some laboratory breadboarding, they unveiled their latest scope. Called the WO-505A, it's all solid state. But more important, this scope retains the direct-reading graticule feature.

Why their Graticule Makes It. RCA's scope graticule contains two separate *vertical* channel (V) calibration scales. One scale



Dual-action probe enables you to measure signals from DC to 500 kHz simply by flipping switch located on probe's body.



reads from 0 to 15, while the other scale runs from 0 to 5. The V attenuator is directly calibrated from .05 to 150 volts, thanks to the graticule's read-out feature.

You work with the appropriate graticule scale by matching the V attenuator setting to its corresponding scale. For example, if you've set the V attenuator to read 5 volts, the 0-5 scale represents 5 volts full scale. Suppose your trace falls between 0 and 4.3. Now, the signal voltage is 4.3 volts P-P. Similarly, if the V attenuator is set to 150, and the trace falls between 0 and 62 on the 0 to 15 scale, you're looking at a 62 volts P-P signal voltage. Easy, isn't it?

On the outside, the WO-505A resembles any other scope. You're presented with the usual control lineup: *Intensity, Focus,* and *Phase. Horizontal* and *Vertical* centering is also accounted for on the front panel, as is *scale illumination,* fine and coarse *sweep* frequency range, *sync* selector and horizontal *gain.* Last, but not least, you'll find a stepped *vertical* attenuator and infinitely-variable vertical *gain* control.

You'll also run across a *Vertical Polarity* control. Not usually seen on a service-grade scope, this switch can flip an input signal's polarity so that negative-going pulses are displayed right side up. The last position this control provides for is direct connection to

LAB CHECK

the CRT plates without need to fumble with electrically hot connecting jumpers.

Even though the WO-505A is solid state, its 5-in. CRT still dictates the overall size of the instrument. But all things considered, the name of RCA's 11⅜ x 9 x 16½-in. game is portability.

What's Inside. Now let's go inside WO-505A to see how it works. The sweep range is spread between 10 Hz and 1 MHz in 6 switch-selected steps. Two additional switch positions provide 30-Hz and 7875-Hz sweep frequencies for TV servicing. RCA tried several sweep circuits for this scope, but finally decided upon their tried 'n' true free-running (or recurrent) sweep generation system.

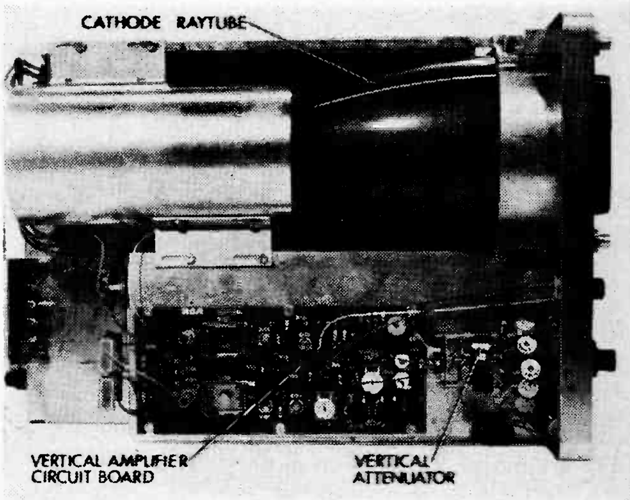
There's no stinting in the bandwidth department. Vertical-input frequency response is rated ±1 dB from DC to 5 MHz, but the WO-505A's usable to 8 MHz. You need this extra bandwidth when you're probing about in ham-radio gear, or a color TV's video IF stage.

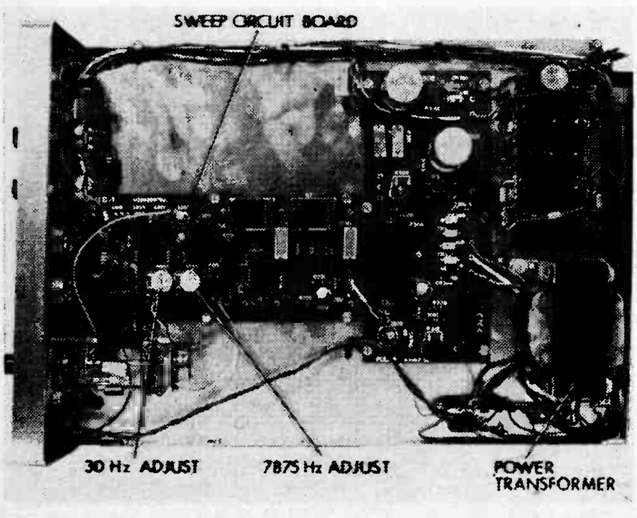
Input to the scope's V attenuator is either direct for DC signals, or through a switch-selected capacitor for AC voltages. Frequency response in the AC mode starts from 5 Hz and works its way up to 8 MHz.

The vertical input is terminated through a BNC connector. You'll find five-way binding posts terminating the external-sync/horizontal input, Ground, and 5-V P-P Calibration square wave functions. Direct plate connections to the CRT, and Z-axis (CRT control grid) binding posts are on the scope's rear apron.

Sitting behind the business end of the BNC connector is the V attenuator. It's calibrated with the aid of the built-in 5-V square-wave calibration voltage. Merely crank the V attenuator up to its 5-V position, then touch the input probe to the *Calibrate* binding post. Adjust the vertical-gain control 'til you see the trace just touch both 0 and 5 graticule markings. The V attenuator is now calibrated for all voltage ranges.

(Continued on page 100)





Top photo shows how CRT's neck is shielded against stray magnetic fields. Vertical setup of chassis saves space, also makes it easier to service PC board circuit modules. Trimmer capacitors on vertical attenuator are easy to get to for servicing. Left photo shows sweep-circuit board, power supply board next to it. Power transformer's shielded for minimum 60-Hz radiation. Note that all potentiometers are easily reached; 30-, 7875-Hz frequency-adjust pots are knurled so you can adjust both units by hand if necessary.

Confessions of a solid-state circuit sleuth

or—how beautiful life can be when you build our continuity tester

by John McNarney

Most recently designed VOMs need to have built-in electronic movement protection. It's meant to guard the fragile, taut-band meter movement from the aftermath of accidentally trying to measure volts when the meter's selector knob tells you to read current. But what about those day-to-day thumps, thuds, and jars accumulated while your VOM tries living in a tool box? Or, how 'bout your VOM taking an occasional pendulum-like swing from the ends of your test leads. Followed, of course, by a fast trip to the floor when both leads jerk from their sockets.

Meter fatalities may not always be so spectacular, but it's another matter to an ever-famished wallet. And when a VOM finds itself hung across everything, from the switching circuit of the attic fan to the field coil on the sump pump, accidents are sure to occur a lot more frequently. For those around-the-house jobs where you've only got to check the circuit's continuity, we introduce you to *CON-TEST*, our faceless, scaleless continuity tester.

Our *CON-TEST* won't give you a voltage, current, or resistance *reading*. But it can surely check vacuum-tube filaments, auto fuses, power supply transformers and chokes, and heating elements from electric broilers or hotplates. Fact is, it's sensitive enough to handle most point-to-point testing where element continuity, rather than an exact resistance reading, is your unknown variable.

Since *CON-TEST* has no meter movement to damage, it's rugged enough to survive in a handyman's tool box. And with this beeper in your pocket, you avoid the need to juggle a delicate meter and two probes on your knee while crouching behind the kitchen range or balanced on a stepladder.

Budding radio amateurs also take to our tester, and for good reason. By connecting a key in place of the test leads, our ham has a very realistic practice oscillator for learning code! Between wrist-twister sessions, and after he's earned his ticket, our novice happily finds that his tester leads a double life as it earns its keep on a variety of household maintainence chores.

Total cost is less than $4.00, and it can be assembled in an evening with no danger of missing the late show.

Cheapy Beepy. *CON-TEST* (for Continuity Tester, see?) keeps costs to a minimum by having its panel serve as a chassis. Starting with the speaker, all parts except both transistors, and the capacitor, can be assembled directly on the front panel. The speaker opening was cut for a 2-in. speaker; it's about 1-in. high by 1½-in. wide.

The author home-brewed his battery holder from light aluminum stock and shaped to enclose a Burgess 2U6, or equivalent, 9-V transistor battery. No attempt was made to search the spare parts collection for subminiature parts. An alternate subminiature potentiometer with *on/off* switch is included in the Parts List. This pot eliminates

Confessions

cutting 'n' filing chores for the slide switch.

Both transistors and the 0.02-uF capacitor are mounted on a board approximately 1¾ x 1¼ in. cut from ⅛-in. masonite or hardboard stock. This assembly is supported on two speaker bolts. If you don't have masonite or hardboard in your workshop, old reliable perfboard makes our construction scene just as well.

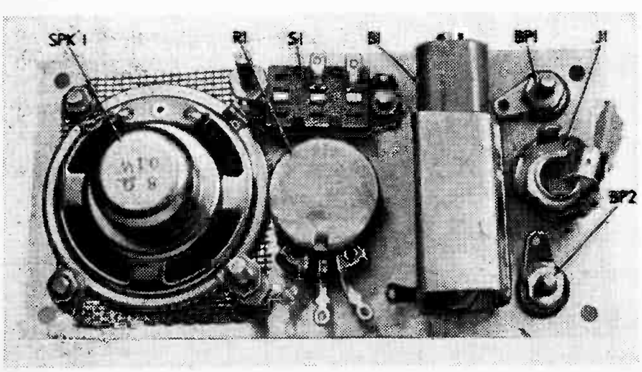
Your choice of transistors is not critical. For transistor Q1, the author found a bargain-basement 2N170 to his liking. And after thumbing through an electronics parts catalog, he tried several universal npn replacements jobs from those 20-for-a-buck assortment bags, with equally good results. Transistor Q2 can be any pnp power pusher, so long as it's happy with a 9- or 12-volt supply. In spite of the awkward size of Q2's TO-36 case, we found the 2N173 equivalent shown worked AOK in this circuit. The alternates given in the Parts List for Q2 would be just as satisfactory; any transistor enclosed in a TO-3 package would be smaller and easier to fit.

Log Taper Turn On. Resistor R1's a you-seen-'em-once-you've-seen-them-all ½-watt carbon potentiometer. Controlling circuit feedback, this 1-megger helps produce a low audio tone from the speaker, with minimum drain on the battery. Obviously you'll need less resistance as the battery ages, or if you're testing a high-resistance circuit. While your family's ham cures his code by using our *CON-TEST* as a practice oscillator, potentiometer R1 serves as pitch control. Don't be too surprised if his speed sweetens considerably, for a very realistic effect can be produced by our baby beeper!

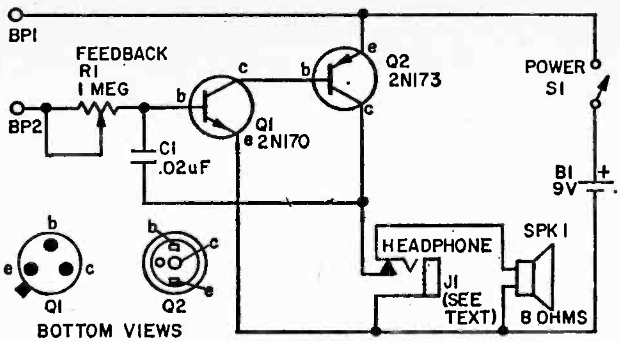
Generations of budding hams have relied upon publications made available by The American Radio Relay League. One particular manual, entitled "Learning The Radiotelegraph Code" is perfect companion for CON-TEST when you use it as code practice oscillator. After you earn your ticket, CON-TEST'll earn its keep in your shack.

It was found that small binding posts work better in place of the usual jacks, as they lock solidly on the test leads. They're also more convenient for inserting connecting wires from a Morse Code key.

Wire Rapping. Needless to say, the wiring is straightforward. You can get a detailed picture from our schematic. The battery's negative side, a speaker terminal, one side of the optional jack, and the emitter of Q1



Almost all parts are mounted to front panel. Only transistors Q1-2, capacitor C1 sit on masonite board. Board's attached to front panel with 1½-in. screws which also hold speaker, grille to front panel. Exercise caution when mounting binding posts BP1-2 to panel; take care not to crack plastic insulators as you tighten down mounting nuts with hex wrench.



PARTS LIST FOR CON-TEST

B1—9-V Battery (Burgess 2U6 or equiv.)
BP1, 2—Binding posts, one red, one black (Lafayette 99E62333 or equiv.)
C1—.02 µF, 50 VDC disc capacitor (Lafayette 32E09491 or equiv.)
J1—Phone jack, closed-circuit (Lafayette 34E60668 or equiv.)
Q1—Transistor, npn replacement type (Lafayette 19E27029 or equiv.)
Q2—Transistor, pnp power replacement type (Lafayette 19E15032 or equiv.)
R1—1,000,000-ohm, carbon potentiometer (Lafayette 99E63521 or equiv.)
S1—Slide switch, spst (Lafayette 34E37035 or equiv.)
SPK1—8-ohm, 2-in. speaker (Lafayette 99E60630 or equiv.)
1—Case, 5⅛ x 2⅝ x 1⅝-in. (Lafayette 99E80756 or equiv.)

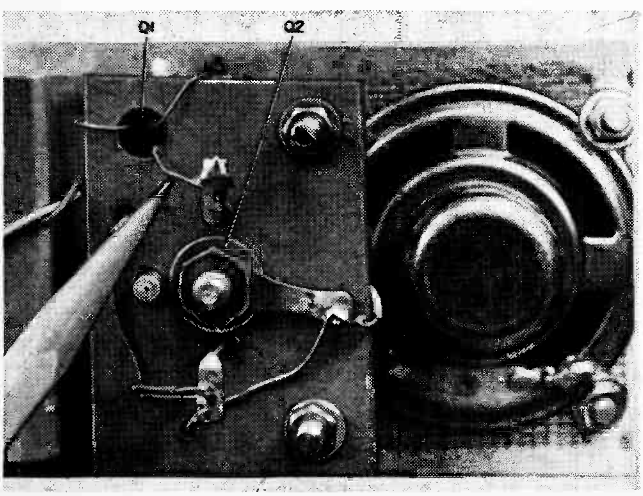
Misc.—Hardware, solder, wire grille, solder lugs, wire, etc.

are all connected to the front panel. If your ear lobes don't take kindly to headphones, the phone jack can be omitted.

The remaining speaker terminal's connected directly to Q2's collector terminal. Power transistor Q2, and the capacitor, can be wedded to your choice of board before uniting this assembly with the panel. Metal-to-metal contact between Q2's case and the panel or potentiometer should be avoided.

As you can see from our photo, all connections excepting one capacitor lead are easily accessible, and can be soldered with the circuit board in place. Transistor Q1 and the battery snap were installed last because their leads are the most fragile.

The current you induce through a component being tested will run between .02 mA and .06 mA. You should be able to wring at least 30 hours of life from the battery as drain will average about 7 mA throughout its life. If you can bear to lose a little audio, your *CON-TEST* will operate with as little as 5 volts from Battery B1. ■



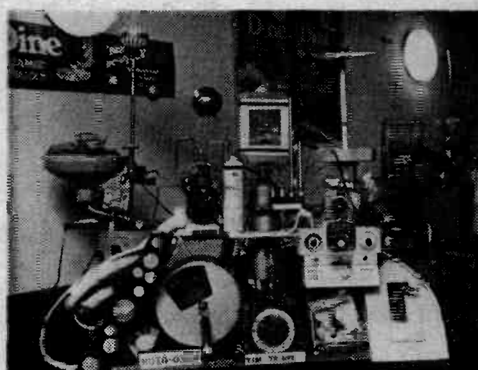
With careful lead placement, transistor Q1 can be mounted to masonite panel with single ¼-in. hole. Pencil's pointing to Q1's collector lead; it is soldered directly to base pin of transistor Q2. Grasp leads with longnose pliers while soldering transistors in place since heat could easily ruin them. Transistor Q2 is bolted to board. Solder lug underneath bolt is Q2's collector lead. Make sure it doesn't touch front panel or emitter lug just below it.

MASHED POTATOES The Hard Way

by Joe Gronk

The machine shown above gets its power from a minied-miss whenever battery power failed—which occurred often.

As she pedaled around, false teeth (left) chomped away at a spud — the first step in the simulated process. The machine awarded first prize (below) used conventional power — how dull!



It's easy to sink your teeth into mashed potatoes, but did you ever imagine how they were prepared commercially? Well, one London concern ran a contest, supplied the recipe for their brand of instant mashed potatoes, and invited all comers to design a machine which appeared to duplicate the factory's process in a bizarre way. More than 800 people entered their machines in the competition. Before long the entries were flooding in and after a preliminary heat, 22 machines were selected for final judging. The judge was Rowland Emett—himself no mean designer and the man responsible for the fantasmagorical car that starred in the film "Chitty Chitty Bang Bang."

First prize was awarded to 18-year-old Michael Haynes whose spectacular construction made great use of borrowed vacuum cleaners and typewriter motors. One entry was made from five bicycles and was too large to fit into the exhibition hall. Some of the machines are on permanent display at Dornay Foods, King's Lynn, Norfolk, England. ■

VOLUME 52, PART 5

WHITE'S RADIO LOG

An up-to-date Directory of North American AM, FM, and TV Stations, including special sections on World-Wide Shortwave Stations and Emergency Stations for Selected Areas

WHITE'S RADIO LOG CONTENTS FOR 1969-1970

WHITE'S RADIO LOG

U. S. AM Stations by Call Letters

Call	Location	kHz
KAAA	Kingman, Ariz	1230
KAAY	Little Rock, Ark.	1090
KABC	Los Angeles, Calif.	790
KABH	Midland, Tex.	1510
KABI	Abilene, Kans.	1560
KABL	Oakland, Calif.	960
KABQ	Albuquerque, N.M.	1350
KABR	Aberdeen, S.Dak.	1420
KACE	Riverside, Calif.	1570
KACI	The Dalles, Oreg.	1300
KACL	Santa Barbara, Cal.	1290
KACT	Andrews, Tex.	1360
KACY	Port Hueneme, Calif.	1520
KADA	Ada, Okla.	1230
KADL	Pine Bluff, Ark.	1270
KADO	Marshall, Tex.	1410
KADS	Elk City, Okla.	1240
KAFE	Sante Fe, N.M.	810
KAFF	Flagstaff, Ariz.	930
KAFY	Bakersfield, Calif.	550
KAGE	Winona, Minn.	1380
KAGH	Crossett, Ark.	800
KAGI	Grants Pass, Oreg.	930
KAGO	Klamath Falls, Oreg.	1150
KAGT	Anacortes, Wash.	1340
KAHI	Auburn, Calif.	950
KAHU	Waipahu, Hawaii	940
KAIM	Honolulu, Hawaii	870
KAIN	Nampa, Ida.	1340
KAIR	Tucson, Ariz.	1490
KAJN	Crowley, La.	1560
KAJO	Grants Pass, Oreg.	1270
KAKC	Tulsa, Okla.	970
KAKE	Wichita, Kan.	1240
KALB	Alexandria, La.	580
KALE	Richland, Wash.	960
KALG	Alamogordo, N.Mex.	1230
KALI	San Gabriel, Cal.	1430
KALL	Salt Lake City, Utah	910
KALM	Thayer, Mo.	1290
KALN	Iola, Kan.	1370
KALO	Little Rock, Ark.	1250
KALT	Atlanta, Tex.	900
KALV	Alva, Okla.	1430
KAMD	Camden, Ark.	910
KAMI	Cozad, Neb.	1580
KAML	Kenedy-Karnes City, Tex.	990
KAMO	Rogers, Ark.	1390
KAMP	El Centro, Calif.	1430
KAMX	Albuquerque, N.M.	1520
KANA	Anaconda, Mont.	580
KAND	Corsicana, Tex.	1340
KANE	New Iberia, La.	1240
KANI	Wharton, Tex.	1500
KANN	Ogden, Utah	1090
KANO	Anoka, Minn.	1470
KANS	Larned, Kan.	1510
KAOH	Duluth, Minn.	1390
KAOK	Lake Charles, La.	1400
KAOL	Carrollton, Mo.	1430
KAOR	Oroville, Calif.	1340
KAPA	Raymond, Wash.	1340
KAPB	Marksville, La.	1370
KAPE	San Antonio, Tex.	1480
KAPJ	Pueblo, Colo.	690
KAPR	Douglas, Ariz.	930
KAPS	Mt. Vernon, Wash.	1470
KAPT	Salem, Ore.	1220
KAPY	Port Angeles, Wash.	1290
KARE	Atchison, Kan.	1470
KARI	Blaine, Wash.	550
KARK	Little Rock, Ark.	920
KARM	Fresno, Calif.	1430
KARR	Great Falls, Mont.	1400
KARS	Belen, N.M.	860
KART	Jerome, Idaho	1400
KARV	Russellville, Ark.	1490
KARY	Prosser, Wash.	1310
KASA	Phoenix, Ariz.	1540
KASH	Eugene, Ore.	1600
KASI	Ames, Iowa	1430
KASL	Newcastle, Wyo.	1240
KASM	Albany, Minn.	1150
KASO	Minden, La.	1240
KAST	Astoria, Ore.	1370
KASY	Auburn, Wash.	1220
KATA	Areata, Calif.	1340
KATE	Albert Lea, Minn.	1450
KATI	Casper, Wyo.	1400
KATL	Miles City, Mont.	1340
KATN	Boise, Ida.	950
KATO	Safford, Ariz.	1230
KATQ	Texarkana, Tex.	940
KATR	Eugene, Ore.	1320
KATY	San Luis Obispo, Cal.	1340
KATZ	St. Louis, Mo.	1600
KAUS	Austin, Minn.	1480
KAVA	Burney, Cal.	1450
KAVE	Carlsbad, N.Mex.	1240
KAVI	Rocky Ford, Colo.	1320

Call	Location	kHz
KAVL	Lancaster, Calif.	610
KAVR	Apple Valley, Calif.	960
KAWA	Waco-Marlin, Tex.	1010
KAWC	Yuma, Ariz.	1320
KAWL	York, Neb.	1370
KAWT	Douglas, Ariz.	1450
KAWW	Heber Springs, Ark.	1370
KAYC	Beaumont, Tex.	1450
KAYE	Puyallup, Wash.	1450
KAYG	Lakewood, Wash.	1480
KAYL	Storm Lake, Iowa	990
KAYO	Seattle, Wash.	1150
KAYQ	Kansas City, Mo.	1190
KAYS	Hays, Kans.	1400
KAYT	Rupert, Idaho	970
KAZA	Gilroy, Cal.	1290
KBAB	Indianola, Iowa	1490
KBAD	Carlsbad, N.M.	740
KBAL	San Saba, Tex.	1410
KBAM	Longview, Wash.	1270
KBAN	Bowie, Tex.	1410
KBAR	Burley, Idaho	1230
KBAT	San Antonio, Tex.	680
KBBA	Benton, Ark.	690
KBBB	Borger, Tex.	1600
KBBC	Centerville, Utah	1600
KBBO	Yakima, Wash.	1390
KBBQ	Burbank, Cal.	1500
KBBR	North Bend, Oreg.	1340
KBBS	Buffalo, Wyo.	1450
KBCH	Oceanlake, Oreg.	1380
KBCL	Shreveport, La.	1220
KBEA	Mission, Kans.	1480
KBEC	Waxahachie, Tex.	1390
KBEE	Modesto, Calif.	970
KBEL	Idabel, Okla.	1240
KBEN	Carrizo Sprgs., Tex.	1450
KBER	San Antonio, Tex.	1150
KBEW	Blue Earth, Minn	1560
KBFS	Belle Fourche, S.Dak.	1450
KBFW	Bellingham, Wash.	930
KBGH	Memphis, Tex.	1130
KBGN	Caldwell, Idaho	910
KBGO	Waco, Tex.	1580
KBHB	Sturgis, S. D.	810
KBHC	Nashville, Ark.	1260
KBHM	Branson, Mo.	1220
KBHS	Hot Springs, Ark.	590
KBIB	Monette, Ark.	1560
KBIF	Fresno, Calif.	900
KBIG	Avalon, Cal.	740
KBIL	Liberty, Mo.	1140
KBIM	Roswell, N.Mex.	910
KBIS	Bakersfield, Calif.	970
KBIX	Muskogee, Okla.	1490
KBJM	Lemmon, S.D.	1400
KBJS	Sallisaw, Okla.	1510
KBIZ	Ottuwa, Iowa	1240
KBJS	Sallisaw, Mich.	1510
KBJT	Fordyce, Ark.	1570
KBKR	Baker, Oreg.	1490
KBKW	Aberdeen, Wash.	1450
KBLC	Lakeport, Cal.	1270
KBLE	Seattle, Wash.	1050
KBLF	Red Bluff, Calif.	1490
KBLI	Blackfoot, Idaho	690
KBLL	Helena, Mont.	1240
KBLR	Bolivar, Mo.	1130
KBLU	Yuma, Ariz.	560
KBLW	Logan, Utah	1390
KBLY	Gold Beach, Oreg.	1220
KBMI	Henderson, Nev.	1400
KBMN	Bozeman, Mont.	1230
KBMO	Benson, Minn.	1290
KBMR	Bismarck, N. D.	1350
KBMW	Wahpeton, N.D.-Breckenridge, Minn.	1450
KBMY	Billings, Mont.	1240
KBND	Bend, Oreg.	1110
KBOA	Kennett, Mo.	830
KBOE	Oskaloosa, Iowa	740
KBOI	Boise, Ida.	670
KBOK	Malvern, Ark.	1310
KBOL	Boulder, Colo.	1490
KBOM	Bismark-Mandan,	1460
	N.Dak.	1270
KBON	Omaha, Nebr.	1490
KBOP	Pleasanton, Tex.	1380
KBOR	Brownsville, Tex.	1600
KBOW	Butte, Mont.	550
KBOX	Dallas, Tex.	1480
KBOY	Medford, Oreg.	730
KBPS	Portland, Oreg.	1450
KBRB	Ainsworth, Neb.	1400
KBRC	Mt. Vernon, Wash.	1420
KBRF	Fergus Falls, Minn.	1250
KBRI	Brinkley, Ark.	1570
KBRK	Brookings, S.Dak.	1430
KBRL	McCook, Nebr.	1300
KBRN	Brighton, Colo.	800
KBRO	Bremerton, Wash.	1490
KBRR	Leadville, Colo.	1230
KBRS	Springdale, Ark.	1340
KBRV	Soda Springs, Ida.	790
KBRX	O'Neill, Nebr.	1350
KBRZ	Freeport, Texas	1460
KBSF	Springhill, La.	1460
KBSN	Crane, Tex.	970
KBST	Big Spring, Tex.	1490

Call	Location	kHz
KBTA	Batesville, Ark.	1340
KBTC	Houston, Mo.	1250
KBTM	Jonesboro, Ark.	1230
KBTN	Neosho, Mo.	1420
KBTO	El Dorado, Kans.	1360
KBTR	Denver, Colo.	710
KBUB	Sparks, Nev.	1270
KBUC	San Antonio, Tex.	1310
KBUD	Athens, Tex.	1410
KBUH	Brigham City, Utah	800
KBUN	Bemidji, Minn.	1450
KBUR	Burlington, Iowa	1490
KBUS	Mexia, Tex.	1590
KBUY	Ft. Worth, Tex.	1540
KBUZ	Mesa, Ariz.	1310
KBVM	Lancaster, Calif.	1380
KBWD	Brownwod, Tex.	1380
KBXM	Kennett, Mo.	1540
KBYE	Okla. City, Okla.	890
KBYG	Big Springs, Tex.	1400
KBYP	Shamrock, Tex.	1580
KBYR	Anchorage, Alaska	1270
KBZB	Odessa, Tex.	920
KBZY	Salem, Oreg.	1490
KBZZ	LaJunta, Colo.	1400
KCAB	Dardanelle, Ark.	980
KCAC	Phoenix, Ariz.	1010
KCAD	Abilene, Tex.	1560
KCAL	Redlands, Calif.	1410
KCAM	Glennallen, Alaska	790
KCAN	Canyon, Tex.	1550
KCAP	Helena, Mont.	1340
KCAR	Clarksville, Tex.	1350
KCAS	Slaton, Tex.	1050
KCAT	Pine Bluff, Ark.	1530
KCAW	Port Arthur, Tex.	1510
KCBC	Des Moines, Iowa	1390
KCBD	Lubbock, Tex.	1590
KCBN	Reno, Nev.	1230
KCBQ	San Diego, Calif.	1170
KCBS	San Fran., Calif.	740
KCCB	Corning, Ark.	1260
KCCC	Carlsbad, N.M.	930
KCCL	Paris, Ark.	1480
KCCN	Honolulu, Hawaii	1420
KCCO	Lawton, Okla.	1050
KCCR	Pierre, S. D.	1240
KCCT	Corpus Christi, Tex.	1150
KCCV	Independence, Mo.	1510
KCEE	Tucson, Ariz.	790
KCEY	Turlock, Cal.	1390
KCFA	Spokane, Wash.	1330
KCFH	Cuero, Tex.	1600
KCFI	Cedar Falls, Iowa	1250
KCGO	Cheyenne, Wyo.	1530
KCHA	Charles City, Iowa	1580
KCHE	Cherokee, Iowa	1440
KCHF	Sioux Falls, S.D.	1520
KCHI	Chillicothe, Mo.	1010
KCHJ	Delano, Calif.	1010
KCHR	Charleston, Mo.	1350
KCHS	Truth or Consequences, New Mexico	1400
KCHV	Coachella, Calif.	970
KCID	Caldwell, Idaho	1490
KCII	Washington, Iowa	1380
KCIJ	Shreveport, La.	980
KCIM	Carroll, Iowa	1380
KCIN	Victorville, Calif.	1590
KCJB	Minot, N.Dak.	910
KCKC	San Bernardino, Cal.	1350
KCNC	Kansas City, Kans.	1340
KCKW	Jena, La.	1480
KCKY	Coolidge, Ariz.	1150
KCLA	Pine Bluff, Ark.	1400
KCLE	Cleburne, Tex.	1120
KCLM	Redding, Cal.	1330
KCLN	Clinton, Iowa	1390
KCLO	Leavenworth, Kans.	1410
KCLR	Ralls, Tex.	1530
KCLS	Flagstaff, Ariz.	600
KCLU	Rolla, Mo.	1590
KCLV	Clovis, N.Mex.	1240
KCLW	Hamilton, Tex.	900
KCLX	Colfax, Wash.	1450
KCMC	Texarkana, Tex.	1230
KCMJ	Palm Sprgs., Calif.	1010
KCMD	Kansas City, Mo.	810
KCMS	Manitou Sprgs., Colo.	1490
KCNI	Broken Bow, Nebr.	1280
KCND	Alturas, Calif.	570
KCNW	Tulsa, Okla.	1300
KPNW	Eugene, Ore.	1120
KCNY	San Marcos, Tex.	1470
KCOB	Newton, Iowa	1280
KCOG	Centerville, Iowa	1400
KCOH	Houston, Tex.	1430
KCOK	Tulare, Calif.	1270
KCOL	Ft. Collins, Colo.	1410
KCOM	Comanche, Tex.	1550
KCON	Conway, Ark.	1230
KCOR	San Antonio, Tex.	1350
KCOW	Alliance, Nebr.	1400
KCPX	Salt Lake City, Utah	1320
KCRA	Sacramento, Calif.	1320
KCRC	Enid, Okla.	1390
KCRG	Cedar Rapids, Iowa	1600
KCRL	Reno, Nev.	780
KCRM	Crane, Tex.	1380

Call	Location	kHz
KCRS	Midland, Tex.	550
KCRT	Trinidad, Colo.	1240
KCRV	Caruthersville, Mo.	1370
KCSJ	Pueblo, Colo.	590
KCSR	Chadron, Nebr.	610
KCTA	Corpus Christi, Tex.	1030
KCTI	Gonzales, Tex.	1450
KCTO	Columbia, La.	1540
KCTY	Salinas, Calif.	980
KCTX	Childress, Tex.	1510
KCUB	Tucson, Ariz.	1290
KCUE	Red Wing, Minn.	1250
KCUZ	Clifton, Ariz.	1490
KCVL	Colville, Wash.	1270
KCVR	Lodi, Calif.	1570
KCYL	Lampasas, Tex.	1450
KCYN	Williams, Ariz.	1240
KDAC	Ft. Bragg, Calif.	1230
KDAK	Carrington, N.D.	1600
KDAL	Duluth, Minn.	610
KDAN	South St. Paul, Minn.	1370
KDAV	Lubbock, Tex.	580
KDAY	Santa Monica, Calif.	1580
KDAZ	Albuquerque, N.M.	730
KDB	Santa Barbara, Calif.	1490
KDBM	Dillon, Mont.	1490
KDBS	Alexandria, La.	1410
KDCE	Espanola, N.M.	970
KDDA	Dumas, Ark.	1560
KDDD	Dumas, Tex.	800
KDEC	Decorah, Iowa	1240
KDEF	Albuquerque, N.Mex.	1150
KDEN	Denver, Colo.	1340
KDEO	El Cajon, Calif.	910
KDES	Palm Sprgs., Calif.	920
KDET	Center, Tex.	930
KDEW	DeWitt, Ark.	1470
KDEX	Dexter, Mo.	1590
KDFL	Sumner, Wash.	1560
KDFN	Doniphan, Mo.	1500
KDGO	Durango, Colo.	1240
KDHI	Twenty-nine Palms, California	1250
KDHL	Faribault, Minn.	920
KDHN	Dimmitt, Tex.	1470
KDIA	Oakland, Calif.	1310
KDIO	Ortonville, Minn.	1350
KDIX	Dickinson, N.Dak.	1230
KDJI	Holbrook, Ariz.	1270
KDJW	Amarillo, Tex.	1010
KDKA	Pittsburgh, Pa.	1020
KDKD	Clinton, Mo.	1280
KDKO	Littleton, Colo.	1510
KDLA	DeRidder, La.	1010
KDLK	Del Rio, Tex.	1230
KDLM	Detroit Lakes, Minn.	1340
KDLR	Devils Lake, N.Dak.	1240
KDLS	Perry, Iowa	1310
KDMA	Montevideo, Minn.	1450
KDMO	Carthage, Mo.	1490
KDMS	El Dorado, Ark.	1290
KDNC	Spokane, Wash.	1440
KDNT	Denton, Tex.	1440
KDOK	Tyler, Tex.	1490
KDOL	Mojave, Calif.	1340
KDOM	Windom, Minn.	1580
KDON	Salinas, Calif.	1460
KDOT	Scottsdale, Ariz.	1440
KDOV	Medford, Oreg.	1300
KDOX	Marshall, Tex.	1410
KDQN	DeQueen, Ark.	1390
KDRG	Deer Lodge, Mont.	1400
KDRO	Sedalia, Mo.	1490
KDRS	Paragould, Ark.	1490
KDRY	Alamo Hts., Tex.	1110
KDSI	Deadwood, S. Dak.	980
KDSN	Denison, Ia.	1530
KDSX	Denison-Sherman, Tex.	950
KDTA	Delta, Colo.	1400
KDTH	Dubuque, Iowa	1370
KDUN	Reedsport, Ore.	1470
KDUZ	Hutchinson, Minn.	1260
KDWA	Hastings, Minn.	1460
KDWB	St. Paul, Minn.	630
KDWT	Stamford, Tex.	1400
KDXE	No. Little Rock, Ark.	1380
KDXI	Mansfield, La.	1360
KDXU	St. George, Utah	1430
KDYL	Tooele, Utah	990
KDZA	Pueblo, Colo.	1230
KEAN	Brownwood, Tex.	1240
KEAP	Fresno, Calif.	980
KEBE	Jacksonville, Tex.	1400
KECH	Ketchikan, Alaska	620
KECK	Lincoln, Neb.	1530
KEDA	San Antonia, Tex.	1540
KEDD	Dodge City, Kans.	1550
KEDD	Longview, Wash.	1400
KEED	Eugene, Ore.	1450
KEEE	Nacogdoches, Tex.	1230
KEEL	Shreveport, La.	710
KEEN	San Jose, Calif.	1370
KEEP	Twin Falls, Idaho	1450
KEES	Gladewater, Tex.	1430
KEGG	Daingerfield, Tex.	1560
KEGL	Santa Clara, Cal.	1430
KEHG	Fosston, Minn.	1480
KELA	Centralia-Chehalis, Wash.	1470

Call	Location	kHz
KELD	El Dorado, Ark.	1400
KELI	Tulsa, Okla.	1430
KELK	Elko, Nev.	1240
KELO	Sioux Falls, S.Dak.	1320
KELP	El Paso, Tex.	920
KELR	El Reno, Okla.	1460
KELY	Ely, Nev.	1230
KEMM	Marshfield, Mo.	1510
KENA	Mena, Ark.	1450
KENE	Toppenish, Wash.	1490
KENI	Anchorage, Alaska	550
KENM	Portales, N.Mex.	1450
KENN	Farmington, N.M.	1390
KENO	Las Vegas, Nev.	1460
KENR	Houston, Tex.	1070
KENT	Prescott, Ariz.	1340
KEOR	Atoka, Okla.	1110
KEOS	Flagstaff, Ariz.	690
KEPS	Eagle Pass, Tex.	1270
KERB	Kermit, Tex.	600
KERC	Eastland, Tex.	1590
KERG	Eugene, Oreg.	1280
KERN	Bakersfield, Calif.	1410
KERV	Kerrville, Tex.	1230
KESM	Eldorado Spring, Mo.	1580
KEST	Boise, Idaho	790
KETX	Livingston, Tex.	1440
KEUN	Eunice, La.	1490
KEVA	Evanston, Wyo.	1240
KEVT	Tucson, Ariz.	690
KEWE	Ft. Collins, Colo.	600
KEWI	Topeka, Kans.	1440
KEWQ	Paradise, Cal.	930
KEX	Portland, Oreg.	1190
KEXO	Grand Junc., Colo.	1230
KEXS	Excelsior Springs, Mo.	1090
KEYD	Oakes, N.Dak.	1220
KEYE	Perryton, Tex.	1400
KEYJ	Jamestown, N.Dak.	1400
KEYL	Long Prairie, Minn.	1400
KEYN	Wichta, Kan.	900
KEYR	Terrytown, Nebr.	690
KEYS	Corpus Christi, Tex.	1440
KEYY	Provo, Utah	1450
KEYZ	Williston, N.Dak.	1360
KEZU	Rapid City, S.Dak.	920
KEZY	Anaheim, Calif.	1190
KFAB	Omaha, Nebr.	1110
KFAC	Los Angeles, Calif.	1330
KFAH	Lakewood Center, Wash.	1480
KFAL	Fulton, Mo.	900
KFAM	St. Cloud, Minn.	1450
KFAR	Fairbanks, Alaska	660
KFAX	San Francisco, Calf.	1100
KFAY	Fayetteville, Ark.	1250
KFBC	Cheyenne, Wyo.	1240
KFBD	Waynesville, Mo.	1270
KFBK	Sacramento, Calif.	1530
KFBR	Nogales, Ariz.	1340
KFCB	Redfield, S. Dak.	1380
KFDF	Van Buren, Ark.	1580
KFDI	Wichita, Kansas	1070
KFDR	Grand Coulee, Wash.	1360
KFEL	Pueblo, Colo.	970
KFEQ	St. Joseph, Mo.	680
KFFA	Helena, Ark.	1360
KFGO	Fargo, N.D.	790
KFGQ	Boone, Iowa	1260
KFH	Wichita, Kans.	1330
KFI	Los Angeles, Calif.	640
KFIL	Preston, Minn.	1060
KFIR	Sweet Home, Ore.	1370
KFIV	Modesto, Calif.	1360
KFIZ	Fond du Lac, Wis.	1450
KFJB	Marshalltown, Iowa	1230
KFJM	Grand Forks, N.Dak.	1370
KFJZ	Ft. Worth, Tex	1270
KFKA	Greeley, Colo.	1310
KFKF	Bellevue, Wash.	1540
KFKU	Lawrence, Kans.	1250
KFLA	Scott City, Kans.	1310
KFLD	Floydada, Tex.	900
KFLI	Mountain Home, Ida.	1240
KFLJ	Walsenburg, Colo.	1380
KFLN	Baker, Mont.	960
KFLW	Klamath Fals, Oreg.	1450
KFLY	Corvallis, Oreg.	1240
KFMB	San Diego, Cal.	760
KFMJ	Tulsa, Okla.	1050
KFML	Denver, Colo.	1390
KFMO	Flat River, Mo.	1240
KFNV	Ferriday, La.	1600
KFNW	Fargo, N.Dak.	900
KFOR	Lincoln, Nebr.	1240
KFOX	Long Beach, Calif.	1280
KFPW	Ft. Smith, Ark.	1230
KFQD	Anchorage, Alaska	750
KFRA	Franklin, La.	1390
KFRB	Fairbanks, Alaska	900
KFRC	San Francisco, Calif.	610
KFRD	Rosenberg-Richmond, Tex.	980
KFRE	Fresno, Calif.	940
KFRM	Salina, Kan.	550
KFRO	Longview, Tex.	1370
KFRU	Columbia, Mo.	1400
KFSA	Ft. Smith, Ark	950
KFSB	Joplin, Mo.	1310
KFSC	Denver, Colo.	1220
KFST	Ft. Stockton, Tex.	860
KFTM	Ft. Morgan, Colo.	1400
KFTW	Fredericktown, Mo.	1450
KFUN	Las Vegas, N.Mex.	1230
KFUO	Clayton, Mo.	850
KFVS	Cape Girardeau, Mo.	960
KFWB	Los Angeles, Calif.	980
KFWJ	Lake Havasu City, Ariz.	980
KFXD	Nampa, Idaho	580
KFXM	San Bernardino, Calif.	590
KFYN	Bonham, Tex.	1420
KFYO	Lubbock, Tex.	790
KFYR	Bismarck, N.Dak.	550
KGA	Spokane, Wash.	1510
KGAF	Gainesville, Tex.	1580
KGAK	Gallup, N.Mex.	1330
KGAL	Lebanon, Oreg.	920
KGAR	Vancouver, Wash.	1550
KGAS	Carthage, Tex.	1590
KGAY	Salem, Oreg.	1430
KGB	San Diego, Calif.	1360
KGBC	Galveston, Tex.	1540
KGBS	Los Angeles, Calif.	1020
KGBT	Harlingen, Tex.	1530
KGBX	Springfield, Mo.	1260
KGCA	Rugby, N.D.	1450
KGCL	East Prairie, Mo.	1080
KGCX	Sidney, Mont.	1480
KGDN	Edmonds, Wash.	630
KGEE	Bakersfield, Calif.	1230
KGEK	Sterling, Colo.	1230
KGEM	Boise, Idaho	1140
KGEN	Tulare, Calif.	1370
KGER	Long Beach, Calif.	1390
KGEZ	Kalispell, Mont.	600
KGFF	Shawnee, Okla.	1450
KGFJ	Los Angeles, Calif.	1230
KGFL	Roswell, N.M.	1430
KGFW	Kearney, Nebr.	1340
KGFX	Pierre, S.D.	1060
KGGF	Cuffeyville, Kans.	690
KGGM	Albuquerque, N.Mex.	610
KGHL	Billings, Mont.	790
KGHM	Brookfield, Mo.	1470
KGHO	Hoquiam, Wash.	1560
KGHS	International Falls, Minn.	1230
KGIL	San Fernando, Calif.	1260
KGIW	Alamosa, Colo.	1450
KGKL	San Angelo, Tex.	960
KGKO	Benton, Ark.	850
KGLA	Gretna, La.	1540
KGLC	Miami, Okla.	910
KGLE	Glendive, Mont.	590
KGLM	Avalon, Calif.	740
KGLN	Glenwood Sprgs., Colo.	980
KGLO	Mason City, Iowa	1300
KGLU	Safford, Ariz.	1480
KGMB	Honolulu, Hawaii	590
KGMC	Englewood, Colo.	1150
KGMI	Bellingham, Wash.	790
KGMO	Cape Girardeau, Mo.	1220
KGMR	Jacksonville, Ark.	1500
KGMS	Sacramento, Calif.	1380
KGMT	Fairbury, Nebr.	1310
KGMY	Missoula, Mont.	1450
KGNB	New Braunfels, Tex.	1420
KGNC	Amarillo, Tex.	710
KGNO	Dodge City, Kans.	1370
KGO	San Francisco, Calif.	810
KGOL	Palm Desert, Cal.	1270
KGOS	Torrington, Wyo.	1490
KGPC	Grafton, N.Dak.	1340
KGRB	West Loma, Cal.	900
KGRI	Henderson, Tex.	1000
KGRL	Bend, Oreg.	940
KGRN	Grinnell, Iowa	1410
KGRO	Pampa, Tex.	1230
KGRS	Pasco, Wash.	1340
KGRT	Las Cruces, N.Mex.	570
KGST	Fresno, Calif.	1600
KGTN	Georgetown, Tex.	1530
KGU	Honolulu, Hawaii	760
KGUC	Gunnison, Colo.	1490
KGUD	Santa Barbara ,Calif.	990
KGUL	Port Lavac, Tex.	1560
KGVL	Greenville, Tex.	1400
KGVO	Missoula, Mont.	1290
KGVW	Belgrade, Mont.	630
KGW	Portland, Oreg.	620
KGWA	Enid, Okla.	960
KGY	Olympia, Wash.	1240
KGYN	Guymon, Okla.	1210
KHAC	Window Rock, Ariz.	1300
KHAD	DeSoto, Mo.	1190
KHAI	Honolulu, Hawaii	1090
KHAK	Cedar Rapids, Iowa	1360
KHAL	Homer, La.	1320
KHAP	Aztec, N.M.	1340
KHAR	Anchorage, Alaska	590
KHAS	Hastings, Nebr.	1230
KHAT	Phoenix, Ariz.	1480
KHBM	Monticello, Ark.	1430
KHBR	Hillsboro, Tex.	1560
KHDN	Hardin, Mont.	1230
KHEM	Big Springs, Tex.	1270
KHEN	Henryetta, Okla.	1590
KHEP	Phoenix, Ariz.	1280
KHEY	El Paso, Tex.	690
KHFH	Sierra Vista, Ariz.	1420
KHHH	Pampa, Tex.	1230
KHIL	Wilcox, Ariz.	1250
KHIT	Walla Walla, Wash.	1320
KHJ	Los Angeles, Calif.	930
KHLO	Hilo, Hawaii	850
KHMO	Hannibal, Mo.	1070
KHOB	Hobbs, N.Mex.	1390
KHOG	Fayetteville, Ark.	1440
KHOS	Tucson, Arz.	940
KHOT	Madera, Calif.	1250
KHOW	Denver, Colo.	630
KHOZ	Harrison, Ark.	900
KHQ	Spokane, Wash.	590
KHRB	Lockhart, Tex.	1060
KHRT	Minot, N. D.	1320
KHSJ	Hemet, Calif.	1320
KHSL	Chico, Calif.	1290
KHUB	Fremont, Nebr.	1340
KHUZ	Borger, Tex.	1490
KHVH	Honolulu, Hawaii	1040
KHYT	Tucson, Ariz.	1330
KIBE	Palo Alto, Calif.	1220
KIBL	Beeville, Tex.	1490
KIBS	Bishop, Calif.	1230
KICA	Clovis, N.M.	980
KICD	Spencer, Iowa	1240
KICK	Springfield, Mo.	1340
KICO	Calexico, Calif.	1490
KICS	Hastings, Neb.	1550
KICX	McCook, Neb.	1360
KICY	Nome, Alaska	850
KID	Idaho Falls, Idaho	590
KIDD	Monterey, Calif.	630
KIDD	Boise, Idaho	630
KIEV	Glendale, Calif.	870
KIFG	Iowa Falls, Ia.	1510
KIFN	Phoenix, Ariz.	860
KIFW	Sitka, Alaska	1230
KIGO	St. Anthony, Ida.	1400
KIHN	Hugo, Okla.	1340
KIHR	Hood River, Oreg.	1340
KIIS	Los Angeles, Cal.	1340
KIJV	Huron, S.Dak.	830
KIKI	Honolulu, Hawaii	650
KIKK	Pasadena, Tex.	1340
KIKO	Miami, Ariz.	1310
KIKS	Sulphur, La.	580
KIKX	Tucson, Ariz.	1250
KIKZ	Seminole, Tex.	1400
KILE	Galveston, Tex.	1440
KILO	Grand Forks, N.D.	1070
KILR	Estherville, Ia.	610
KILT	Houston, Tex.	1260
KIMB	Kimball, Nebr.	1270
KIML	Gillette, Wyo.	1150
KIMM	Rapid City, S.D.	950
KIMN	Denver, Colo.	960
KIMP	Mt. Pleasant, Tex.	1010
KIND	Independence, Kans.	1330
KINE	Kingsville, Tex.	1090
KING	Seattle, Wash.	1270
KINN	Alamagordo, N. M.	1230
KINO	Winslow, Ariz.	980
KINS	Eureka, Calif.	1590
KINT	El Paso, Tex.	800
KINY	Juneau, Alaska	940
KIOA	Des Moines, Iowa	1310
KIOT	Barstow, Calif.	1270
KIOX	Bay City, Tex.	1560
KIQS	Willows, Calif.	1460
KIRL	St. Charles, Mo.	710
KIRO	Seattle, Wash.	1580
KIRT	Mission, Tex.	1510
KIRV	Fresno, Cal.	1450
KIRX	Kirksville, Mo.	1230
KISD	Sioux Falls, S.Dak.	910
KISN	Vancouver, Wash.	1150
KIST	Santa Barbara, Calif.	1340
KIT	Yakima, Wash.	1280
KITE	Terrell Hills, Tex.	930
KITI	Chahalis-Centralia, Wash.	1420
KITN	Olympia, Wash.	920
KIUL	Garden City, Kans.	1240
KIUN	Pecos, Tex.	1400
KIUP	Durango, Colo.	930
KIVY	Crockett, Tex.	1290
KIWA	Sheldon, Iowa	1550
KIXI	Seattle, Wash.	910
KIXL	Dallas, Tex.	1040
KIXX	Provo, Utah	1400
KIXZ	Amarillo, Tex.	940
KIZZ	El Paso, Tex.	1150
KJAM	Madison, S.Dak.	1390
KJAN	Atlantic, Iowa	1220
KJAX	Santa Rosa, Calif.	1150
KJAY	Sacramento, Calif.	1430
KJBC	Midland, Tex.	1150
KJCF	Festus, Mo.	1400
KJCK	Junction City, Kns.	1420
KJDY	John Day, Ore.	1400
KJEF	Jennings, La.	1290
KJEM	Oklahoma City, Okla.	800
KJET	Beaumont, Tex.	1380
KJFJ	Webster City, Iowa	1570
KJIM	Ft. Worth, Tex.	870
KJIN	Houma, La.	1490
KJLT	North Platte, Nebr.	970
KJND	North Pole, Alaska	1170
KJNO	Juneau, Alaska	630
KJNP	North Pole, Alaska	1170
KJOE	Shreveport, La.	1480
KJOY	Stockton, Calif.	1280
KJPW	Waynesville, Mo.	1390
KJR	Seattle, Wash.	950
KJRB	Spokane, Wash.	790
KJRG	Newton, Kans.	950
KJSK	Columbus, Nebr.	900
KJST	Joshua Tree, Cal.	1420
KJWE	Burien, Wash.	800
KJWH	Camden, Ark.	1450
KKAL	Denver City, Tex.	1580
KKAM	Pueblo, Colo.	1350
KKAN	Phillipsburg, Kans.	1490
KKAR	Pomona, Calif.	1220
KKAS	Silsbee, Tex.	1300
KKAT	Roswell, N.M.	1430
KKDA	Grand Prairie, Tex.	730
KKEP	Estes Park, Colo.	1470
KKEY	Portland, Ore.	1150
KKGF	Great Falls, Mont.	1310
KKHI	San Francisco, Calif.	1550
KKID	Thousand Oaks, Cal.	850
KKIN	Aitkin, Minn.	930
KKIS	Pittsburg, Calif.	990
KKIT	Taos, N.Mex.	1340
KKJO	St. Joseph, Mo.	1550
KKOK	Lompoc, Calif.	1410
KKON	Kealakekua, Hawaii	790
KKOY	Chanute, Kan.	1460
KKUA	Honolulu, Hawaii	690
KKUB	Brownfield, Tex.	1300
KLAC	Los Angeles, Calif.	570
KLAK	Lakewood, Colo.	1600
KLAM	Cordova, Alaska	1450
KLAN	Lemoore, Calif.	1320
KLAR	Laredo, Tex.	1300
KLAV	Las Vegas, Nev.	1230
KLBK	Lubbock, Tex.	1340
KLBM	La Grande, Oreg.	1450
KLBS	Los Banos, Calif.	1330
KLCB	Libby, Mont.	1230
KLCN	Blytheville, Ark.	910
KLCO	Poteau, Okla.	1280
KLEA	Lovington, N.Mex.	630
KLEB	Golden Meadow, La.	1600
KLEE	Ottumwa, Iowa	1480
KLEI	Kailua, Hawaii	1130
KLEM	LeMars, Iowa	1410
KLEN	Killeen, Tex.	1050
KLEO	Wichita, Kans.	1480
KLER	Orofino, Idaho	950
KLEX	Lexington, Mo.	1570
KLEY	Wellington, Kan.	1130
KLFB	Lubbock, Tex.	1420
KLFD	Litchfield, Minn.	1410
KLGA	Algona, Iowa	1600
KLGR	Redwood Falls, Minn.	1490
KLIB	Liberal, K ans.	1470
KLIC	Monroe, La.	1230
KLID	Poplar Bluff, Mo.	1340
KLIF	Dallas, Tex.	1190
KLIK	Jefferson City, Mo.	950
KLIN	Lincoln, Nebr.	1400
KLIP	Fowler, Calif.	1220
KLIQ	Portland, Oreg.	1290
KLIR	Denver, Colo.	990
KLIV	San Jose, Cal.	1590
KLIX	Twin Falls, Idaho	1310
KLIZ	Brainerd, Minn.	1380
KLKC	Parsons, Kans.	1540
KLLA	Leesville, La.	1570
KLLL	Lubbock, Tex.	1460
KLME	Laramie, Wyo.	1490
KLMO	Longmont, Colo.	1060
KLMR	Lamar, Colo.	920
KLMS	Lincoln, Nebr.	1480
KLMX	Clayton, N.Mex.	1450
KLO	Ogden, Utah	1430
KLOA	Ridgecrest, Calif.	1240
KLOC	Ceres, Calif.	920
KLOE	Goodland, Kans.	730
KLOG	Kelso, Wash.	1490
KLOH	Pipestone, Minn.	1050
KLOK	San Jose, Calif.	1170
KLOL	Lincoln, Neb.	1530
KLOM	Lompoc, Calif.	1330
KLOO	Corvallis, Ore.	1340
KLOR	Blackwell, Okla.	1580
KLOU	Lake Charles, La.	1580
KLOV	Loveland, Colo.	1570
KLOW	Loveland, Colo.	1570
KLPL	Lake Providence, La.	1050
KLPM	Minot, N.Dak.	1390
KLPR	Okla. City, Okla.	1140
KLPW	Union, Mo.	1220
KLRA	Little Rock, Ark.	1010
KLRS	Mountain Grove, Mo.	1360
KLSI	Salina, Kan.	910
KLSU	White Castle, La.	1590
KLTF	Little Falls, Minn.	960
KLTI	Macon, Mo.	1560
KLTZ	Glasgow, Mont.	1240
KLUB	Salt Lake City, Utah	570
KLUC	Las Vegas, Nev.	1140
KLUE	Longview, Tex.	1280
KLUF	Lufkin, Tex.	1420
KLUV	Haynesville, La.	1580
KLVI	Beaumont, Tex.	560
KLVL	Pasadena, Tex.	1480
KLVT	Levelland, Tex.	1230
KLWN	Lawrence, Kans.	1320
KLWT	Lebanon, Mo.	1230
KLWW	Cedar Rapids, Iowa	1450
KLYD	Bakersfield, Calif.	1350
KLYQ	Hamilton, Mont.	980
KLYR	Clarksville, Ark.	1360
KLZ	Denver, Colo.	560
KMA	Shenandoah, Iowa	960
KMAC	San Antonio, Tex.	630
KMAD	Madill, Okla.	1550
KMAK	Fresno, Calif.	1340
KMAM	Butler, Mo.	1530

WHITE'S RADIO LOG

Call	Location	kHz
KMAN	Manhattan, Kans.	1350
KMAQ	Maquoketa, Iowa	1320
KMAR	Winnsboro, La.	1570
KMAS	Shelton, Wash.	1280
KMAV	Mayville, N.D.	1520
KMAX	Albuquerque, N.M.	1520
KMBL	Junction, Tex.	1450
KMBY	Monterey, Calif.	1240
KMBZ	Kansas City, Mo.	980
KMCD	Fairfield, Iowa	1570
KMCL	McCall, Ida.	1240
KMCM	McMinnville, Oreg.	1260
KMCO	Conroe, Tex.	900
KMCW	Augusta, Ark.	1190
KMDO	Ft. Scott, Kans.	1600
KMED	Medford, Oreg.	1440
KMEL	Wenatchee, Wash.	1340
KMEN	San Bernardino, Cal.	1290
KMEO	Phoenix, Ariz.	740
KMER	Kemmerer, Wyo.	950
KMFB	Mendocino, Cal.	1300
KMHL	Marshall, Minn.	1400
KMHT	Marshall, Tex.	1450
KMIL	Cameron, Tex.	1330
KMIN	Grants, N.M.	980
KMIS	Portageville, Mo.	1050
KMJ	Fresno, Calif.	580
KMLB	Monroe, La.	1440
KMLO	Vista, Cal.	1000
KMMJ	Grand Island, Nebr.	750
KMMO	Marshall, Mo.	1300
KMND	Mesa, Ariz.	1510
KMNS	Sioux City, Iowa	620
KMO	Tacoma, Wash.	1360
KMON	Great Falls, Mont.	560
KMOR	Murray, Utah	1230
KMOX	St. Louis, Mo.	1120
KMPC	Los Angeles, Calif.	710
KMPG	Hollister, Cal.	1540
KMPL	Sikeston, Mo.	1520
KMRC	Morgan City, La.	1430
KMRE	Anderson, Cal.	1580
KMRS	Morris, Minn.	1230
KMSL	Ukiah, Cal.	1250
KMUL	Muleshoe, Tex.	1380
KMUS	Muskogee, Okla.	1380
KMVI	Wailuku, Hawaii	550
KMWX	Yakima, Wash.	1460
KMYC	Marysville, Calif.	1410
KMYO	Little Rock, Ark.	1050
KNAB	Burlington, Colo.	1140
KNAF	Fredericksburg, Tex.	910
KNAH	Agana, Guam	610
KNAK	Salt Lake City, Utah	1280
KNAL	Victoria, Tex.	1410
KNBA	Vallejo, Calif.	1190
KNBI	Norton, Kan.	1530
KNBO	New Boston, Tex.	1530
KNBR	San Francisco, Cal.	680
KNBY	Newport, Ark.	1280
KNCB	Vivian, La.	1600
KNCK	Concordia, Kans.	1390
KNCR	Fortuna, Cal.	1090
KNCY	Nebraska City, Nebr.	1600
KNDC	Hettinger, N.Dak.	1490
KNDI	Honolulu, Hawaii	1270
KNDK	Langdon, N.D.	1080
KNDY	Marysville, Kans.	1570
KNEA	Jonesboro, Ark.	970
KNEB	Scottsbluff, Nebr.	960
KNED	McAlester, Okla.	1150
KNEI	Waukon, Ia.	1140
KNEL	Brady, Tex.	1490
KNEM	Nevada, Mo.	1240
KNET	Palestine, Tex.	1450
KNEW	Oakland, Cal.	910
KNEX	McPherson, Kans.	1540
KNEZ	Lompoc, Calif.	960
KNFT	Bayard, N.M.	950
KNGS	Hanford, Calif.	620
KNIA	Knoxville, Iowa	1320
KNIC	Winfield, Kan.	1550
KNIM	Maryville, Mo.	1580
KNIN	Wichita Falls, Tex.	990
KNIR	New Iberia, La.	1360
KNIT	Abilene, Tex.	1280
KNLV	Ord, Neb.	1060
KNND	Cottage Grove, Oreg.	1400
KNNN	Friona, Tex.	1070
KNOC	Natchitoches, La.	1450
KNOE	Monroe, La.	540
KNOK	Ft. Worth, Tex.	970
KNOP	N. Platte, Nebr.	1410
KNOR	Norman, Okla.	1400
KNOT	Prescott, Ariz.	1450
KNOW	Austin, Tex.	1490
KNOX	Grand Forks, N.Dak.	1310
KNPT	Newport, Ore.	1310
KNUI	Kahului, Hawaii	1310
KNUJ	New Ulm, Minn.	860
KNUZ	Houston, Tex.	1230
KNWC	Sioux Falls, S.D.	1270
KNWS	Waterloo, Iowa	1090
KNX	Los Angeles, Calif.	1070
KOA	Denver, Colo.	850
KOAC	Corvallis, Oreg.	550
KOAD	Lemoore, Calif.	1240
KOAG	Arroyo Grande, Cal.	1280
KOAK	Red Oak, Ia.	1080
KOAL	Price, Utah	1230
KOAM	Pittsburg, Kans.	860
KOB	Albuquerque, N.Mex.	770
KOBE	Las Cruces, N.Mex.	1450
KOBH	Hot Springs, S.Dak.	580
KOBO	Yuba City, Cal.	1450
KOBY	Reno, Nev.	1550
KOCA	Kilgore, Tex.	1240
KOCY	Oklahoma City, Okla.	1340
KODA	Houston, Tex.	1010
KODE	Joplin, Mo.	1230
KODI	Cody, Wyo.	1400
KODL	The Dalles, Oreg.	1440
KODY	North Platte, Nebr.	1240
KOEL	Oelwein, Iowa	950
KOFE	St. Maries, Idaho	1480
KOFI	Kalispell, Mont.	1180
KOFO	Ottawa, Kans.	1220
KOFY	San Mateo, Calif.	1050
KOGA	Ogallala, Nebr.	930
KOGO	San Diego, Calif.	600
KOGT	Orange, Tex.	1600
KOH	Reno, Nev.	630
KOHI	St. Helens, Ore.	1600
KOHO	Honolulu, Hawaii	1170
KOHU	Hermiston, Oreg.	1290
KOIL	Omaha, Nebr.	1290
KOIN	Portland, Oreg.	970
KOJM	Havre, Mont.	610
KOKA	Shreveport, La.	1550
KOKE	Austin, Tex.	1370
KOKL	Okmulgee, Okla.	1240
KOKO	Warrensburg, Mo.	1450
KOKX	Keokuk, Iowa	1310
KOKY	Little Rock, Ark.	1440
KOL	Seattle, Wash.	1300
KOLE	Port Arthur, Tex.	1340
KOLI	Coalinga, Cal.	1050
KOLJ	Quanah, Tex.	1150
KOLM	Rochester, Minn.	1520
KOLO	Reno, Nev.	920
KOLS	Pryor, Okla.	1570
KOLT	Scottsbluff, Nebr.	1320
KOLY	Mobridge, S.Dak.	1300
KOMA	Okla. City, Okla.	1520
KOMO	Seattle, Wash.	1000
KOMW	Omak, Wash.	680
KOMY	Watsonville, Calif.	1340
KONA	Kennewick, Wash.	1340
KONE	Reno, Nev.	1450
KONG	Visalia, Calif.	1400
KONI	Spanish Fork, Utah	1480
KONO	San Antonio, Tex.	860
KONP	Port Angeles, Wash.	1450
KOOD	Lakewood Center, Wash.	1480
KOOK	Billings, Mont.	970
KOOL	Phoenix, Ariz.	960
KOOO	Omaha, Nebr.	1420
KOOS	Coos Bay, Oreg.	1230
KOPO	Tucson, Ariz.	1450
KOPR	Butte, Mont.	550
KOPY	Alice, Tex.	1070
KOQT	Bellingham, Wash.	1550
KORA	Bryan, Tex.	1240
KORC	Mineral Wells, Tex.	1140
KORD	Pasco, Wash.	910
KORE	Springfield-Eugene, Ore.	1050
KORK	Las Vegas, Nev.	920
KORL	Honolulu, Hawaii	650
KORN	Mitchell, S.Dak.	1490
KORT	Grangeville, Idaho	1230
KOSE	Osceola, Ark.	860
KOSG	Panshuska, Okla.	1500
KOSI	Aurora, Colo.	1430
KOSY	Texarkana, Ark.	790
KOTA	Rapid City, S.Dak.	1380
KOTD	Plattsmouth, Neb.	1000
KOTN	Pine Bluff, Ark.	1490
KOTS	Deming, N.M.	1230
KOUR	Independence, Iowa	1220
KOVC	Valley City, N.Dak.	1490
KOVE	Lander, Wyo.	1330
KOVO	Provo, Utah	960
KOWB	Laramie, Wyo.	1290
KOWL	South Lake Tahoe, Cal.	1490
KOWN	Escondido, Calif.	1450
KOXR	Oxnard, Calif.	910
KOY	Phoenix, Ariz.	550
KOYL	Odessa, Tex.	1310
KOYN	Billings, Mont.	910
KOZA	Odessa, Tex.	1230
KOZE	Lewiston, Idaho	1300
KOZI	Chelan, Wash.	1230
KOZN	Omaha, Neb.	660
KOZY	Grand Rapids, Minn.	1490
KPAC	Port Arthur, Tex.	1250
KPAL	Palm Springs, Calif.	1450
KPAM	Portland, Oreg.	1410
KPAN	Hereford, Tex.	860
KPAR	Albuquerque, N.M.	1190
KPAS	Banning, Calif.	1490
KPAT	Berkeley, Calif.	1400
KPAY	Chico, Calif.	1060
KPBA	Pine Bluff, Ark.	1590
KPBC	Port Sulphur, La.	1510
KPCA	Marked Tree, Ark.	1580
KPCO	Quincy, Cal.	1370
KPCR	Bowling Green, Mo.	1530
KPDN	Pampa, Tex.	1340
KPDQ	Portland, Oreg.	800
KPEG	Spokane, Wash.	1380
KPEL	Lafayette, La.	1420
KPEP	San Angelo, Tex.	1420
KPET	Lamesa, Tex.	690
KPHO	Phoenix, Ariz.	910
KPIK	Colorado Sprgs., Colo.	1580
KPIN	Casa Grande, Ariz.	1260
KPLC	Lake Charles, La.	1470
KPLT	Paris, Tex.	1490
KPLY	Crescent City, Calif.	1240
KPMC	Bakersfield, Calif.	1560
KPNG	Port Neches, Tex.	1150
KPNW	Eugene, Ore.	1120
KPOC	Pocahontas, Ark.	1420
KPOD	Crescent City, Calif.	1310
KPOF	Denver, Colo.	910
KPOI	Honolulu, Hawaii	1380
KPOK	Portlans, Ore.	1330
KPOL	Los Angeles, Calif.	1540
KPOP	Roseville, Cal.	1110
KPOR	Quincy, Wash.	1370
KPOS	Post, Tex.	1370
KPOW	Powell, Wyo.	1260
KPPC	Pasadena, Calif.	1240
KPQ	Wenatchee, Wash.	560
KPRB	Redmond, Oreg.	1240
KPRC	Houston, Tex.	950
KPRE	Paris, Tex.	1250
KPRK	Livingston, Mont.	1340
KPRL	Paso Robles, Calif.	1230
KPRM	Park Rapids, Minn.	1240
KPRO	Riverside, Calif.	1440
KPRS	Kansas City, Mo.	1590
KPSO	Falfurrias, Tex.	1260
KPST	Preston, Idaho	1340
KPUA	Hilo, Hawaii	970
KPUB	Pueblo, Colo.	1480
KPUG	Bellingham, Wash.	1170
KPUL	Pullman, Wash.	1150
KPUR	Amarillo, Tex.	1440
KPWB	Piedmont, Mo.	1140
KPXE	Liberty, Tex.	1050
KQAQ	Austin, Minn.	970
KQEN	Roseburg, Ore.	1240
KQEO	Albuquerque, N.Mex.	920
KQIK	Lakeview, Oreg.	1230
KQIL	Grand Junction, Col.	1340
KQIQ	Santa Paula, Cal.	1400
KQMS	Redding, Calif.	1400
KQOT	Yakima, Wash.	930
KQRS	Golden Valley, Minn.	1440
KQV	Pittsburgh, Pa.	1410
KQWB	Fargo, N. D.	1550
KQXI	Arvada, Colo.	1550
KQYX	Joplin, Mo.	1560
KRAD	E. Grand Forks, Minn.	1590
KRAE	Cheyenne, Wyo.	1480
KRAI	Craig, Colo.	550
KRAK	Sacramento, Cal.	1140
KRAL	Rawlins, Wyo.	1240
KRAM	Las Vegas, Nev.	1340
KRAN	Morton, Tex.	1280
KRAY	Amarillo, Tex.	1360
KRBA	Lufkin, Tex.	1340
KRBC	Abilene, Tex.	1470
KRBI	St. Peter, Minn.	1310
KRBN	Red Lodge, Mont.	1450
KRCB	Council Bluffs, Ia.	1560
KRCO	Prineville, Oreg.	690
KRDG	Redding, Calif.	1230
KRDO	Colo. Springs, Colo.	1240
KRDR	Gresham, Ore.	1230
KRDS	Tolleson, Ariz.	1190
KRDU	Dinuba, Calif.	1240
KRED	Eureka, Cal.	1480
KREH	Oakdale, La.	900
KREI	Farmington, Mo.	800
KREK	Sapulpa, Okla.	1550
KREL	Corona, Cal.	1370
KREM	Spokane, Wash.	970
KREO	Indio, Calif.	1400
KREW	Sunnyside, Wash.	1230
KREX	Grand Junction, Colo.	1100
KRFO	Owatonna, Minn.	1390
KRFS	Superior, Nebr.	1600
KRGI	Grand Island, Neb.	1430
KRGV	Weslasco, Tex.	1550
KRGO	Salt Lake City, Utah	1290
KRHD	Duncan, Okla.	1350
KRIB	Mason City, Iowa	1490
KRIG	Odessa, Tex.	1410
KRIH	Rayville, La.	990
KRIO	McAllen, Tex	910
KRIZ	Phoenix, Ariz.	1230
KRKC	King City, Calif.	1490
KRKO	Everett, Wash.	1380
KRKT	Albany, Ore.	990
KRLA	Pasadena, Calif.	1110
KRLC	Lewiston, Ida. Clarkston, Wash.	1350
KRLD	Dallas, Tex.	1080
KRLN	Canon City, Colo.	1400
KRLW	Walnut Ridge, Ark.	1320
KRMD	Shreveport, La.	1340
KRME	Hondo, Tex.	1460
KRMG	Tulsa, Okla.	740
KRML	Carmel, Calif.	1410
KRMO	Monett, Mo.	990
KRMS	Osage Beach, Mo.	1150
KRNO	San Bernardino, Calif.	1240
KRNR	Roseburg, Oreg.	1490
KRNS	Burns, Oreg.	1230
KRNT	Des Moines, Iowa	1350
KRNY	Kearney, Nebr.	1460
KROB	Robstown, Tex.	1510
KROC	Rochester, Minn.	1340
KROD	El Paso, Tex.	600
KROE	Sheridan, Wyo.	930
KROF	Abbeville, La.	960
KROP	Brawley, Calif.	1300
KROS	Clinton, Iowa	1340
KROW	Dallas, Ore.	1460
KROX	Crookston, Minn.	1260
KROY	Sacramento, Calif.	1240
KRPL	Moscow, Idaho	1400
KRPT	Anadarko, Okla.	850
KRRR	Ruidoso, N.Mex.	1340
KRRV	Sherman, Tex.	910
KRSA	Salinas, Cal.	1570
KRSC	Othello, Wash.	1400
KRSD	Rapid City, S.Dak.	1340
KRSI	St. Louis Park, Minn.	950
KRSL	Russell, Kans.	990
KRSN	Los Alamos, N.Mex.	1490
KRSP	Salt Lake City, Utah	1060
KRSY	Roswell, N.Mex.	1230
KRTN	Raton, N.Mex.	1490
KRTR	Thermopolis, Wyo.	1490
KRUN	Ballinger, Tex.	1400
KRUS	Ruston, La.	1490
KRUX	Glendale, Ariz.	1360
KRVC	Ashland, Oreg.	1350
KRVN	Lexington, Neb.	880
KRWB	Roseau, Minn.	1410
KRWL	Carson City, Nev.	1300
KRXK	Rexburg, Idaho	1230
KRYS	Corpus Christi, Tex.	1360
KRYT	Colo Springs, Colo.	1530
KRZE	Farmington, N.M.	1280
KRZY	Albuquerque, N.M.	1450
KSAC	Manhattan, Kans.	580
KSAL	Salina, Kans.	1150
KSAM	Huntsville, Tex.	1490
KSAY	San Francisco, Calif.	1010
KSCB	Liberal, Kans.	600
KSCJ	Sioux City, Iowa	1360
KSCO	Santa Cruz, Calif.	1080
KSD	St. Louis, Mo.	550
KSDN	Aberdeen, S.Dak.	930
KSDO	San Diego, Calif.	1130
KSDR	Waterton, S.Dak.	1480
KSEE	Santa Maria, Calif.	1480
KSEI	Pocatello, Idaho	930
KSEK	Pittsburg, Kans.	1340
KSEL	Lubbock, Tex.	950
KSEM	Moses Lake, Wash.	1470
KSEN	Shelby, Mont.	1150
KSEO	Durant, Okla.	750
KSET	El Paso, Tex.	1340
KSEW	Sitka, Alaska	1400
KSEY	Seymour, Tex.	1230
KSFA	Nacogdoches, Tex.	860
KSFE	Needles, Calif.	1340
KSFO	San Francisco, Calif.	560
KSGM	Chester, Ill.	980
KSGT	Jackson, Wyo.	1340
KSHA	Medford, Ore.	860
KSIB	Creston, Iowa	1520
KSID	Sidney, Nebr.	1340
KSIG	Crowley, La.	1450
KSIL	Silver City, N.Mex.	1340
KSIM	Sikeston, Mo.	1400
KSIS	Sedalia, Mo.	1050
KSIW	Woodward, Okla.	1450
KSIX	Corpus Christi, Tex.	1230
KSJB	Jamestown, N.Dak.	600
KSKI	Hailey, Ida.	1340
KSKY	Dallas, Tex.	660
KSL	Salt Lake City, Utah	1160
KSLM	Salem, Oreg.	1390
KSLO	Opelousas, La.	1230
KSLV	Monte Vista, Colo.	1240
KSLY	San Luis Obispo, Cal.	1400
KSMA	Santa Maria, Calif.	1240
KSMK	Kennewick, Pasco-Richland, Wash.	1340
KSMM	Shakopee, Minn.	1530
KSMN	Mason City, Iowa	1010
KSMO	Salem, Mo.	1340
KSND	Seattle, Wash.	1590
KSNN	Pocatello, Ida.	1290
KSNO	Aspen, Colo.	1260
KSNY	Snyder, Tex.	1450
KSO	Des Moines, Iowa	1460
KSOA	Ava, Mo.	1430
KSOK	Arkansas City, Kans.	1280
KSOL	San Francisco, Cal.	1450
KSOM	Ontario, Cal.	1510
KSON	San Diego, Calif.	1240
KSOO	Sioux Falls, S.Dak.	1140
KSOP	Salt Lake City, Utah	1370
KSOX	Raymondville, Tex.	1240
KSPI	Stillwater, Okla.	780
KSPL	Diboll, Tex.	1260
KSPO	Spokane, Wash.	1230
KSPR	Springdale, Ark.	1590
KSPT	Sandpoint, Idaho	1400
KSRA	Salmon, Idaho	960
KSRC	Socorro, N.Mex.	1290
KSRM	Soldatna, Alaska	920
KSRO	Santa Rosa, Calif.	1350

Call	Location	kHz
KSRV	Ontario, Oreg.	1380
KSSS	Colorado Springs, Colo.	740
KSST	Sulphur Springs, Tex.	1230
KSTA	Coleman, Tex.	1000
KSTB	Breckenridge, Tex.	1430
KSTL	St. Louis, Mo.	690
KSTN	Stockton, Calif.	1420
KSTP	St. Paul, Minn.	1500
KSTR	Grand Junction, Colo.	620
KSTT	Davenport, Iowa	1170
KSTV	Stephenville, Tex.	1510
KSUB	Cedar City, Utah	590
KSUD	W. Memphis, Ark.	730
KSUE	Susanville, Calif.	1240
KSUM	Fairmont, Minn.	1370
KSUN	Bisbee, Ariz.	1230
KSVC	Richfield, Utah	980
KSVN	Ogden, Utah	730
KSVP	Artesia, N.Mex.	990
KSWA	Graham, Tex.	1330
KSWB	Seaside, Ore.	930
KSWM	Aurora, Mo.	940
KSWO	Lawton, Okla.	1380
KSWS	Roswell, N. M.	1020
KSWW	Wickenburg, Ariz.	1250
KSXX	Salt Lake City, Utah	630
KSYC	Yreka, Calif.	1490
KSYL	Alexandria, La.	970
KSYX	Santa Rosa, N.Mex.	1420
KTAC	Tacoma, Wash.	850
KTAE	Taylor, Tex.	1260
KTAP	Austin, Tex.	970
KTAR	Phoenix, Ariz.	620
KTAT	Frederick, Okla.	1570
KTBB	Tyler, Tex.	600
KTBC	Austin, Tex.	590
KTCB	Malden, Mo.	1470
KTCH	Wayne, Neb.	1590
KTCR	Minneapolis, Minn.	690
KTCS	Fort Smith, Ark.	1410
KTDL	Farmersville, La.	1470
KTDO	Toledo, Oreg.	1230
KTEE	Idaho Falls, Idaho	1260
KTEL	Walla Walla, Wash.	1490
KTEM	Temple, Tex.	1400
KTEO	San Angelo, Tex.	1340
KTER	Terrell, Tex.	1570
KTET	Payette, Idaho	1450
KTFI	Twin Falls, Idaho	1270
KTFS	Texarkana, Tex.	1400
KTGO	Tioga, N. D.	1090
KTGR	Columbia, Mo.	1580
KTHE	Thermopolis, Wyo.	1240
KTHO	South Lake Tahoe, Cal.	590
KTHS	Berryville, Ark.	1480
KTHT	Houston, Tex.	790
KTIB	Thibodaux, La.	630
KTIL	Tillamook, Oreg.	1590
KTIM	San Rafael, Calif.	1510
KTIP	Porterville, Calif.	1450
KTIS	Minneapolis, Minn.	900
KTIX	Pendleton, Ore.	1240
KTKN	Ketchikan, Alaska	930
KTKR	Taft, Calif.	1310
KTKT	Tucson, Ariz.	990
KTLD	Tullulah, La.	1360
KTLK	Denver, Colo.	1280
KTLO	Mountain Home, Ark.	1240
KTLQ	Tahlequah, Okla.	1350
KTLU	Rusk, Tex.	1580
KTLW	Texas City, Tex.	920
KTMC	McAlester, Okla.	1400
KTMF	New Prague, Minn.	1350
KTMN	Trumann, Ark.	1530
KTMS	Santa Barbara, Calif.	1250
KTNC	Falls City, Nebr.	1230
KTNM	Tucumcari, N.Mex.	1400
KTNT	Tacoma, Wash.	1400
KTOB	Petaluma, Cal.	1490
KTOC	Jonesboro, La.	920
KTOD	Sinton, Tex.	1590
KTOE	Mankato, Minn.	1420
KTOH	Lihue, Hawaii	1350
KTOK	Oklahoma City, Okla.	1000
KTOM	Salinas, Cal.	1380
KTON	Belton, Tex.	940
KTOP	Topeka, Kans.	1490
KTOT	Big Bear Lake, Cal.	1050
KTOW	Sand Spring, Okla.	1340
KTPA	Prescott, Ark.	1370
KTRB	Modesto, Calif.	860
KTRC	Santa Fe, N.Mex.	1400
KTRF	Thief River Falls, Minn.	1230
KTRG	Honolulu, Hawaii	990
KTRH	Houston, Tex.	740
KTRI	Sioux City, Iowa	1470
KTRM	Beaumont, Tex.	990
KTRN	Wichita Falls, Tex.	1290
KTRT	Truckee, Cal.	1400
KTRY	Bastrop, La.	730
KTSA	San Antonio, Tex.	550
KTSL	Burnett, Tex.	1340
KTSM	El Paso, Tex.	1380
KTTN	Trenton, Mo.	1600
KTTR	Rolla, Mo.	1490
KTTS	Springfield, Mo.	1400
KTTT	Columbus, Nebr.	1510
KTUC	Tucson, Ariz.	1400
KTUE	Tulia, Tex.	1260
KTUF	Tempe, Ariz.	1580
KTUI	Sullivan, Mo.	1560
KTW	Seattle, Wash.	1250
KTWO	Casper, Wyo.	1030
KTXJ	Jasper, Tex.	1350
KTXO	Sherman, Tex.	1500
KTYM	Inglewood, Calif.	1460
KTYN	Minot, N.D.	1430
KUAD	Windsor, Colo.	1170
KUAI	Eleele, Kanai, Hawaii	720
KUAT	Tucson, Ariz.	1550
KUBA	Yuba City, Calif.	1600
KUBC	Montrose, Colo.	580
KUDE	Oceanside, Calif.	1320
KUDI	Great Falls, Mont.	1450
KUDL	Fairway, Kan.	1380
KUDU	Ventura, Calif.	1590
KUDY	Spokane, Wash.	1280
KUEN	Wenatchee, Wash.	900
KUGN	Eugene, Oreg.	590
KUHL	Santa Maria, Cal.	1440
KUIK	Hillsboro, Oreg.	1360
KUJ	Walla Walla, Wash.	1420
KUKA	San Antonio, Tex.	1250
KUKI	Ukiah, Calif.	1400
KUKU	Willow Springs, Mo.	1330
KULA	Honolulu, Hawaii	690
KULE	Ephrata, Wash.	730
KULP	El Campo, Tex.	1390
KULY	Ulysses, Kan.	1420
KUMA	Pendleton, Oreg.	1290
KUMU	Honolulu, Hawaii	1500
KUNO	Corpus Christi, Tex.	1400
KUOA	Siloam Springs, Ark.	1290
KUOM	Minneapolis, Minn.	770
KUPD	Tempe, Ariz.	1060
KUPI	Idaho Falls, Idaho	980
KUPK	Garden City, Kan.	1050
KURA	Moab, Utah	1450
KURB	Mountlake Terrace, Wash.	1510
KURL	Billings, Mont.	730
KURV	Edinburg, Tex.	710
KURY	Brookings, Oreg.	910
KUSD	Vermillion, S.Dak.	690
KUSH	Cushing, Okla.	1600
KUSN	St. Joseph, Mo.	1270
KUTA	Blanding, Utah	790
KUTI	Yakima, Wash.	980
KUTY	Palmdale, Calif.	1470
KUVR	Holdredge, Nebr.	1380
KUXL	Golden Valley, Minn.	1570
KUZN	W. Monroe, La.	1310
KUZZ	Bakersfield, Calif.	800
KVAC	Forks, Wash.	1490
KVAL	Sauk Rapids, Minn.	800
KVAN	Vancouver, Wash.	1480
KVAS	Astoria, Ore.	1230
KVBR	Brainerd, Minn.	1340
KVCK	Wolf Point, Nebr.	1450
KVCL	Winnfield, La.	1270
KVCV	Redding, Calif.	600
KVOB	Sioux Center, Ia.	1090
KVEC	San Luis Obispo, Calif.	920
KVEE	Conway, Ark.	1330
KVEG	Las Vegas, Nev.	970
KVEL	Vernal, Utah	920
KVEN	Ventura, Calif.	1450
KVET	Austin, Tex.	1300
KVFC	Cortez, Colo.	740
KVFD	Ft. Dodge, Iowa	1400
KVGB	Great Bend, Kans.	1590
KVI	Seattle, Wash.	570
KVIC	Victoria, Tex.	1340
KVIL	Highland Park, Tex.	1150
KVIN	Vinita, Okla.	1470
KVIO	Cottonwood, Ariz.	1600
KVIP	Redding, Calif.	540
KVKM	Monahans, Tex.	1330
KVLB	Cleveland, Tex.	1410
KVLF	Alpine, Tex.	1240
KVLG	LaGrange, Tex.	1570
KVLH	Pauls Valley, Okla.	1470
KVLL	Woodville, Tex.	1220
KVLV	Fallon, Nev.	980
KVMA	Magnolia, Ark.	630
KVMC	Colorado City, Tex.	1320
KVML	Sonora, Calif.	1450
KVNC	Winslow, Ariz.	1010
KVNI	Coeur d'Alene, Idaho	1240
KVNU	Logan, Utah	610
KVOB	Bastrop, La.	1340
KVOC	Casper, Wyo.	1230
KVOE	Emporia, Kans.	1400
KVOG	Ogden, Utah	1490
KVOL	Lafayette, La.	1330
KVOM	Morrilton, Ark.	800
KVON	Napa, Calif.	1440
KVOO	Tulsa, Okla.	1170
KVOP	Plainview, Tex.	1400
KVOR	Colo. Springs, Colo.	1300
KVOU	Uvalde, Tex.	1400
KVOV	Henderson, Nev.	1280
KVOW	Riverton, Wyo.	1450
KVOX	Moorhead, Minn.	1280
KVOY	Yuma, Ariz.	1400
KVOZ	Laredo, Tex.	1490
KVPI	Ville Platte, La.	1050
KVRA	Vermillion, S. D.	1570
KVRC	Arkadelphia, Ark.	1240
KVRD	Cottonwood, Ariz.	1240
KVRE	Santa Rosa, Calif.	1460
KVRH	Salida, Colo.	1340
KVRS	Rock Springs, Wyo.	1360
KVSA	McGehee, Ark.	1220
KVSF	Sante Fe, N.Mex.	1260
KVSH	Valentine, Nebr.	940
KVSI	Montpelier, Ida.	1450
KVSL	Show Low, Ariz.	1450
KVSO	Ardmore, Okla.	1240
KVWC	Vernon, Tex.	1490
KVWG	Pearsall, Tex.	1280
KVWM	Show Low, Ariz.	970
KVWO	Cheyenne, Wyo.	1370
KVYL	Holdenville, Okla.	1370
KWAC	Bakersfield, Calif.	1490
KWAD	Wadena, Minn.	920
KWAK	Stuttgart, Ark.	1240
KWAM	Memphis, Tenn.	990
KWAT	Watertown, S.Dak.	950
KWBA	Baytown, Tex.	1360
KWBB	Wichita, Kans.	1410
KWBC	Navasota, Tex.	1550
KWBE	Beatrice, Nebr.	1450
KWBG	Boone, Iowa	1590
KWBW	Hutchinson, Kans.	1450
KWBY	Edna, Tex.	1130
KWCB	Searcy, Ark.	1300
KWCL	Oak Grove, La.	1280
KWCO	Chickasha, Okla.	1560
KWDR	Del Rio, Tex.	810
KWEB	Rochester, Minn.	1270
KWED	Seguin, Tex.	1580
KWEI	Weiser, Idaho	1260
KWEL	Midland, Tex.	1600
KWEW	Hobbs, N.Mex.	1480
KWEY	Weatherford, Okla.	1590
KWFA	Merkle, Tex.	1500
KWFR	San Angelo, Tex.	1260
KWFT	Wichita Falls, Tex.	620
KWG	Stockton, Calif.	1230
KWGH	Big Lake, Tex.	1290
KWHI	Brenham, Tex.	1280
KWHK	Hutchinson, Kans.	1260
KWHN	Fort Smith, Ark.	1320
KWHO	Salt Lake City, Utah	860
KWHW	Altus, Okla.	1450
KWIK	Pocatello, Idaho	1240
KWIL	Albany, Oreg.	790
KWIN	Ashland, Oreg.	580
KWIP	Merced, Calif.	1580
KWIQ	Moses Lake, Wash.	1260
KWIV	Douglas, Wyo.	1050
KWIX	Moberly, Mo.	1230
KWIZ	Santa Ana, Calif.	1480
KWJJ	Portland, Oreg.	1080
KWK	St. Louis, Mo.	1380
KWKC	Abilene, Tex.	1340
KWKH	Shreveport, La.	1130
KWKW	Pasadena, Calif.	1300
KWKY	Des Moines, Iowa	1150
KWLA	Many, La.	1530
KWLC	Decorah, Iowa	1240
KWLG	Wagoner, Okla.	1530
KWLM	Willmar, Minn.	1340
KWMC	Del Rio, Tex.	1490
KWMT	Ft. Dodge, Iowa	540
KWNA	Winnemucca, Nev.	1400
KWNO	Winona, Minn.	1230
KWNS	Pratt, Kans.	1290
KWNT	Davenport, Iowa	1580
KWOA	Worthington, Minn.	730
KWOC	Poplar Bluff, Mo.	930
KWOE	Clinton, Okla.	1320
KWON	Bartlesville, Okla.	1400
KWOR	Worland, Wyo.	1340
KWOS	Jefferson City, Mo.	1240
KWOW	Pomona, Calif.	1600
KWPC	Muscatine, Iowa	860
KWPM	West Plains, Mo.	1450
KWPR	Claremore, Okla.	1270
KWRC	Woodburn, Ore.	940
KWRD	Henderson, Tex.	1470
KWRE	Warrenton, Mo.	730
KWRF	Warren, Ark.	860
KWRG	New Roods, La.	1500
KWRO	Coquille, Oreg.	630
KWRT	Boonville, Mo.	1370
KWRW	Guthrie, Okla.	1490
KWSD	Mt. Shasta, Calif.	620
KWSH	Wewoka-Seminole, Oklahoma	1260
KWSO	Wasco, Calif.	1050
KWSR	Rifle, Colo.	810
KWSU	Pullman, Wash.	1250
KWTC	Barstow, Calif.	1230
KWTO	Springfield, Mo.	560
KWTX	Waco, Tex.	1230
KWUN	Concord, Cal.	1480
KWVR	Enterprise, Oreg.	1340
KWVY	Waverly, Iowa	1470
KWWL	Waterloo, Iowa	1330
KWXY	Cathedral City, Cal.	1340
KWYK	Farmington, N.Mex.	960
KWYN	Wynne, Ark.	1400
KWYO	Sheridan, Wyo.	1410
KWYR	Winner, S.Dak.	1260
KWYS	W. Yellowstone, Mont.	920
KWYZ	Everett, Wash.	1230
KXA	Seattle, Wash.	770
KXAR	Hope, Ark.	1490
KXEL	Waterloo, Iowa	1540
KXEM	McFarland, Cal.	1590
KXEO	Mexico, Mo.	1340
KXEN	Festus-St. Louis, Mo.	1010
KXEW	Tucson, Ariz.	1600
KXEX	Fresno, Calif.	1550
KXGN	Glendive, Mont.	1400
KXGI	Ft. Madison, Iowa	1360
KXIC	Iowa City, Iowa	800
KXIT	Dalhart, Tex.	1410
KXIV	Phoenix, Ariz.	1400
KXJK	Forrest City, Ark.	950
KXKW	Lafayette, La.	1520
KXL	Portland, Oreg.	750
KXLE	Ellensburg, Wash.	1240
KXLF	Butte, Mont.	1370
KXLJ	Helena, Mont.	1240
KXLO	Lewiston, Mont.	1230
KXLR	Little Rock, Ark.	1150
KXLW	Clayton, Mo.	1320
KXLY	Spokane, Wash.	920
KXO	El Centro, Calif.	1230
KXOA	Sacramento, Calif.	1470
KXOK	St. Louis, Mo.	630
KXOL	Ft. Worth, Tex.	1360
KXOW	Hot Springs, Ark.	1420
KXOX	Sweetwater, Tex.	1240
KXRA	Alexandria, Minn.	1490
KXRB	Sioux Falls, S.D.	1520
KXRO	Aberdeen, Wash.	1320
KXRX	San Jose, Calif.	1500
KXTO	Sherman, Tex.	1500
KXXL	Bozeman, Mont.	1450
KXXX	Colby, Kans.	790
KXYZ	Houston, Tex.	1320
KYA	San Francisco, Calif.	1260
KYAC	Kirkland, Wash.	1460
KYAK	Anchorage, Alaska	650
KYAL	McKinney, Tex.	1600
KYCA	Prescott, Ariz.	1490
KYCN	Wheatland, Wyo.	1340
KYES	Roseburg, Oreg.	950
KYJC	Medford, Oreg.	1230
KYLT	Missoula, Mont.	1340
KYME	Boise, Idaho	740
KYMO	East Prairie, Mo.	1080
KYND	Burlington, Ia.	1150
KYNG	Coos Bay, Oreg.	1420
KYNO	Fresno, Calif.	1300
KYNT	Yankton, S.Dak.	1450
KYOK	Houston, Tex.	1590
KYOR	Blythe, Calif.	1450
KYOS	Merced, Calif.	1480
KYRO	Potosi, Mo.	1280
KYOU	Greeley, Colo.	1450
KYSM	Mankato, Minn.	1230
KYSN	Colorado Sprgs., Colo.	1460
KYSS	Missoula, Mont.	930
KYVA	Gallup, N.Mex.	1230
KYW	Philadelphia, Pa.	1060
KYXI	Oregon City, Ore.	1520
KZAK	Tyler, Tex.	1330
KZEE	Weatherford, Tex.	1220
KZEY	Tyler, Tex.	690
KZIA	Albuquerque, N.M.	1580
KZIP	Amarillo, Tex.	1310
KZNG	Hot Springs, Ark.	1340
KZOE	Princeton, Ill.	1490
KZOL	Farwell, Tex.	1570
KZON	Santa Maria, Cal.	1600
KZOO	Honolulu, Hawaii	1210
KZOT	Marianna, Ark.	1460
KZOW	Globe, Ariz.	1240
KZRK	Ozark, Ark.	1540
KZUN	Opportunity, Wash.	830
KZYX	Weatherford, Okla.	1580
KZYM	Cape Girardeau, Mo.	1220
KZZN	Littlefield, Tex.	1490
VOUS	Argentia, Nfld.	1480
WAAA	Winston-Salem, N.C.	980
WAAB	Worcester, Mass.	1440
WAAC	Terre Haute, Ind.	1300
WAAF	Chicago, Ill.	950
WAAK	Dallas, N.C.	960
WAAM	Ann Arbor, Mich.	1600
WAAN	Waynesboro, Tenn.	1480
WAAO	Andalusia, Ala.	1530
WAAT	Trenton, N.J.	1300
WAAX	Gadsden, Ala.	570
WAAY	Huntsville, Ala.	1550
WABA	Aquadilla, P.Rico	850
WABB	Mobile, Ala.	1480
WABC	New York, N.Y.	770
WABD	Ft. Campbell, Ky.	1370
WABF	Fairhope, Ala.	1220
WABG	Greenwood, Miss.	960
WABH	Deerfield, Va.	1150
WABI	Bangor, Maine	910
WABJ	Adrian, Mich.	1490
WABK	Gardiner, Me.	1280
WABL	Amite, La.	1570
WABO	Waynesboro, Miss.	990
WABQ	Cleveland, Ohio	1540
WABR	Winter Park, Fla.	1440
WABT	Tuskegee, Ala.	580
WABV	Abbeville, S.C.	1590
WABY	Albany, N.Y.	1400
WABZ	Albemarle, N.C.	1010
WACA	Camden, S.C.	1590
WACB	Kittanning, Pa.	1380
WACE	Chicopee, Mass.	730
WACI	The Dalles, Ore.	1300
WACK	Newark, N.Y.	1420
WACL	Waycross, Ga.	570
WACO	Waco, Tex.	1460
WACR	Columbus, Miss.	1050
WACT	Tuscaloosa, Ala.	1420
WACX	Austell, Ga.	1600
WACY	Kissimmee, Fla.	1220
WADA	Shelby, N.C.	1390
WADD	Brockport, N.Y.	1560
WADE	Wadesboro, N.C.	1210
WADK	Newport, R.I.	1540
WADM	Decatur, Ind.	1540

WHITE'S RADIO LOG

Call	Location	kHz
WADO	New York, N.Y.	1280
WADR	Remsen, N. Y.	1480
WADS	Ansonia, Conn.	690
WAEB	Allentown, Pa.	790
WAEL	Mayaguez, P.Rico	600
WAEW	Crossville, Tenn.	1330
WAFC	Staunton, Va.	900
WAFI	Middlesboro, Ky.	1560
WAFT	Grand Rapids, Mich.	1480
WAGC	Centre, Ala.	1550
WAGE	Leesburg, Va.	1290
WAGF	Dothan, Ala.	1320
WAGG	Franklin, Tenn.	950
WAGL	Lancaster, S. C.	1560
WAGM	Presque Isle, Maine	950
WAGN	Menominee, Mich.	1340
WAGO	Oshkosh, Wis.	690
WAGR	Lumberton, N.C.	580
WAGS	Bishopville, S.C.	1380
WAGY	Forest City, N.C.	1320
WAHT	Annville-Cleona, Pa.	1510
WAIK	Gainesburg, Ill.	1590
WAIL	Baton Rouge, La.	1260
WAIM	Anderson, S.C.	1230
WAIN	Columbia, Ky.	1270
WAIR	Winston-Salem, N.C.	1340
WAIT	Chicago, Ill.	820
WAJF	Decatur, Ala.	1490
WAJR	Morgantown, W.Va.	1440
WAKE	Valparaiso, Ind.	1500
WAKI	McMinnville, Tenn.	1230
WAKN	Aiken, S.C.	990
WAKO	Lawrenceville, Ill.	910
WAKR	Akron, Ohio	1590
WAKS	Fuquay-Varina, N.C.	1460
WAKX	Superior, Wisc.	1320
WAKY	Louisville, Ky.	790
WALD	Walterboro, S.C.	1060
WALE	Fall River, Mass.	1400
WALG	Albany, Ga.	1590
WALK	Patchogue, N.Y.	1370
WALL	Middletown, N.Y.	1340
WALM	Albion, Mich.	1260
WALO	Humacao, P.R.	1240
WALT	Tampa, Fla.	1110
WALY	Herkimer, N.Y.	1420
WAMA	Selma, Ala.	1340
WAMB	Donelson, Tenn.	1190
WAMD	Aberdeen, Md.	970
WAME	Charlotte, N.C.	1480
WAMG	Gallatin, Tenn.	1130
WAMI	Opp, Ala.	860
WAML	Laurel, Miss.	1340
WAMM	Flint, Mich.	1420
WAMO	Homstead, Pa.	860
WAMR	Venice, Fla.	1320
WAMS	Wilmington, Del.	1380
WAMW	Washington, Ind.	1580
WAMY	Amory, Miss.	1580
WANA	Anniston, Ala.	1490
WANB	Waynesburg, Pa.	1580
WANL	Lineville, Ala.	1540
WANN	Annapolis, Md.	1190
WANO	Pineville, Ky.	1230
WANS	Anderson, S.C.	1280
WANT	Richmond, Va.	990
WANV	Waynesboro, Va.	970
WANY	Albany, Ky.	1390
WAOA	Opelika, Ala.	1520
WAOK	Atlanta, Ga.	1380
WAOP	Ostego, Mich.	980
WAOV	Vincennes, Ind.	1450
WAPA	San Juan, P.R.	680
WAPC	Riverhead, N.Y.	1570
WAPE	Jacksonville, Fla.	690
WAPF	McComb, Miss.	980
WAPG	Arcadia, Fla.	1480
WAPI	Birmingham, Ala.	1070
WAPL	Appleton, Wis.	1570
WAPR	Avon Park, Fla.	1390
WAPX	Montgomery, Ala.	1600
WAQI	Ashtabula, Ohio	1600
WAQY	Birmingham, Ala.	1220
WARA	Attleboro, Mass.	1320
WARB	Covington, La.	730
WARD	Johnstown, Pa.	1490
WARE	Ware, Mass.	1250
WARF	Jasper, Ala.	1240
WARI	Abbeville, Ala.	1480
WARK	Hagerstown, Md.	1490
WARM	Scranton, Pa.	590
WARN	Ft. Pierce, Fla.	1330
WARO	Canonsburg, Pa.	540
WARR	Warrenton, N.C.	1520
WART	Moulton, Ala.	1530
WARU	Peru, Ind.	1600
WARV	Warwick-E. Greenwich, R.I.	1590
WASA	Havre de Grace, Md.	1330
WASC	Spartanburg, S.C.	1530
WASK	Lafayette, Ind.	1450

Call	Location	kHz
WASP	Brownsville, Pa.	1130
WASR	Wolfeboro, N.H.	1420
WATA	Boone, N.C.	1450
WATC	Gaylord, Mich.	900
WATE	Knoxville, Tenn.	620
WATH	Athens, Ohio	970
WATI	Indianapolis, Ind.	810
WATK	Antigo, Wis.	900
WATM	Atmore, Ala.	1590
WATN	Watertown, N.Y.	1240
WATO	Oak Ridge, Tenn.	1290
WATP	Marion, S.C.	1430
WATR	Waterbury, Conn.	1320
WATS	Sayre, Pa.	960
WATT	Cadillac, Mich.	1240
WATV	Birmingham, Ala.	900
WATW	Ashland, Wis.	1400
WATZ	Alpena, Mich.	1450
WAUB	Auburn, N.Y.	1590
WAUC	Wauchula, Fla.	1310
WAUD	Auburn, Ala.	1230
WAUG	Augusta, Ga.	1050
WAUK	Waukesha, Wis.	1510
WAVA	Arlington, Va.	780
WAVC	Warner Robins, Ga.	1350
WAVE	Louisville, Ky.	970
WAVI	Dayton, Ohio	1210
WAVL	Apollo, Pa.	910
WAVN	Stillwater, Minn.	1220
WAVO	Avondale Estates, Ga.	1420
WAVP	Avon Park, Fla.	1390
WAVS	Ft. Lauderdale, Fla.	1190
WAVU	Albertville, Ala.	630
WAVZ	New Haven, Conn.	1300
WAWA	West Allis, Wis.	1590
WAWK	Kendallville, Ind.	1140
WAWZ	Zarephath, N.J.	1380
WAXE	Vero Beach, Fla.	1370
WAXU	Georgetown, Ky.	1580
WAXX	Chippewa Falls, Wis.	1150
WAYB	Waynesboro, Va.	1490
WAYD	Ozark, Ala.	1190
WAYE	Baltimore, Md.	860
WAYK	Lehigh Acres, Fla.	1440
WAYN	Rockingham, N.C.	900
WAYR	Orange Park, Fla.	550
WAYS	Charlotte, N.C.	610
WAYX	Waycross, Ga.	1230
WAYZ	Waynesboro, Pa.	1380
WAZA	Bainbridge, Ga.	1360
WAZE	Clearwater, Fla.	860
WAZL	Hazelton, Pa.	1490
WAZF	Yazoo City, Miss.	1230
WAZS	Summerville, S. C.	980
WAZY	Lafayette, Ind.	1410
WBAA	West Lafayette, Ind.	920
WBAB	Babylon, N.Y.	1440
WBAC	Cleveland, Tenn.	1340
WBAF	Barnesville, Ga.	1090
WBAG	Burlington, N.C.	1150
WBAL	Baltimore, Md.	1090
WBAM	Montgomery, Ala.	740
WBAP	Fort Worth, Tex.	570 & 820
WBAR	Bartow, Fla.	1460
WBAT	Marion, Ind.	1400
WBAW	Barnwell, S.C.	740
WBAX	Wilkes-Barre, Pa.	1240
WBAY	Green Bay, Wis.	1360
WBAZ	Kingston, N.Y.	1550
WBBA	Pittsfield, Ill.	1580
WBBB	Burlington-Graham, N.C.	920
WBBF	Rochester, N.Y.	950
WBBI	Abingdon, Va.	1230
WBBK	Blakely, Ga.	1260
WBBL	Richmond, Va.	1480
WBBM	Chicago, Ill.	780
WBBO	Forest City, N.C.	780
WBBQ	Augusta, Ga.	1340
WBBR	Travelers Rest, S.C.	1580
WBBS	Jacksonville, N.C.	1290
WBBT	Lyons, Ga.	1340
WBBW	Youngstows, Ohio	1240
WBBX	Portsmouth, N.H.	1380
WBBZ	Pona City, Okla.	1230
WBCA	Bay Minette, Ala.	1110
WBCB	Levittown, Pa.	1490
WBCH	Hastings, Mich.	1220
WBCI	Williamsburg, Va.	740
WBCK	Battle Creek, Mich.	930
WBCM	Bay City, Mich.	1440
WBCO	Bucyrus, Ohio	1540
WBCU	Union, S.C.	1460
WBEC	Pittsfield, Mass.	1420
WBEE	Harvey, Ill.	1570
WBEJ	Elizabethton, Tenn.	1240
WBEL	So. Beloit, Ill.	1380
WBEN	Buffalo, N.Y.	930
WBER	Moncks Corner, S.C.	950
WBET	Brockton, Mass.	1460
WBEU	Beaufort, S.C.	960
WBEV	Beaver Dam, Wis.	1430
WBEX	Chillicothe, Ohio	1490
WBFD	Bedford, Pa.	1310
WBFJ	Woodbury, Tenn.	1540
WBFN	Quitman, Miss.	1500
WBGC	Chipley, Fla.	1240
WBGN	Bowling Green, Ky.	1340
WBGS	Slidell, La.	1560
WBHB	Fitzgerald, Ga.	1240
WBHC	Hampton, S.C.	1270
WBHF	Cartersville, Ga.	1450
WBHM	Birmingham, Ala.	1550

Call	Location	kHz
WBHN	Bryson City, N. C.	1590
WBHP	Huntsville, Ala.	1230
WBHT	Brownsville, Tenn.	1520
WBIA	Augusta, Ga.	1230
WBIB	Centreville, Ala.	1110
WBIE	Marietta, Ga.	1080
WBIG	Greensboro, N.C.	1470
WBIP	Booneville, Miss.	1400
WBIR	Knoxville, Tenn.	1240
WBIS	Bristol, Conn.	1440
WBIT	Adel, Ga.	1470
WBIW	Bedford, Ind.	1340
WBIX	Jacksonville Beach, Fla.	1010
WBIZ	Eau Claire, Wis.	1400
WBJM	Lemmon, S. D.	1400
WBKC	Chardon, O.	1560
WBKH	Hattiesburg, Miss.	950
WBKN	Newton, Miss.	1410
WBKV	West Bend, Wis.	1470
WBLA	Elizabethtown, N.C.	1440
WBLC	Lenoir City, Tenn.	1360
WBLE	Batesville, Miss.	1290
WBLF	Bellefonte, Pa.	970
WBLG	Lexington, Ky.	1300
WBLJ	Dalton, Ga.	1230
WBLO	Evergreen, Ala.	1470
WBLR	Batesburg, S.C.	1430
WBLT	Bedford, Va.	1350
WBLU	Salem, Va.	1480
WBLY	Springfield, Ohio	1600
WBMA	Beaufort, N.C.	1400
WBMC	McMinnville, Tenn.	960
WBMD	Baltimore, Md.	750
WBME	Belfast, Me.	1230
WBMJ	San Juan, P. R.	1190
WBMK	West Point, Ga.	1310
WBML	Macon, Ga.	1240
WBMS	Black Mountain, N.C.	1350
WBNC	Conway, N.H.	1050
WBNL	Boonville, Ind.	1540
WBNO	Bryan, Ohio	1520
WBNR	Beacon, N.Y.	1260
WBNS	Columbus, Ohio	1460
WBNT	Oneida, Tenn.	1310
WBNX	New York, N.Y.	1380
WBOB	Galax, Va.	1360
WBOC	Salisbury, Md.	960
WBOK	New Orleans, La.	1230
WBOL	Bolivar, Tenn.	1560
WBOO	Baraboo, Wis.	740
WBOP	Pensacola, Fla.	980
WBOS	Brookline, Mass.	1600
WBOW	Terre Haute, Ind.	1230
WBOX	Bogalusa, La.	920
WBOY	Clarksburg, W.Va.	1400
WBPZ	Lock Haven, Pa.	1230
WBRB	Mt. Clemens, Mich.	1430
WBRC	Birmingham, Ala.	960
WBRD	Bradenton, Fla.	1420
WBRE	Wilkes-Barre, Pa.	1340
WBRG	Lynchburg, Va.	1050
WBRI	Indianapolis, Ind.	1500
WBRJ	Marietta, O.	910
WBRK	Pittsfield, Mass.	1340
WBRL	Berlin, N.H.	1400
WBRM	Marion, N.C.	1250
WBRN	Big Rapids, Mich.	1460
WBRT	Bardstown, Ky.	1320
WBRO	Waynesboro, Ga.	1310
WBRV	Boonville, N.Y.	900
WBRX	Berwick, Pa.	1280
WBSA	Boaz, Ala.	1300
WBSC	Bennetsville, S.C.	1550
WBSG	Blackshear, Ga.	1350
WBSM	New Bedford, Mass.	1420
WBSR	Pensacola, Fla.	1450
WBT	Charlotte, N.C.	1110
WBTA	Batavia, N.Y.	1490
WBTC	Uhrichsville, O.	1540
WBTE	Windsor, N.C.	990
WBTH	Williamson, W.Va.	1400
WBTM	Danville, Va.	1330
WBTN	Bennington, Vt.	1370
WBTO	Linton, Ind.	1600
WBTS	Bridgeport, Ala.	1480
WBUC	Buckhannon, W.Va.	1460
WBUD	Trenton, N.J.	1260
WBUG	Ridgeland, S.C.	1430
WBUT	Butler, Pa.	1050
WBUX	Doylestown, Pa.	1570
WBUY	Lexington, N.C.	1440
WBUZ	Fredonia, N.Y.	1570
WBVM	Utica, N.Y.	1550
WBVP	Beaver Falls, Pa.	1230
WBYB	St. Pauls, N.C.	1060
WBYE	Calera, Ala.	1370
WBYG	Savannah, Ga.	1450
WBYS	Canton, Ill.	1560
WBZ	Boston, Mass.	1030
WBZA	Glens Falls, N.Y.	1410
WBZB	Selma, N.C.	1090
WBZY	New Castle, Pa.	1140
WCAB	Rutherfordton, N.C.	590
WCAI	Fort Myers, Fla.	1350
WCAL	Northfield, Minn.	770
WCAM	Camden, N.J.	1310
WCAO	Baltimore, Md.	600
WCAP	Lowell, Mass.	980
WCAR	Detroit, Mich.	1130
WCAS	Cambridge, Mass.	740
WCAT	Orange, Mass.	1390
WCAU	Philadelphia, Pa.	1210
WCAW	Charleston, W.Va.	680

Call	Location	kHz
WCAY	Cayce, S.C.	620
WCAZ	Carthage, Ill.	990
WCBA	Corning, N.Y.	1350
WCBG	Chambersburg, Pa.	1590
WCBI	Columbus, Miss.	550
WCBK	Martinsville, Ind.	1540
WCBL	Benton, Ky.	1290
WCBM	Baltimore, Md.	680
WCBR	Richmond, Ky.	1110
WCBS	New York, N.Y.	880
WCBT	Roanoke Rapids, N.C.	1230
WCBX	Eden, N.C.	1130
WCBY	Cheboygan, Mich.	1240
WCCC	Hartford, Conn.	1290
WCCF	Punta Gorda, Fla.	1580
WCCM	Lawrence, Mass.	800
WCCN	Neillsville, Wis.	1370
WCCO	Minneapolis-St. Paul, Minn.	830
WCCP	Clemson, S.C.	1560
WCCR	Urbana, Ill.	1580
WCCW	Traverse City, Mich.	1310
WCDJ	Edenton, N.C.	1260
WCDL	Carbondale, Pa.	1440
WCDQ	Hamden, Conn.	1220
WCDS	Glasgow, Ky.	1440
WCDT	Winchester, Tenn.	1340
WCEC	Rocky Mount, N.C.	810
WCED	DuBois, Pa.	1420
WCEF	Parkersburg, W.Va.	1050
WCEH	Hawkinsville, Ga.	610
WCEM	Cambridge, Md.	1240
WCEN	Mt. Pleasant, Mich.	1150
WCER	Charlotte, Mich.	1390
WCFL	Chicago, Ill.	1000
WCFR	Springfield, Vt.	1480
WCFV	Clifton Forge, Va.	1230
WCGB	Pastillo, P. R.	1050
WCGC	Belmont, N.C.	1270
WCGO	Chicago Hghts., Ill.	1600
WCGR	Canandaigua, N.Y.	1550
WCHA	Chambersburg, Pa.	800
WCHB	Inkster, Mich.	1440
WCHE	Westchester, Pa.	1520
WCHI	Chillicothe, Ohio	1350
WCHJ	Brookhaven, Miss.	1470
WCHK	Canton, Ga.	1290
WCHL	Chapel Hill, N.C.	1360
WCHN	Norwich, N.Y.	970
WCHO	Washington Court House, Ohio	1250
WCHQ	Camuy, P.R.	1360
WCHS	Charleston, W.Va.	580
WCHV	Charlottesville, Va.	1260
WCIL	Carbondale, Ill.	1020
WCIN	Cincinnati, Ohio	1480
WCIR	Beckley, W. Va.	1070
WCIS	Moss Point, Miss.	1460
WCIT	Lima, Ohio	940
WCJU	Columbia, Miss.	1450
WCKB	Dunn, N.C.	780
WCKD	Ishpenning, Mich.	970
WCKI	Greer, S.C.	1300
WCKL	Catskill, N.Y.	560
WCKM	Winnsboro, S.C.	1250
WCKY	Cincinnati, Ohio	1530
WCLA	Claxton, Ga.	1470
WCLB	Camilla, Ga.	1220
WCLC	Jamestown, Tenn.	1260
WCLD	Cleveland, Miss.	1490
WCLE	Cleveland, Tenn.	1570
WCLG	Morgantown, W.Va.	1300
WCLI	Corning, N.Y.	1450
WCLO	Janesville, Wis.	1230
WCLS	Columbus, Ga.	1580
WCLT	Newark, Ohio	1430
WCLU	Covington, Ky.	1320
WCLW	Mansfield, O.	1140
WCMA	Corinth, Miss.	1230
WCMB	Harrisburg, Pa.	1460
WCMC	Wildwood, N.J.	1230
WCME	Brunswick, Maine	900
WCMI	Ashland, Ky.	1340
WCMN	Arecibo, P.R.	1280
WCMP	Pine City, Minn.	1350
WCMR	Elkhart, Ind.	1270
WCMS	Norfolk, Va.	1050
WCMT	Martin, Tenn.	1410
WCMY	Ottawa, Ill.	1430
WCNB	Connersville, Ind.	1580
WCNC	Elizabeth City, N.C.	1240
WCND	Shelbyville, Ky.	940
WCNH	Quincy, Fla.	1230
WCNL	Newport, N. H.	1010
WCNR	Bloomsburg, Pa.	930
WCNU	Crestview, Fla.	1010
WCNW	Fairfield, O.	1560
WCNX	Middletown, Conn.	1150
WCOA	Pensacola, Fla.	1370
WCOC	Meridian, Miss.	910
WCOF	Immokalee, Fla.	1490
WCOG	Greensboro, N.C.	1320
WCOH	Newnan, Ga.	1400
WCOJ	Coatesville, Pa.	1420
WCOK	Sparta, N.C.	1060
WCOL	Columbus, Ohio	1230
WCON	Cornelia, Ga.	1450
WCOP	Boston, Mass.	1150
WCOR	Lebanon, Tenn.	900
WCOS	Columbia, S.C.	1400
WCOU	Lewiston, Maine	1240
WCOV	Montgomery, Ala.	1170
WCOW	Sparta, Wis.	1290
WCOX	Camden, Ala.	1540

Call	Location	kHz
WCOY	Columbia, Pa.	1580
WCPA	Clearfield, Pa.	900
WCPC	Houston, Miss.	940
WCPH	Etowah, Tenn.	1220
WCPK	Chesapeake, Va.	1600
WCPM	Cumberland, Ky.	1280
WCPR	Coamo, P. R.	1450
WCPS	Tarboro, N.C.	760
WCRA	Effingham, Ill.	1090
WCRB	Waltham, Mass.	1330
WCRE	Cheraw, S.C.	1420
WCRI	Scottsboro, Ala.	1050
WCRK	Morristown, Tenn.	1150
WCRL	Oneonta, Ala.	1570
WCRM	Clare, Mich.	990
WCRO	Johnstown, Pa.	1230
WCRS	Greenwood, S.C.	1450
WCRT	Birmingham, Ala.	1260
WCRV	Washington, N.J.	1580
WCRW	Chicago, Ill.	1240
WCRY	Macon, Ga.	900
WCSA	Ripley, Mass.	1260
WCSC	Charleston, S.C.	1390
WCSH	Portland, Maine	970
WCSI	Columbus, Ind.	1010
WCSJ	Morris, Ill.	1550
WCSL	Cherryville, N. C.	1590
WCSM	Celina, Ohio	1350
WCSR	Hillsdale, Mich.	1340
WCSS	Amsterdam, N.Y.	1490
WCST	Berkeley Springs, W.Va.	1010
WCSV	Crossville, Tenn.	1520
WCSW	Shell Lake, Wis.	940
WCTA	Andalusia, Ala.	920
WCTC	New Brunswick, N.J.	1450
WCTR	Chestertown, Md.	1530
WCTT	Corbin, Ky.	680
WCTW	New Castle, Ind.	1550
WCUB	Manitowoc, Wis.	980
WCUE	Cuyahoga Falls, Ohio	1150
WCUM	Cumberland, Md.	1230
WCVA	Culpeper, Va.	1490
WCVI	Connellsville, Pa.	1340
WCVL	Crawfordsville, Ind.	1550
WCVP	Murphy, N.C.	600
WCVR	Randolph, Vt.	1320
WCVS	Springfield, Ill.	1450
WCVU	Portsmouth, Va.	1350
WCWA	Toledo, O.	1230
WCWC	Ripon, Wis.	1600
WCWR	Tarpon Springs, Fla.	1470
WCYB	Bristol, Va.	690
WCYN	Cynthiana, Ky.	1400
WDAD	Indiana, Pa.	1450
WDAE	Tampa, Fla.	1250
WDAF	Kansas City, Mo.	610
WDAK	Columbus, Ga.	540
WDAL	Meridian, Miss.	1330
WDAN	Danville, Ill.	1490
WDAR	Darlington, S.C.	1350
WDAS	Philadelphia, Pa.	1480
WDAT	Ormond Beach, Fla.	1380
WDAX	McRae, Ga.	1410
WDAY	Fargo, N. Dak.	970
WDBC	Escanaba, Mich.	680
WDBF	Delray Beach, Fla.	1420
WDBL	Springfield, Tenn.	1590
WDBM	Statesville, N.C.	550
WDBO	Orlando, Fla.	580
WDBQ	Dubuque, Iowa	1490
WDCF	Dade City, Fla.	1350
WDCJ	Arlington, Fla.	1220
WDCR	Hanover, N.H.	1340
WDDT	Greenvile, Miss.	900
WDDY	Gloucester, Va.	1420
WDEA	Ellsworth, Me.	1370
WDEB	Jamestown, Tenn.	1500
WDEC	Americus, Ga.	1290
WDEE	Detroit, Mich.	1500
WDEF	Chattanooga, Tenn.	1370
WDEH	Sweetwater, Tenn.	800
WDEL	Wilmington, Del.	1150
WDEN	Macon, Ga.	1500
WDEV	Waterbury, Vt.	550
WDEW	Westfield, Mass.	1570
WDLG	Douglasville, Ga.	1520
WDGY	Minneapolis, Minn.	1130
WDIA	Memphis, Tenn.	1070
WDIC	Clinchco, Va.	1430
WDIG	Dothan, Ala.	1450
WDIX	Orangeburg, S.C.	1150
WDJS	Mt. Olive, N.C.	1430
WDJZ	Bridgeport, Conn.	1530
WDKD	Kingstree, S. C.	1310
WDKN	Dickson, Tenn.	1260
WDLA	Walton, N.Y.	12[illegible]0
WDLC	Port Jervis, N.Y.	1490
WDLG	Marshfield, Wis.	1450
WDLR	Delaware, Ohio	1550
WDLM	E. Moline, Ill.	960
WDLP	Panama City, Fla.	590
WDLT	Indianola, Miss.	1380
WDME	Dover-Foxcraft, Me.	1340
WDMG	Douglas, Ga.	860
WDMJ	Marquette, Mich.	1320
WDMP	Dodgeville, Wis.	810
WDMV	Pocomoke City, Md.	540
WDNC	Durham, N.C.	620
WDNE	Elkins, W.Va.	1240
WDNG	Anniston, Ala.	1450
WDNL	Warren, O.	1570
WDNT	Dayton, Tenn.	1280
WDOB	Canton, Miss.	1370
WDOC	Prestonsburg, Ky.	1310
WDOD	Chattanooga, Tenn.	1310
WDOE	Dunkirk, N.Y.	1410
WDOG	Allendale, S.C.	1450
WDOL	Athens, Ga.	1470
WDON	Wheaton, Md.	1540
WDOR	Sturgeon Bay, Wis.	910
WDOS	Oneonta, N.Y.	730
WDOV	Dover, Del.	1410
WDOT	Burlington, Vt.	1400
WDOW	Dowagiac, Mich.	1440
WDQN	DuQuoin, Ill.	1580
WDRC	Hartford, Conn.	1360
WDSC	Dillon, S.C.	800
WDSG	Dyersburg, Tenn.	1450
WDSK	Cleveland, Miss.	1410
WDSL	Mocksville, N. C.	1520
WDSM	Superior, Wis.	710
WDSR	Lake City, Fla.	1340
WDSU	New Orleans, La.	1280
WDTM	Selmer, Tenn.	1130
WDUN	Gainesville, Ga.	1240
WDUX	Waupaca, Wis.	800
WDUZ	Green Bay, Wis.	1400
WDVA	Danville, Va.	1250
WDVH	Gainesville, Fla.	980
WDVL	Vineland, N.J.	1270
WDWD	Dawson, Ga.	990
WDWS	Champaign, Ill.	1400
WDXB	Chattanooga, Tenn.	1490
WDXE	Lawrenceburg, Tenn.	1370
WDXI	Jackson, Tenn.	1310
WDXL	Lexington, Tenn.	1490
WDXN	Clarksville, Tenn.	540
WDXR	Puducah, Ky.	1560
WDXY	Sumter, S.C.	1240
WDYZ	Buford, Ga.	1460
WDZ	Decatur, Ill.	1050
WEAB	Greer, S.C.	800
WEAC	Gaffney, S. C.	1500
WEAD	College Park, Ga.	1570
WEAG	Alcoa, Tenn.	1470
WEAL	Greensboro, N.C.	1510
WEAM	Arlington, Va.	1390
WEAN	Providence, R.I.	790
WEAQ	Eau Claire, Wis.	790
WEAS	Savannah, Ga.	900
WEAT	W. Palm Beach, Fla.	850
WEAV	Plattsburg, N.Y.	960
WEAW	Evanston, Ill.	1330
WEBB	Baltimore, Md.	1360
WEBC	Duluth, Minn.	560
WEBJ	Brewton, Ala.	1240
WEBO	Owego, N.Y.	1330
WEBQ	Harrisburg, Ill.	1240
WEBR	Buffalo, N.Y.	970
WEBS	Calhoun, Ga.	1110
WEBY	Milton, Fla.	1330
WECL	Eau Claire, Wis.	1050
WECO	Wartburg, Tenn.	940
WECP	Cathage, Miss.	1480
WEDC	Chicago, Ill.	1240
WEDG	Soddy, Tenn.	1240
WEDO	McKeesport, Pa.	810
WEEB	Southern Pines, N.C.	990
WEEO	Waynesboro, Pa.	1130
WEEE	Rensselaer, N.Y.	1300
WEEF	Highland Park, Ill.	1430
WEEI	Boston, Mass.	590
WEEL	Fairfax, Va.	1310
WEEN	Lafayette, Tenn.	1460
WEEP	Pittsburgh, Pa.	1080
WEER	Warrenton, Va.	1250
WEET	Richmond, Va.	1320
WEEU	Reading, Pa.	850
WEEW	Washington, N.C.	1320
WEEX	Easton, Pa.	1230
WEEZ	Chester, Pa.	1590
WEGA	Vega Baja, P. R.	1350
WEGO	Concord, N.C.	1410
WEGP	Presque Isle, Maine	1390
WEHH	Elmira Heights-Horseheads, N.Y.	1590
WEIC	Charleston, Ill.	1270
WEIF	Moundsville, W. Va.	1370
WEIM	Fitchburg, Mass.	1280
WEIR	Weirton, W.Va.	1430
WEIS	Centre, Ala.	990
WEJL	Scranton, Pa.	630
WEKG	Jackson, Ky.	810
WEKO	Cabo Rojo, P.R.	930
WEKR	Fayetteville, Tenn.	1240
WEKY	Richmond, Ky.	1340
WEKZ	Monroe, Wis.	1260
WELA	Elizabeth, N.J.	1530
WELB	Elba, Ala.	1350
WELC	Welch, W.Va.	1150
WELD	Fisher, W.Va.	690
WELE	S. Daytona, Fla.	1590
WELF	Tomahawk, Wis.	810
WELI	New Haven, Conn.	960
WELK	Charlottesville, Va.	1010
WELM	Elmira, N.Y.	1410
WELO	Tupelo, Miss.	580
WELP	Easley, S.C.	1360
WELR	Roanoke, Ala.	1360
WELS	Kinston, N.C.	1010
WELV	Ellenville, N.Y.	1350
WELW	Willoughby, O.	1330
WELX	Xenia, O.	1110
WELY	Ely, Minn.	1450
WELZ	Belzoni, Miss.	1460
WEMB	Erwin, Tenn.	1420
WEMD	Easton, Md.	1460
WEMJ	Laconia, N.H.	1490
WEMP	Milwaukee, Wis.	1250
WENC	Whiteville, N.C.	1220
WEND	Ebensburg, Pa.	1580
WENE	Endicott, N.Y.	1430
WENG	Englewood, Fla.	1530
WENK	Union City, Tenn.	1240
WENN	Birmingham, Ala.	1320
WENO	Madison, Tenn.	1430
WENR	Englewood, Tenn.	1090
WENT	Gloversville, N.Y.	1340
WENY	Elmira, N.Y.	1230
WENZ	Highland Springs, Va.	1450
WEOK	Poughkeepsie, N.Y.	1390
WEOL	Elyria, Ohio	930
WEPG	S. Pittsburgh, Tenn.	910
WEPM	Martinsburg, W.Va.	1340
WEPN	Elizabethtown, Pa.	1600
WERA	Plainfield, N.J.	1590
WERD	Atlanta, Ga.	860
WERE	Cleveland, Ohio	1300
WERH	Hamilton, Ala.	970
WERI	Westerly, R.I.	1230
WERK	Muncie, Ind.	990
WERL	Eagle River, Wis.	950
WERT	Van Wert, Ohio	1220
WERX	Wyoming, Mich.	1530
WESA	Charleroi, Pa.	940
WESB	Bradford, Pa.	1490
WESC	Greenville, S.C.	660
WESO	Southbridge, Mass.	970
WESR	Tasley, Va.	1330
WEST	Easton, Pa.	1400
WESX	Salem, Mass.	1230
WESY	Leland, Miss.	1580
WETB	Johnson City, Tenn.	790
WETC	Wendell-Zebulon, N.C.	540
WETH	St. Augustine, Fla.	1420
WETO	DeLand, Fla.	1490
WETT	Ocean City, Md.	1590
WETU	Wetumpka, Ala.	1250
WETZ	New Martinsville, West Virginia	1330
WEUC	Ponce, P.R.	1420
WEUP	Huntsville, Ala.	1600
WEVA	Emporia, Va.	860
WEVD	New York, N.Y.	1330
WEVE	Eveleth, Minn.	1340
WEVR	River Falls, Wis.	1550
WEW	St. Louis, Mo.	770
WEWO	Laurinburg, N.C.	1080
WEXL	Royal Oak, Mich.	1340
WEXT	W. Hartford, Conn.	1550
WEYE	Sanford, N.C.	1290
WEYY	Talladega, Ala.	1580
WEZE	Boston, Mass.	1260
WEZJ	Williamsburg, Ky.	1440
WEZQ	Winfield, Ala.	1300
WEZY	Cocoa, Fla.	1350
WFAA	Dallas, Tex.	570 & 820
WFAB	Miami, Fla.	990
WFAD	Middlebury, Vt.	1490
WFAG	Farmville, N.C.	1250
WFAH	Alliance, Ohio	1310
WFAI	Fayetteville, N.C.	1230
WFAR	Farrell, Pa.	1470
WFAS	White Plains, N.Y.	1230
WFAU	Augusta, Me.	1340
WFAW	Ft. Atkinson, Wis.	940
WFAX	Falls Church, Va.	1220
WFBA	San Sebastion, P.R.	1460
WFBC	Greenville, S.C.	1330
WFBF	Fernandina Beach, Fla.	1570
WFBG	Altoona, Pa.	1290
WFBL	Syracuse, N.Y.	1390
WFBM	Indianapolis, Ind.	1260
WFBR	Baltimore, Md.	1300
WFBS	Spring Lake, N. C.	1450
WFCG	Franklinton, La.	1110
WFCM	Winston-Salem, N. C.	1550
WFDF	Flint, Mich.	910
WFDR	Manchester, Ga.	1370
WFEA	Manchester, N.H.	1370
WFEB	Sylacauga, Ala.	1340
WFEC	Harrisburg, Pa.	1400
WFFF	Columbia, Miss.	1360
WFFG	Marathon, Fla.	1300
WFGL	Fitchburg, Mass.	960
WFGN	Gaffney, S.C.	1570
WFGW	Black Mountains, N.C.	1010
WFHG	Bristol, Va.	980
WFHK	Pell City, Ala.	1430
WFHR	Wis. Rapids, Wis.	1320
WFIA	Louisville, Ky.	900
WFIC	Collinsville, Va.	1530
WFIF	Milford, Conn.	1500
WFIG	Sumter, S.C.	1290
WFIL	Philadelphia, Pa.	560
WFIN	Findlay, Ohio	1380
WFIR	Roanoke, Va.	960
WFIS	Fountain Inn, S.C.	1600
WFIV	Kissimmee, Fla.	1080
WFIW	Fairfield, Ill.	1390
WFIX	Huntsville, Ala.	1450
WFKN	Franklin, Ky.	1220
WFKY	Frankfort, Ky.	1490
WFLA	Tampa, Fla.	970
WFLB	Fayetteville, N.C.	1490
WFLI	Lookout Mtn., Tenn.	1070
WFLN	Philadelphia, Pa.	900
WFLO	Farmville, Va.	870
WFLR	Dundee, N.Y.	1570
WFLS	Fredericksburg, Va.	1350
WFLW	Monticello, Ky.	1360
WFMC	Goldsboro, N.C.	730
WFMD	Frederick, Md.	930
WFME	Punxsutawney, Pa.	1540
WFMH	Cullman, Ala.	1460
WFMJ	Youngstown, Ohio	1390
WFMO	Fairmont, N.C.	860
WFMW	Madisonville, Ky.	730
WFNC	Fayetteville, N.C.	940
WFNL	No. Augusta, S.C.	1600
WFOB	Fostoria, Ohio	1430
WFOM	Marietta, Ga.	1230
WFOR	Hattiesburg, Miss.	1400
WFOY	St. Augustine, Fla.	1240
WFPA	Fort Payne, Ala.	1400
WFPG	Atlantic City, N.J.	1450
WFPM	Fort Valley, Ga.	1150
WFPR	Hammond, La.	1400
WFRA	Franklin, Pa.	1450
WFRB	Frostburg, Md.	560
WFRC	Reidsville, N.C.	1600
WFRM	Coudersport, Pa.	600
WFRO	Fremont, Ohio	900
WFRX	West Frankfort, Ill.	1300
WFSC	Franklin, N.C.	1050
WFSG	Boca Raton, Fla.	740
WFSH	Valparaiso, Fla.	1340
WFSO	Pinellas, Fla.	570
WFSP	Kingwood, W. Va.	1560
WFSR	Bath, N.Y.	1380
WFST	Caribou, Maine	600
WFTC	Kinston, N.C.	960
WFTG	London, Ky.	1400
WFTL	Ft. Lauderdale, Fla.	1400
WFTM	Maysville, Ky.	1240
WFTN	Franklin, N.H.	1240
WFTO	Fulton, Miss.	1330
WFTR	Front Royal, Va.	1450
WFTW	Ft. Walton Beach, Fla.	1260
WFUL	Fulton, Ky.	1270
WFUN	Miami, Fla.	790
WFUR	Grand Rapids, Mich.	1570
WFVA	Fredericksburg, Va.	1230
WFWL	Camden, Tenn.	1220
WFWR	Ft. Wayne, Ind.	1090
WFYC	Alma, Mich.	1280
WGAA	Cedartown, Ga.	1340
WGAC	Augusta, Ga.	580
WGAD	Gadsden, Ala.	1350
WGAF	Valdosta, Ga.	910
WGAI	Elizabeth City, N.C.	560
WGAL	Lancaster, Pa.	1490
WGAN	Portland, Maine	560
WGAP	Maryville, Tenn.	1400
WGAR	Cleveland, Ohio	1220
WGAS	S. Gastonia, N.C.	1420
WGAT	Gate City, Va.	1050
WGAU	Athens, Ga.	1340
WGAW	Gardner, Mass.	1340
WGBB	Freeport, N.Y.	1240
WGBC	Chipley, Fla.	1240
WGBF	Evansville, Ind.	1280
WGBG	Greensboro, N.C.	1400
WGBI	Scranton, Pa.	910
WGBR	Goldsboro, N. C.	1150
WGBS	Miami, Fla.	710
WGCB	Red Lion, Pa.	1440
WGCD	Chester, S.C.	1490
WGCH	Greenwich, Conn.	1490
WGCM	Gulfport, Miss.	1240
WGEA	Geneva, Ala.	1150
WGEE	Indianapolis, Ind.	1590
WGEN	Geneseo, Ill.	1500
WGEM	Quincy, Ill.	1440
WGEN	Genesco, Ill.	1500
WGET	Gettysburg, Pa.	1320
WGEZ	Beloit, Wis.	1490
WGFA	Watseka, Ill.	1360
WGFS	Covington, Ga.	1430
WGGA	Gainesville, Ga.	550
WGGG	Gainesville, Fla.	1230
WGGH	Marion, Ill.	1150
WGGO	Salamanca, N.Y.	1590
WGH	Newport News, Va.	1310
WGHC	Clayton, Ga.	1570
WGHM	Skowegan, Maine	1150
WGHN	Grd. Haven, Mich.	1370
WGHQ	Kingston, N.Y.	920
WGIC	Xenia, O.	1500
WGIG	Brunswick, Ga.	1440
WGIL	Galesburg, Ill.	1400
WGIR	Manchester, N.H.	610
WGIV	Charlotte, N.C.	1600
WGKA	Atlanta, Ga.	1190
WGKR	Perry, Fla.	1310
WGL	Fort Wayne, Ind.	1250
WGLA	Gretna, La.	1540
WGLB	Port Wash., Wis.	1560
WGLC	Mendota, Ill.	1090
WGLI	Babylon, N.Y.	1290
WGMA	Hollywood, Fla.	1320
WGMF	Watkins Glen, N.Y.	1500
WGML	Hinesville, Ga.	990
WGMS	Bethesda, Md.	570
WGN	Chicago, Ill.	720
WGNC	Gastonia, N.C.	1450
WGNE	Panama City Beach, Fla.	1480
WGNI	Wilmington, N.C.	1450

WHITE'S RADIO LOG

Call	Location	kHz
WGNP	Indian Rocks Beach, Fla.	1520
WGNS	Murfreesboro, Tenn.	1450
WGNU	Granite City, Ill.	920
WGNY	Newburgh, N.Y.	1220
WGOC	Kingsport, Tenn.	1090
WGOE	Richmond, Va.	1590
WGOG	Walhalla, S.C.	1000
WGOH	Grayson, Ky.	1370
WGOK	Mobile, Ala.	900
WGOM	Marion, Ind.	860
WGON	Munsing, Mich.	1400
WGOV	Valdosta, Ga.	950
WGOW	Chattanooga, Tenn.	1150
WGPA	Bethlehem, Pa.	1100
WGPC	Albany, Ga.	1450
WGR	Buffalo, N.Y.	550
WGRA	Cairo, Ga.	790
WGRD	Grand Rapids, Mich.	1410
WGRI	Griffin, Ga.	1410
WGRM	Greenwood, Miss.	1240
WGRO	Lake City, Fla.	960
WGRP	Greenville, Pa.	940
WGRT	Chicago, Ill.	950
WGRV	Greeneville, Tenn.	1340
WGRY	Grayling, Mich.	1590
WGSA	Ephrata, Pa.	1310
WGSB	Geneva, Ill.	1480
WGSM	Huntington, N.Y.	740
WGSR	Millen, Ga.	1570
WGST	Atlanta, Ga.	920
WGSV	Guntersville, Ala.	1270
WGSW	Greenwood, S.C.	1350
WGTA	Summerville, Ga.	950
WGTC	Greenville, N.C.	1590
WGTL	Kannapolis, N.C.	870
WGTM	Wilson, N.C.	590
WGTN	Georgetown, S.C.	1400
WGTO	Cypress Gardens, Fla.	540
WGTR	Natick, Mass.	1060
WGTX	DeFuniak Springs, Fla.	1280
WGUL	New Port Richey, Fla.	1500
WGUN	Atlanta-Decatur, Ga.	1010
WGUS	North Augusta, S.C.	1380
WGUY	Bangor, Maine	1250
WGVA	Geneva, N.Y.	1240
WGVM	Greenville, Miss.	1260
WGWC	Selma, Ala.	1340
WGWR	Asheboro, N.C.	1260
WGY	Schenectady, N.Y.	810
WGYV	Greenville, Ala.	1380
WHA	Madison, Wis.	970
WHAG	Halfway, Md.	1410
WHAI	Greenfield, Mass.	1240
WHAK	Rogers City, Mich.	960
WHAL	Shelbyville, Tenn.	1400
WHAM	Rochester, N.Y.	1180
WHAN	Haines City, Fla.	930
WHAP	Hopewell, Va.	1340
WHAR	Clarksburg, W.Va.	1340
WHAS	Louisville, Ky.	840
WHAT	Philadelphia, Pa.	1340
WHAV	Haverhill, Mass.	1490
WHAW	Weston, W.Va.	980
WHAZ	Troy, N.Y.	1330
WHB	Kansas City, Mo.	710
WHBB	Selma, Ala.	1490
WHBC	Canton, Ohio	1480
WHBF	Rock Island, Ill.	1270
WHBG	Harrisonburg, Va.	1360
WHBL	Sheboygan, Wis.	1330
WHBN	Harrodsburg, Ky.	1420
WHBO	Tampa, Fla.	1050
WHBQ	Memphis, Tenn.	560
WHBT	Harriman, Tenn.	1600
WHBU	Anderson, Ind.	1240
WHBY	Appleton, Wis.	1230
WHCC	Waynesville, N.C.	1400
WHCO	Sparta, Ill.	1230
WHCQ	Spartanburg, S.C.	1400
WHCU	Ithaca, N.Y.	870
WHDF	Houghton, Mich.	1400
WHDH	Boston, Mass.	850
WHDL	Olean, N.Y.	1450
WHDM	McKenzie, Tenn.	1440
WHEB	Portsmouth, N.H.	750
WHEC	Rochester, N.Y.	1460
WHEE	Martinsville, Va.	1370
WHEL	New Albany, Ind.	1570
WHEN	Syracuse, N.Y.	620
WHEO	Stuart, Va.	1270
WHEP	Foley, Ala.	1310
WHER	Memphis, Tenn.	1430
WHFB	Benton Harbor-St. Joseph, Mich.	1060
WHGR	Houghton L., Mich.	1290
WHHH	Warren, Ohio	1440
WHHM	Henderson, Tenn.	1580
WHHO	Hornell, N.Y.	1320
WHHT	Lucedale, Miss.	1440

Call	Location	kHz
WHHV	Hillsville, Va.	1400
WHHY	Montgomery, Ala.	1440
WHIC	Hardinsburg, Ky.	1520
WHIE	Griffin, Ga.	1320
WHIH	Portsmouth, Va.	1400
WHIL	Medford, Mass.	1430
WHIM	Providence, R.I.	1110
WHIN	Gallatin, Tenn.	1010
WHIO	Dayton, Ohio	1290
WHIP	Mooresville, N.C.	1350
WHIR	Danville, Ky.	1230
WHIS	Bluefield, W.Va.	1440
WHIT	New Bern, N.C.	1450
WHIZ	Zanesville, Ohio	1240
WHJB	Greensburg, Pa.	620
WHJC	Matewan, W. Va.	1360
WHK	Cleveland, Ohio	1420
WHKP	Hendersonville, N.C.	1450
WHKY	Hickory, N.C.	1290
WHLB	Virginia, Minn.	1400
WHLD	Niagara Falls, N.Y.	1270
WHLF	South Boston, Va.	1400
WHLI	Hempstead, N.Y.	1100
WHLL	Wheeling, W.Va.	1600
WHLM	Bloomsburg, Pa.	550
WHLN	Harlan, Ky.	1410
WHLO	Akron, Ohio	640
WHLP	Centerville, Tenn.	1570
WHLS	Port Huron, Mich.	1450
WHLT	Huntington, Ind.	1300
WHLW	Lakewood, N.J.	1170
WHMA	Anniston, Ala.	1390
WHMC	Gaithersburg, Md.	1150
WHMI	Howell, Mich.	1350
WHMP	Northampton, Mass.	1400
WHN	New York, N.Y.	1050
WHNC	Henderson, N.C.	890
WHNY	McComb, Miss.	1250
WHO	Des Moines, Iowa	1040
WHOA	San Juan, P.R.	870
WHOC	Philadelphia, Miss.	1490
WHOD	Jackson, Ala.	1290
WHOK	Lancaster, Ohio	1320
WHOL	Allentown, Pa.	1600
WHOM	New York, N.Y.	1480
WHON	Centerville, Ind.	930
WHOO	Orlando, Fla.	990
WHOP	Hopkinsville, Ky.	1230
WHOS	Decatur, Ala.	800
WHOT	Campbell, Ohio	1330
WHOU	Houlton, Maine	1340
WHOW	Clinton, Ill.	1520
WHOY	Salinas, P. R.	1210
WHP	Harrisburg, Pa.	580
WHPB	Belton, S.C.	1390
WHPE	High Point, N.C.	1070
WHPL	Winchester, Va.	610
WHRF	Riverhead, N.Y.	1570
WHRN	Herendon, Va.	1440
WHRT	Hartselle, Ala.	860
WHSC	Hartsville, S.C.	1450
WHSL	Wilmington, N.C.	1490
WHSM	Hayward, Wis.	910
WHSY	Hattiesburg, Miss.	1230
WHTC	Holland, Mich.	1450
WHTG	Eatontown, N.J.	1410
WHTH	Heath, O.	1000
WHUB	Cookeville, Tenn.	1400
WHUC	Hudson, N.Y.	1230
WHUM	Reading, Pa.	1240
WHUN	Huntington, Pa.	1150
WHUT	Anderson, Ind.	1470
WHVL	Hendersonville, N.C.	1600
WHVR	Hanover, Pa.	1280
WHVW	Hyde Park, N.Y.	950
WHWB	Rutland, Vt.	1000
WHWH	Princeton, N.J.	1350
WHYD	Columbus, Ga.	1270
WHYL	Carlisle, Pa.	960
WHYN	Springfield, Mass.	560
WHYP	North East, Pa.	1530
WHYT	Noblesville, Ind.	1110
WHYZ	Greenville, S. C.	1070
WHZN	Hazleton, Pa.	1300
WIAC	San Juan, P.R.	740
WIAM	Williamston, N.C.	900
WIBA	Madison, Wis.	1310
WIBB	Macon, Ga.	1280
WIBC	Indianapolis, Ind.	1070
WIBG	Philadelphia, Pa.	990
WIBM	Jackson, Mich.	1450
WIBQ	Warwick, N.Y.	1110
WIBR	Baton Rouge, La.	1300
WIBU	Poynette, Wis.	1240
WIBV	Belleville, Ill.	1260
WIBW	Topeka, Kans.	580
WIBX	Utica, N.Y.	950
WICC	Bridgeport, Conn.	600
WICE	Providence, R.I.	1290
WICH	Norwich, Conn.	1310
WICK	Scranton, Pa.	1400
WICO	Salisbury, Md.	1320
WICY	Malone, N.Y.	1490
WIDE	Biddeford, Maine	1400
WIDD	Elizabethton, Tenn.	1520
WIDG	St. Ignace, Mich.	940
WIDU	Fayetteville, N.C.	1600
WIEL	Elizabethtown, Ky.	1400
WIFE	Indianapolis, Ind.	1310
WIFF	Auburn, Ind.	1570
WIFM	Elkin, N.C.	1540
WIGG	Wiggins, Miss.	1420

Call	Location	kHz
WIGM	Medford, Wis.	1490
WIGO	Atlanta, Ga.	1340
WIGS	Gouverneur, N.Y.	1230
WIID	Garden City, Mich.	1090
WIII	Homestead, Fla.	1430
WIIN	Atlanta, Ga.	970
WIKB	Iron River, Mich.	1230
WIKC	Bogalusa, La.	1490
WIKE	Newport, Vt.	1490
WIKI	Chester, Va.	1410
WIKY	Evansville, Ind.	820
WIL	St. Louis, Mo.	1430
WILA	Danville, Va.	1580
WILD	Boston, Mass.	1090
WILE	Cambridge, Ohio	1270
WILI	Willimantic, Conn.	1400
WILK	Wilkes-Barre, Pa.	980
WILL	Urbana, Ill.	580
WILM	Wilmington, Del.	1450
WILO	Frankfort, Ind.	1570
WILS	Lansing, Mich.	1320
WILY	Centralia, Ill.	1210
WILZ	St. Petersburg Beach, Fla.	1590
WIMA	Lima, Ohio	1150
WIMO	Winder, Ga.	1300
WIMS	Michigan City, Ind.	1420
WINA	Charlottesville, Va.	1070
WINC	Winchester, Va.	1400
WIND	Chicago, Ill.	560
WINE	Brookfield, Conn.	940
WINF	Manchester, Conn.	1230
WING	Dayton, Ohio	1410
WINH	Georgetown, S. C.	1470
WINI	Murphysboro, Ill.	1420
WINK	Fort Myers, Fla.	1240
WINN	Louisville, Ky.	1240
WINQ	Tampa, Fla.	1010
WINR	Binghamton, N.Y.	680
WINS	New York, N. Y.	1010
WINT	Winter Haven, Fla.	1360
WINU	Highland Park, Ill.	1510
WINW	Canton, O.	1520
WINX	Rockville, Md.	1600
WINY	Putnam, Conn.	1350
WINZ	Miami, Fla.	940
WIOD	Miami, Fla.	610
WIOI	New Boston, Ohio	1010
WIOK	Normal, Ill.	1440
WIOM	Pittsfield, Mass.	1110
WION	Ionia, Mich.	1430
WIOO	Carlisle, Pa.	1000
WIOS	Tawas City-East Tawas, Mich.	1480
WIOU	Kokomo, Ind.	1350
WIP	Philadelphia, Pa.	610
WIPC	Lake Wales, Fla.	1280
WIPR	San Juan, P.R.	940
WIPS	Ticonderoga, N.Y.	1250
WIQT	Horseheads, N. Y.	1000
WIRA	Ft. Pierce, Fla.	1400
WIRB	Enterprise, Ala.	600
WIRC	Hickory, N.C.	630
WIRD	Lake Placid, N.Y.	920
WIRE	Indianapolis, Ind.	1430
WIRJ	Humboldt, Tenn.	740
WIRK	W. Palm Beach, Fla.	1290
WIRL	Peoria, Ill.	1290
WIRO	Lorain, O.	1230
WIRV	Irvine, Ky.	1550
WIRY	Plattsburg, N.Y.	1340
WIS	Columbia, S.C.	560
WISA	Isabella, P.R.	1390
WISE	Asheville, N.C.	1310
WISK	Americus, Ga.	1390
WISL	Shamokin, Pa.	1480
WISM	Madison, Wis.	1480
WISN	Milwaukee, Wis.	1130
WISO	Ponce, P.R.	1260
WISP	Kinston, N.C.	1230
WISR	Butler, Pa.	680
WISS	Berlin, Wis.	1090
WIST	Charlotte, N.C.	1240
WISV	Virouqua, Wis.	1360
WISZ	Glen Burnie, Md.	1590
WITH	Baltimore, Md.	1230
WITL	Lansing, Mich.	1010
WITN	Washington, N.C.	930
WITY	Danville, Ill.	980
WITZ	Jasper, Ind.	990
WIVE	Ashland, Va.	1430
WIVK	Knoxville, Tenn.	850
WIVS	Crystal Lake, Ill.	850
WIVV	Vieques, P.R.	1370
WIVY	Jacksonville, Fla.	1050
WIXE	Monroe, N.C.	1190
WIXI	Lancaster, Ky.	1280
WIXK	New Richmond, Wis.	1590
WIXN	Dixon, Ill.	1460
WIXX	Oakland Park, Fla.	1520
WIXY	Cleveland, O.	1260
WIXZ	McKeesport, Pa.	1360
WIYN	Rome, Ga.	1360
WIZE	Springfield, Ohio	1340
WIZO	Franklin, Tenn.	1380
WIZR	Johnstown, N. Y.	930
WIZS	Henderson, N.C.	1450
WIZZ	Streator, Ill.	1250
WJAB	Westbrook, Me.	1440
WJAC	Johnstown, Pa.	850
WJAG	Norfolk, Nebr.	780
WJAK	Jackson, Tenn.	1450
WJAM	Marion, Ala.	1310

Call	Location	kHz
WJAR	Providence, R.I.	920
WJAS	Pittsburgh, Pa.	1320
WJAT	Swainsboro, Ga.	800
WJAX	Jacksonville, Fla.	930
WJAY	Mullins, S.C.	1280
WJAZ	Albany, Ga.	960
WJBB	Haleyville, Ala.	1230
WJBC	Bloomington, Ill.	1230
WJBO	Salem, Ill.	1350
WJBE	Knoxville, Tenn.	1430
WJBL	Holland, Mich.	1260
WJBM	Jerseyville, Ill.	1480
WJBO	Baton Rouge, La.	1150
WJBY	Gadsden, Ala.	930
WJCD	Seymour, Ind.	1390
WJCM	Sebring, Fla.	960
WJCO	Jackson, Mich.	1510
WJCW	Johnson City, Tenn.	910
WJDA	Quincy, Mass.	1300
WJDB	Thomasville, Ala.	630
WJDX	Jackson, Miss.	620
WJDY	Salisbury, Md.	1470
WJEF	Grand Rapids, Mich.	1230
WJEH	Gallipolis, Ohio	990
WJEJ	Hagerstown, Md.	1240
WJEM	Valdosta, Ga.	1150
WJER	Dover-New Philadelphia, O.	1450
WJES	Johnston, S.C.	1570
WJET	Erie, Pa.	1400
WJFC	Jefferson City, Tenn.	1480
WJGA	Jackson, Ga.	1540
WJHO	Opelika, Ala.	1400
WJIC	Salem, N. J.	1510
WJIG	Tullahoma, Tenn.	740
WJIL	Jacksonville, Ill.	1550
WJIM	Lansing, Mich.	1240
WJIT	San Juan, P.R.	1140
WJJC	Commerce, Ga.	1270
WJJD	Chicago, Ill.	1160
WJJJ	Christiansburg, Va.	1260
WJJL	Niagara Falls, N.Y.	1440
WJJM	Lewisburg, Tenn.	1490
WJJZ	Mt. Holly, N. J.	1460
WJKM	Hartsville, Tenn.	1090
WJKY	Jamestown, Ky.	1060
WJLB	Detroit, Mich.	1400
WJLD	Homewood, Ala.	1400
WJLE	Smithville, Tenn.	1480
WJLK	Asbury Park, N.J.	1310
WJLS	Beckley, W.Va.	560
WJMA	Orange, Va.	1340
WJMB	Brookhaven, Miss.	1340
WJMC	Rice Lake, Wis.	1240
WJML	Petoskey, Mich.	1110
WJMO	Cleveland Hghts., Ohio	1490
WJMR	New Orleans, La.	990
WJMS	Ironwood, Mich.	590
WJMW	Athens, Ala.	730
WJMX	Florence, S.C.	970
WJNC	Jacksonville, N.C.	1240
WJNO	W. Palm Beach, Fla.	1230
WJOB	Hammond, Ind.	1230
WJOE	Port St. Joe, Fla.	1080
WJOI	Florence, Ala.	1340
WJOL	Joliet, Ill.	1340
WJON	St. Cloud, Minn.	1240
WJOR	South Haven, Mich.	940
WJOT	Lake City, S.C.	1260
WJOY	Burlington, Vt.	1230
WJPA	Washington, Pa.	1450
WJPD	Ishpeming, Mich.	1240
WJPF	Herrin, Ill.	1340
WJPR	Greenville, Miss.	1330
WJPS	Evansville, Ind.	1330
WJPW	Rockford, Mich.	810
WJQS	Jackson, Miss.	1400
WJR	Detroit, Mich.	760
WJRC	Joliet, Ill.	1510
WJRD	Tuscaloosa, Ala.	1150
WJRI	Lenoir, N.C.	1340
WJRL	Calhoun City, Miss.	1530
WJRM	Troy, N.C.	1390
WJRZ	Hackensack, N.J.	970
WJSB	Crestview, Fla.	1050
WJSM	Martinsburg, Pa.	1110
WJSO	Jonesboro, Tenn.	1590
WJST	Jupiter, Fla.	1000
WJSW	Maplewood, Minn.	1010
WJTN	Jamestown, N.Y.	1240
WJTO	Bath, Me.	730
WJTS	Jupiter, Fla.	1000
WJUN	Mexico, Pa.	1220
WJVA	South Bend, Ind.	1580
WJW	Cleveland, Ohio	850
WJWL	Georgetown, Del.	900
WJWS	South Hill, Va.	1370
WJXN	Jackson, Miss.	1450
WJZM	Clarksville, Tenn.	1400
WKAC	Athens, Ala.	1080
WKAI	Macomb, Ill.	1510
WKAJ	Saratoga Springs, N.Y.	900
WKAL	Rome, N.Y.	1450
WKAM	Goshen, Ind.	1460
WKAN	Kankakee, Ill.	1320
WKAP	Allentown, Pa.	1320
WKAQ	San Juan, P.R.	580
WKAR	East Lansing, Mich.	870
WKAT	Miami Beach, Fla.	1360
WKAU	Kaukanna, Wis.	1050
WKAY	Glasgow, Ky.	1490
WKAZ	Charleston, W.Va.	950

Call	Location	kHz
WKBA	Vinton, Va.	1550
WKBC	N. Wilkesboro, N.C.	810
WKBH	La Crosse, Wis.	1410
WKBI	St. Marys, Pa.	1400
WKBJ	Milan, Tenn.	1600
WKBK	Keene, N.H.	1220
WKBL	Covington, Tenn.	1250
WKBN	Youngstown, Ohio	570
WKBO	Harrisburg, Pa.	1230
WKBQ	Garner, N.C.	1000
WKBR	Manchester, N.H.	1250
WKBV	Richmond, Ind.	1490
WKBW	Buffalo, N.Y.	1520
WKBX	Winston-Salem, N.C.	1500
WKBY	Chatham, Va.	1080
WKBZ	Muskegon, Mich.	850
WKCB	Hindman, Ky.	1540
WKCT	Bowling Green, Ky.	930
WKCU	Corinth, Miss.	1350
WKCW	Warrenton, Va.	1420
WKCY	Harrisonburg, Va.	1300
WKDA	Nashville, Tenn.	1240
WKDE	Altavista, Va.	1000
WKDK	Newberry, S.C.	1240
WKDL	Clarksdale, Miss.	1600
WKDO	Liberty, Ky.	1560
WKDR	Plattsburgh, N.Y.	1070
WKDX	Hamlet, N. C.	1250
WKDZ	Cadiz, Ky.	1110
WKEE	Huntington, W. Va.	800
WKEG	Washington, Pa.	1110
WKEI	Kewanee, Ill.	1450
WKEN	Dover, Del.	1590
WKER	Pompton Lakes, N.J.	1500
WKEU	Griffin, Ga.	1450
WKEX	Blacksburg, Va.	1430
WKEY	Covington, Va.	1340
WKFD	Wickford, R.I.	1370
WKFE	Yauco, P.R.	1550
WKFR	Battle Creek, Mich.	1400
WKGN	Knoxville, Tenn.	1340
WKGX	Lenoir, N.C.	1080
WKHM	Jackson, Mich.	970
WKIC	Hazard, Ky.	1390
WKIG	Glenville, Ga.	1580
WKIK	Leonardtown, Md.	1370
WKIN	Kingsport, Tenn.	1320
WKIP	Poughkeepsie, N.Y.	1450
WKIS	Orlando, Fla.	740
WKIX	Raleigh, N.C.	850
WKIZ	Key West, Fla.	1500
WKJB	Mayaguez, P.R.	710
WKJG	Fort Wayne, Ind.	1380
WKJK	Granite Falls, N.C.	900
WKJR	Muskegon Heights, Mich.	1520
WKKD	Aurora, Ill.	1580
WKKE	Asheville, N.C.	1380
WKKO	Cocoa, Fla.	860
WKKR	Pickens, S. C.	1540
WKKS	Vanceburg, Ky.	1570
WKLA	Ludington, Mich.	1450
WKLC	St. Albans, W.Va.	1300
WKLF	Clanton, Ala.	980
WKLK	Cloquet, Minn.	1230
WKLM	Wilmington, N.C.	980
WKLO	Louisville, Ky.	1080
WKLP	Keyser, W. Va.	1390
WKLV	Blackstone, Va.	1440
WKLY	Hartwell, Ga.	980
WKMC	Roaring Spring, Pa.	1370
WKMF	Flint, Mich.	1470
WKMK	Blountstown, Fla.	1000
WKMT	Kings Mtn., N.C.	1220
WKND	Windsor, Conn.	1480
WKNE	Keene, N.H.	1290
WKMG	Newberry, S.C.	1520
WKNR	Dearborn, Mich.	1310
WKNT	Kent, Ohio	1520
WKNX	Saginaw, Mich.	1210
WKNY	Kingston, N.Y.	1490
WKOA	Hopkinsville, Ky.	1480
WKOG	Gordon, Ga.	1580
WKOK	Sunbury, Pa.	1070
WKOL	Amsterdam, N.Y.	1570
WKOP	Binghamton, N.Y.	1360
WKOR	Starkville, Miss.	980
WKOW	Madison, Wis.	1070
WKOX	Framingham, Mass.	1190
WKOY	Bluefield, W.Va.	1240
WKOZ	Kosciusko, Miss.	1340
WKPA	New Kensington, Pa.	1150
WKPM	Princeton, Minn.	1300
WKPO	Prentiss, Miss.	1510
WKPR	Kalamazoo, Mich.	1420
WKPT	Kingsport, Tenn.	1400
WKQV	Sullivan, Ind.	1550
WKQW	Spring Valley, N.Y.	1300
WKRA	Holly Springs, Miss.	1110
WKRC	Cincinnati, Ohio	550
WKRG	Mobile, Ala.	710
WKRK	Murphy, N.C.	1320
WKRM	Columbia, Tenn.	1340
WKRO	Cairo, Ill.	1490
WKRS	Waukegan, Ill.	1220
WKRT	Cortland, N.Y.	920
WKRW	Cartersville, Ga.	1270
WKRZ	Oil City, Pa.	1340
WKSC	Kershaw, S.C.	1300
WKSK	W. Jefferson, N.C.	1600
WKSN	Jamestown, N.Y.	1340
WKSP	Kingstree, S. C.	1090
WKSR	Pulaski, Tenn.	1420
WKST	New Castle, Pa.	1280
WKTC	Charlotte, N.C.	1310
WKTE	King, N.C.	1090
WKTG	Thomasville, Ga.	730
WKTJ	Farmington, Maine	1380
WKTQ	South Paris, Maine	1450
WKTS	Sheboygan, Wis.	950
WKTX	Atlantic Beach, Fla.	1600
WKTY	LaCrosse, Wis.	580
WKUL	Cullman, Ala.	1340
WKVA	Lewistown, Pa.	920
WKVM	San Juan, P.R.	810
WKVO	Havelock, N.C.	1330
WKVT	Brattleboro, Vt.	1490
WKWF	Key West, Fla.	1600
WKWK	Wheeling, W.Va.	1400
WKWS	Rocky Mount, Va.	1290
WKXL	Concord, N.H.	1450
WKXR	Exeter, N.H.	1540
WKXV	Knoxville, Tenn.	900
WKXY	Sarasota, Fla.	930
WKY	Oklahoma City, Okla.	930
WKYB	Hemingway, S. C.	1000
WKYC	Cleveland, Ohio	1100
WKYE	Bristol, Tenn.	1550
WKYK	Burnsville, N. C.	1540
WKYO	Caro, Mich.	1360
WKYX	Paducah, Ky.	570
WKYZ	Madisonville, Tenn.	1250
WKZA	Kane, Pa.	960
WKZI	Casey, Ill.	800
WKZO	Kalamazoo, Mich.	590
WLAC	Nashville, Tenn.	1510
WLAD	Danbury, Conn.	800
WLAF	LaFollette, Tenn.	1450
WLAG	La Grange, Ga.	1240
WLAK	Lakeland, Fla.	1430
WLAM	Lewiston, Maine	1470
WLAN	Lancaster, Pa.	1390
WLAP	Lexington, Ky.	630
WLAQ	Rome, Ga.	1410
WLAR	Athens, Tenn.	1450
WLAS	Jacksonville, N.C.	910
WLAT	Conway, S.C.	1330
WLAU	Laurel, Miss.	1430
WLAV	Grand Rapids, Mich.	1340
WLAW	Lawrenceville, Ga.	1360
WLAY	Muscle Shoals, Ala.	1450
WLBB	Carrollton, Ga.	1100
WLBC	Muncie, Ind.	1340
WLBE	Leesburg, Fla.	790
WLBG	Laurens, S.C.	860
WLBH	Mattoon, Ill.	1170
WLBI	Denham Springs, La.	1220
WLBJ	Bowling Green, Ky.	1410
WLBK	DeKalb, Ill.	1360
WLBL	Auburndale, Wis.	930
WLBN	Lebanon, Ky.	1590
WLBR	Lebanon, Pa.	1280
WLBS	Centreville, Miss.	1580
WLBZ	Bangor, Maine	620
WLCB	Moulton, Ala.	1530
WLCK	Scottsville, Ky.	1250
WLCM	Lancaster, S.C.	1360
WLCN	Laurensburg, N.C.	1300
WLCO	Eustis, Fla.	1240
WLCS	Baton Rouge, La.	910
WLCX	LaCrosse, Wis.	1490
WLCY	St. Petersburg, Fla.	1380
WLDB	Atlantic City, N.J.	1490
WLDS	Jacksonville, Ill.	1180
WLDY	Ladysmith, Wis.	1340
WLEA	Hornell, N.Y.	1480
WLEE	Richmond, Va.	1480
WLEC	Sandusky, Ohio	1450
WLEF	Greenwood, Miss.	1540
WLEM	Emporium, Pa.	1240
WLES	Lawrenceville, Va.	580
WLET	Toccoa, Ga.	1420
WLEW	Bad Axe, Mich.	1340
WLEY	Cayey, P.R.	1080
WLFA	Lafayette, Ga.	1590
WLFH	Little Falls, N.Y.	1230
WLGM	Lynchburg, Va.	1320
WLGN	Logan, O.	1510
WLIB	New York, N.Y.	1190
WLIJ	Shelbyville, Tenn.	1580
WLIK	Newport, Tenn.	1270
WLIL	Lenoir City, Tenn.	730
WLIP	Kenosha, Wis.	1050
WLIQ	Mobile, Ala.	1360
WLIS	Old Saybrook, Conn.	1420
WLIV	Livingston, Tenn.	920
WLIX	Islip, N. Y.	540
WLIZ	Lake Worth, Fla.	1380
WLKE	Waupun, Wis.	1170
WLKM	Three Rivers, Mich.	1510
WLKN	Lincoln, Me.	1450
WLKR	Norwalk, O.	1510
WLKS	W. Liberty, Ky.	1450
WLKW	Providence, R.I.	990
WLLE	Raleigh, N.C.	570
WLLH	Lowell, Mass.	1400
WLLL	Lynchburg, Va.	930
WLLN	Olney, Ill.	740
WLLS	Hartford, Ky.	1600
WLLY	Wilson, N.C.	1350
WLMD	Laurel, Md.	900
WLMS	Leominster, Mass.	1000
WLNC	Laurinburg, N.C.	1300
WLMJ	Jackson, Ohio	1280
WLNA	Peekskill, N.Y.	1420
WLNC	Laurinburg, N.C.	1300
WLNG	Sag Harbor, N.Y.	1600
WLNH	Laconia, N.H.	1350
WLOA	Braddock, Pa.	1550
WLOB	Portland, Maine	1310
WLOC	Munfordville, Ky.	1150
WLOD	Pompano Beach, Fla.	980
WLOE	Eden, N.C.	1490
WLOF	Orlando, Fla.	950
WLOG	Logan, W.Va.	1230
WLOH	Princeton, W.Va.	1490
WLOI	La Porte, Ind.	1540
WLOK	Memphis, Tenn.	1340
WLOL	Minneapolis, Minn.	1330
WLON	Lincolnton, N.C.	1050
WLOP	Jesup, Ga.	1370
WLOR	Thomasville, Ga.	730
WLOT	Marinette, Wis.	1300
WLOU	Louisville, Ky.	1350
WLOV	Washington, Ga.	1370
WLOW	Aiken, S.C.	1300
WLOX	Biloxi, Miss.	1490
WLPH	Irondale, Ala.	1480
WLPM	Suffolk, Va.	1450
WLPO	LaSalle, Ill.	1220
WLPS	Leighton, Pa.	1150
WLQH	Chiefland, Fla.	940
WLRC	Whitehall, Mich.	1490
WLS	Chicago, Ill.	890
WLSB	Copper Hill, Tenn.	1400
WLSC	Loris, S.C.	1570
WLSD	Big Stone Gap, Va.	1220
WLSE	Wallace, N.C.	1400
WLSH	Lansford, Pa.	1410
WLSI	Pikeville, Ky.	900
WLSM	Louisville, Miss.	1270
WLST	Escanaba, Mich.	600
WLSV	Wellsville, N.Y.	790
WLTC	Gastonia, N.C.	1370
WLTH	Gary, Ind.	1370
WLTN	Littleton, N. H.	1400
WLUV	Loves Park, Ill.	1520
WLUX	Baton Rouge, La.	1550
WLUZ	Bayamon, P. R.	1600
WLVA	Lynchburg, Va.	590
WLW	Cincinnati, Ohio	700
WLWL	Rockingham, N.C.	1500
WLWO	(V.O.A.) Marathon, Fla.	1180
WYLB	Albany, Ga.	1250
WLYC	Williamsport, Pa.	1050
WLYN	Lynn, Mass.	1360
WLYO	New Orleans, La.	940
WLYV	Ft. Wayne, Ind.	1450
WMAB	Munising, Mich.	1400
WMAC	Metter, Ga.	1360
WMAD	Madison, Wis.	1550
WMAF	Madison, Fla.	1230
WMAG	Forest, Miss.	860
WMAJ	State College, Pa.	1450
WMAK	Nashville, Tenn.	1300
WMAL	Washington, D.C.	630
WMAM	Marinette, Wis.	570
WMAN	Mansfield, Ohio	1400
WMAP	Monroe, N.C.	1060
WMAQ	Chicago, Ill.	670
WMAS	Springfield, Mass.	1450
WMAY	Springfield, Ill.	970
WMAZ	Macon, Ga.	940
WMBA	Ambridge, Pa.	1460
WMBC	Columbus, Miss.	1400
WMBD	Peoria, Ill.	1470
WMBH	Joplin, Mo.	1450
WMBI	Chicago, Ill.	1110
WMBL	Morehead City, N.C.	740
WMBM	Miami Beach, Fla.	1490
WMBN	Petoskey, Mich.	1340
WMBO	Auburn, N.Y.	1340
WMBR	Jacksonville, Fla.	1460
WMBS	Uniontown, Pa.	590
WMBT	Shenandoah, Pa.	1530
WMC	Memphis, Tenn.	790
WMCA	New York, N.Y.	570
WMCH	Church Hill, Tenn.	1260
WMCL	McLeansboro, Ill.	1060
WMCP	Columbia, Tenn.	1280
WMCR	Oneida, N.Y.	1600
WMCS	Machias, Me.	1400
WMCT	Mountain City, Tenn.	1390
WMCW	Harvard, Ill.	1600
WMDC	Hazelhurst, Miss.	1220
WMDD	Fajardo, P.R.	1480
WMDN	Midland, Mich.	1490
WMEG	Melbourne, Fla.	920
WMEK	Chase City, Va.	980
WMEL	Pensacola, Fla.	610
WMEN	Tallahassee, Fla.	1330
WMEV	Marion, Va.	1010
WMEX	Boston, Mass.	1510
WMFC	Monroeville, Ala.	1360
WMFD	Wilmington, N.C.	630
WMFG	Hibbing, Minn.	1240
WMFJ	Daytona Beach, Fla.	1450
WMFR	High Point, N.C.	1230
WMGA	Moultrie, Ga.	1130
WMGR	Bainbridge, Ga.	930
WMGS	Bowling Green, Ohio	730
WMGW	Meadville, Pa.	1490
WMGY	Montgomery, Ala.	800
WMIA	Arecibo, P. R.	1070
WMIC	Sandusky, Mich.	1560
WMID	Atlantic City, N.J.	1340
WMIK	Middlesboro, Ky.	560
WMIL	Milwaukee, Wis.	1290
WMIM	Mt. Carmel, Pa.	1590
WMIN	Mpls.-St. Paul, Minn.	1400
WMIQ	Iron Mountain, Mich.	1450
WMIR	Lake Geneva, Wis.	1550
WMIS	Natchez, Miss.	1240
WMIX	Mt. Vernon, Ill.	940
WMJL	Marion, Ky.	1010
WMJM	Cordele, Ga.	1490
WMKR	Millinocket, Me.	1240
WMLC	Monticello, Miss.	1270
WMLO	Beverly, Mass.	1570
WMLP	Milton, Pa.	1380
WMLR	Hohenwald, Tenn.	1540
WMLS	Sylacauga, Ala.	1290
WMLT	Dublin, Ga.	1330
WMMB	Melbourne, Fla.	1240
WMMH	Marshall, N.C.	1460
WMMJ	Lancaster, N.Y.	1300
WMMM	Westport, Conn.	1260
WMMN	Fairmont, W.Va.	920
WMMW	Meriden, Conn.	1470
WMNA	Gretna, Va.	730
WMNB	No. Adams, Mass.	1230
WMNC	Morganton, N.C.	1430
WMNE	Menomonie, Wis.	1360
WMNI	Columbus, Ohio	920
WMNS	Olean, N.Y.	1360
WMNT	Manati, P.R.	1500
WMNZ	Montezuma, Ga.	1050
WMOA	Marietta, Ohio	1490
WMOB	Mobile, Ala.	840
WMOC	Chattanooga, Tenn.	1450
WMOG	Brunswick, Ga.	1490
WMOH	Hamilton, Ohio	1450
WMOK	Metropolis, Ill.	920
WMON	Montgomery, W.Va.	1340
WMOO	Mobile, Ala.	1550
WMOP	Ocala, Fla.	900
WHOR	Morehead, Ky.	1330
WMOU	Berlin, N.H.	1230
WMOV	Ravenswood, W.Va.	1360
WMOX	Meridian, Miss.	1240
WMOZ	Mobile, Ala.	960
WMPA	Aberdeen, Miss.	1240
WMPC	Lapeer, Mich.	1230
WMPL	Hancock, Mich.	920
WMPM	Smithfield, N.C.	1270
WMPO	Middleport-Pomeroy, Ohio	1390
WMPP	Chicago Heights, Ill.	1470
WMPS	Memphis, Tenn.	680
WMPT	So. Williamsport, Pa.	1450
WMQM	Memphis, Tenn.	1480
WMRB	Greenville, S.C.	1490
WMRC	Milford, Mass.	1490
WMRE	Monroe, Ga.	1490
WMRF	Lewistown, Pa.	1490
WMRN	Marion, Ohio	1490
WMRO	Aurora, Ill.	1280
WMRP	Flint, Mich.	1570
WMSA	Massena, N.Y.	1340
WMSG	Oakland, Md.	1050
WMSJ	Sylva, N.C.	680
WMSK	Morganfield, Ky.	1550
WMSL	Decatur, Ala.	1400
WMSR	Manchester, Tenn.	1320
WMST	Mt. Sterling, Ky.	1150
WMT	Cedar Rapids, Iowa	600
WMTA	Central City, Ky.	1380
WMTC	Vancleve, Ky.	730
WMTD	Hinton, W. Va.	1380
WMTE	Manistee, Mich.	1340
WMTL	Leitchfield, Ky.	1580
WMTM	Moultrie, Ga.	1300
WMTN	Morristown, Tenn.	1300
WMTR	Morristown, N.J.	1250
WMTS	Murfreesboro, Tenn.	810
WMUS	Muskegon, Mich.	1090
WMUU	Greenville, S.C.	1260
WMVA	Martinsville, Va.	1450
WMVB	Millville, N.J.	1440
WMVG	Milledgeville, Ga.	1450
WMVI	Mechanicville, N.Y.	1170
WMVO	Mt. Vernon, Ohio	1300
WMVR	Sidney, Ohio	1080
WMWM	Wilmington, O.	1090
WMYB	Myrtle Beach, S.C.	1450
WMYN	Mayodan, N.C.	1420
WMYR	Ft. Myers, Fla.	1410
WNAB	Bridgeport, Conn.	1450
WNAD	Norman, Okla.	640
WNAE	Warren, Pa.	1310
WNAG	Grenada, Miss.	1400
WNAH	Nashville, Tenn.	1360
WNAK	Nanticoke, Pa.	730
WNAL	Nelsonville, O.	940
WNAM	Neenah, Wis.	1280
WNAR	Norristown, Pa.	1110
WNAT	Natchez, Miss.	1450
WNAU	New Albany, Miss.	1470
WNAV	Annapolis, Md.	1430
WNAX	Yankton, S.Dak.	570
WNBC	New York, N.Y.	660
WNBF	Binghamton, N.Y.	1290
WNBH	New Bedford, Mass.	1340
WNBI	Park Falls, Wis.	980
WNBP	Newburyport, Mass.	1470
WNBS	Murray, Ky.	1340
WNBT	Wellsboro, Pa.	1490
WNBY	Newberry, Mich.	1450
WNBZ	Saranac Lake, N.Y.	1240
WNCA	Siler City, N.C.	1570
WNCC	Barnesboro, Pa.	950
WNCG	N. Charleston, S.C.	910
WNCO	Ashland, Ohio	1340
WNCT	Greenville, N.C.	1070

WHITE'S RADIO LOG

Call	Location	kHz
WNDB	Daytona Beach, Fla.	1150
WNDR	Syracuse, N.Y.	1260
WNDU	South Bend, Ind.	1490
WNEB	Worcester, Mass.	1230
WNEG	Taccoa, Ga.	630
WNEL	Caguas, P. R.	1430
WNER	Live Oak, Fla.	1250
WNES	Central City, Ky.	1050
WNEU	Wheeling, W. Va.	1470
WNEW	New York, N.Y.	1130
WNEX	Macon, Ga.	1400
WNFL	Green Bay, Wis.	1440
WNGA	Nashville, Ga.	1600
WNGO	Mayfield, Ky.	1320
WNGR	Gainsville, Ga.	1130
WNHC	New Haven, Conn.	1340
WNHV	White River Jct., Vt.	910
WNIA	Cheektowaga, N.Y.	1230
WNIK	Arecibo, P.R.	1230
WNIL	Niles, Mich.	1290
WNIO	Niles, Ohio	1540
WNJH	Hammonton, N.J.	1580
WNJR	Newark, N.J.	1430
WNKY	Neon, Ky.	1480
WNLC	Nen London, Conn.	1510
WNLK	Norwalk, Conn.	1350
WNMP	Evanston, Ill.	1590
WNMT	Garden City, Ga.	1520
WNNC	Newton, N.C.	1230
WNNJ	Newton, N.J.	1360
WNNT	Warsaw, Va.	690
WNOG	Naples, Fla.	1270
WNOK	Columbia, S.C.	1230
WNOO	Chattanooga, Tenn.	1260
WNOP	Newport, Ky.	740
WNOR	Norfolk, Va.	1230
WNOS	High Point, N.C.	1590
WNOV	Milwaukee, Wis.	860
WNOW	York, Pa.	1250
WNOX	Knoxville, Tenn.	990
WNPS	New Orleans, La.	1450
WNPT	Tuscaloosa, Ala.	1280
WNPV	Lansdale, Pa.	1440
WNRG	Grundy, Va.	940
WNRI	Woonsocket, R.I.	1380
WNRK	Newark, Del.	1260
WNRS	Saline, Mich.	1290
WNRV	Narrows-Pearisburg, Va.	990
WNSL	Laurel, Miss.	1260
WNTN	Newton, Mass.	1550
WNTT	Tazewell, Tenn.	1250
WNTY	Southington, Conn.	990
WNUE	Ft. Walton Bch., Fla.	1400
WNUS	Chicago, Ill.	1390
WNUZ	Talladega, Ala.	1230
WNVA	Norton, Va.	1350
WNVL	Nicholasville, Ky.	1250
WNVY	Pensacola, Fla.	1230
WNWI	Valparaiso, Ind.	1080
WNXT	Portsmouth, Ohio	1260
WNYC	New York, N.Y.	830
WNYN	Canton, O.	900
WNYR	Rochester, N.Y.	680
WOAI	San Antonio, Tex.	1200
WOAP	Owosso, Mich.	1080
WOAY	Oak Hill, W.Va.	860
WOBL	Oberlin, O.	1570
WOBR	Wanchese, N.C.	1530
WOBS	Jacksonville, Fla.	1360
WOBT	Rhinelander, Wis.	1240
WOC	Davenport, Iowa	1420
WOCB	W. Yarmouth, Mass.	1240
WOCH	North Vernon, Ind.	1460
WOCN	Miami, Fla.	1450
WOCO	Oconto, Wis.	1260
WODI	Brookneal, Va.	1230
WODY	Bassett, Va.	900
WOGA	Sylvester, Ga.	1540
WOGO	New Smyrna Beach, Fla.	1550
WOHI	E. Liverpool, Ohio	1490
WOHO	Toledo, Ohio	1470
WOHS	Shelby, N.C.	730
WOI	Ames, Iowa	640
WOIC	Columbia, S.C.	1320
WOIO	Canton, O.	1060
WOKA	Douglas, Ga.	1310
WOKB	Winter Garden, Fla.	1600
WOKC	Okeechobee, Fla.	1570
WOKE	Charleston, S.C.	1340
WOKJ	Jackson, Miss.	1550
WOKK	Meridian, Miss.	1450
WOKL	Eau Claire, Wis.	1050
WOKO	Albany, N.Y.	1460
WOKS	Columbia, Ga.	1340
WOKW	Brockton, Mass.	1410
WOKY	Milwaukee, Wis.	920
WOKZ	Alton, Ill.	1570
WOL	Washington, D.C.	1450
WOLD	Marion, Va.	1330

Call	Location	kHz
WOLF	Syracuse, N.Y.	1490
WOLS	Florence, S. C.	1230
WOMI	Owensboro, Ky.	1490
WOMN	Decatur, Ga.	1310
WOMP	Bellaire, Ohio	1290
WOMT	Manitowoc, Wis.	1240
WONA	Winona, Miss.	1570
WOND	Pleasantville, N.J.	1400
WONE	Dayton, O.	980
WONN	Lakeland, Fla.	1230
WONS	Tallahassee, Fla.	1410
WONW	Defiance, Ohio	1280
WOOD	Grand Rapids, Mich.	1300
WOOF	Dothan, Ala.	560
WOOK	Washington, D.C.	1340
WOOO	DeLand, Fla.	1310
WOOW	Greenville, N.C.	1340
WOPA	Oak Park, Ill.	1490
WOPI	Bristol, Tenn.	1490
WOR	New York, N.Y.	710
WORA	Mayaquez, P.R.	760
WORC	Worcester, Mass.	1310
WORD	Spartanburg, S.C.	910
WORG	Orangeburg, S.C.	1580
WORJ	Orlando, Fla.	1270
WORK	York, Pa.	1350
WORM	Savannah, Tenn.	1010
WORV	Hattiesburg, Miss.	1580
WORX	Madison, Ind.	1270
WOSC	Fulton, N.Y.	1300
WOSH	Oshkosh, Wis.	1490
WOSU	Columbus, Ohio	820
WOTR	Corry, Pa.	1370
WOTT	Watertown, N.Y.	1410
WOTW	Nashua, N.H.	900
WOUB	Athens, Ohio	1340
WOVE	Welch, W.Va.	1340
WOW	Omaha, Nebr.	590
WOWL	Florence, Ala.	1240
WOWO	Ft. Wayne, Ind.	1190
WOWW	Naugatuck, Conn.	1380
WOWY	Clewiston, Fla.	1590
WOXF	Oxford, N.C.	1340
WOZK	Ozark, Ala.	900
WOZN	Jacksonville, Fla.	970
WPAB	Ponce, P.R.	550
WPAC	Patchogue, N.Y.	1580
WPAD	Paducah, Ky.	1450
WPAG	Ann Arbor, Mich.	1050
WPAL	Charleston, S.C.	730
WPAM	Pottsville, Pa.	1450
WPAQ	Mount Airy, N.C.	740
WPAR	Parkersburg, W.Va.	1450
WPAS	Zephyrhills, Fla.	1400
WPAT	Paterson, N.J.	930
WPAW	E. Syracuse, N.Y.	1540
WPAX	Thomasville, Ga.	1240
WPAY	Portsmouth, Ohio	1400
WPAZ	Pottstown, Pa.	1370
WPBC	Richfield, Minn.	980
WPCC	Clinton, S.C.	1400
WPCF	Panama City, Fla.	1430
WPCO	Mt. Vernon, Ind.	1590
WPDE	Paris, Ky.	1440
WPDF	Corydon, Ind.	1550
WPDM	Potsdam, N.Y.	1470
WPDQ	Jacksonville, Fla.	600
WPDR	Portage, Wis.	1350
WPDX	Clarksburg, W.Va.	750
WPED	Crozet, Va.	810
WPEH	Louisvlle, Ga.	1420
WPEL	Montrose, Pa.	1250
WPEN	Philadelphia, Pa.	950
WPEO	Peoria, Ill.	1020
WPEP	Taunton, Mass.	1570
WPET	Greensboro, N.C.	950
WPFA	Pensacola, Fla.	790
WPFB	Middletown, Ohio	910
WPGA	Perry, Ga.	980
WPGC	Bradbury Hghts., Md.	1580
WPFG	Burgaw, N. C.	1470
WPGM	Danville, Pa.	1570
WPGW	Portland, Ind.	1440
WPHB	Philipsburg, Pa.	1260
WPHC	Waverly, Tenn.	1060
WPHM	Port Huron, Mich.	1380
WPIC	Sharon, Pa.	790
WPID	Piedmont, Ala.	1280
WPIK	Alexandria, Va.	730
WPIP	Collierville, Tenn.	1590
WPIT	Pittsburgh, Pa.	730
WPJD	Daisy, Tenn.	1550
WPKE	Pikeville, Ky.	1240
WPKO	Waverly, Ohio	1380
WPKY	Princeton, Ky.	1580
WPLA	Plant City, Fla.	910
WPLB	Greenville, Mich.	1380
WPLK	Rockmart, Ga.	1220
WPLM	Plymouth, Mass.	1390
WPLO	Atlanta, Ga.	590
WPLY	Plymouth, Wis.	1420
WPMB	Vandalia, Ill.	1500
WPME	Punxsutawney, Pa.	1540
WPMP	Portsmouth, Va.	1010
WPMP	Pascagoula, Miss.	1580
WPNC	Plymouth, N.C.	1470
WPNF	Brevard, N.C.	1240
WPNH	Plymouth, N. H.	1300
WPNO	Auburn, Me.	1530
WPNS	Hurricane, W. Va.	1080
WPNX	Columbus, Ga.	1460
WPOK	Pontiac, Ill.	1080
WPON	Pontiac, Mich.	1460
WPOP	Hartford, Conn.	1410

Call	Location	kHz
WPOR	Portland, Maine	1490
WPOW	New York, N.Y.	1330
WPPA	Pottsville, Pa.	1360
WPRA	Mayaguez, P.R.	990
WPRC	Lincoln, Ill.	1370
WPRE	Prairie Du Chien, Wis.	980
WPRJ	Parsippany-Troy Hills, N.J.	1310
WPRN	Butler, Ala.	1240
WPRO	Providence, R.I.	630
WPRP	Ponce, P.R.	910
WPRS	Paris, Ill.	1440
WPRT	Prestonsburg, Ky.	960
WPRV	Wauchula, Fla.	1600
WPRW	Manassas, Va.	1460
WPRY	Perry, Fla.	1400
WPSL	Monroeville, Pa.	1510
WPTF	Raleigh, N.C.	680
WPTL	Canton, N.C.	920
WPTN	Cookeville, Tenn.	1500
WPTR	Albany, N.Y.	1540
WPTS	Pittston, Pa.	1540
WPTW	Piqua, Ohio	1570
WPTX	Lexington Pk., Md.	920
WPUL	Bartow, Fla.	1130
WPUT	Brewster, N.Y.	1510
WPUV	Pulaski, Va.	1580
WPVA	Colonial Hights., Va.	1290
WPVL	Painesville, Ohio	1460
WPXC	Prattville, Ala.	1410
WPXE	Starke, Fla.	1490
WPXY	Greenville, N. C.	1550
WPYB	Benson, N.C.	1130
WQAM	Miami, Fla.	560
WQBA	Miami, Fla.	1140
WQBC	Vicksburg, Miss.	1420
WQBS	San Juan, P.R.	650
WQDY	Calais, Maine	1230
WQIC	Meridian, Miss.	1390
WQIK	Jacksonville, Fla.	1090
WQIZ	St. George, S.C.	810
WQMA	Marks, Miss.	1520
WQMR	Silver Spring, Md.	1050
WQOK	Greenville, S.C.	1440
WQSN	Charleston, S.C.	1450
WQTC	Two Rivers, Wis.	1590
WQTE	Monroe, Mich.	560
WQTW	Latrobe, Pa.	1570
WQTY	Montgomery, Ala.	1000
WQUA	Moline, Ill.	1230
WQVA	Quantico, Va.	1530
WQXI	Atlanta, Ga.	790
WQXL	Columbia, S.C.	1320
WQXQ	Ormond Bch., Fla.	1380
WQXR	New York, N.Y.	1560
WQXT	Palm Beach, Fla.	1340
WRAA	Luray, Va.	1330
WRAB	Arab, Ala.	1380
WRAC	Racine, Wis.	1460
WRAD	Radford, Va.	1460
WRAG	Carrollton, Ala.	590
WRAI	San Juan, P.R.	1520
WRAJ	Anna, Ill.	1440
WRAK	Williamsport, Pa.	1400
WRAM	Monmouth, Ill.	1330
WRAN	Dover, N.J.	1510
WRAP	Norfolk, Va.	850
WRAR	Tappahannock, Va.	1000
WRAW	Reading, Pa.	1340
WRAY	Princeton, Ind.	1250
WRBC	Jackson, Miss.	1300
WRBD	Pampano Beach, Fla.	1470
WRBJ	St. Johns, Mich.	1580
WRBL	Columbus, Ga.	1420
WRBN	Warner Robins, Ga.	1600
WRC	Washington, D.C.	980
WRCD	Dalton, Ga.	1430
WRCH	New Britain, Conn.	910
WRCK	Tuscumbia, Ala.	1410
WRCO	Richland Center, Wis.	1450
WRCP	Philadelphia, Pa.	1540
WRCS	Ahoskie, N.C.	970
WRDB	Reedsburg, Wis.	1400
WRDN	Durand, Wis.	1430
WRDO	Augusta, Maine	1400
WROS	S. Charleston, W.Va.	1410
WRDW	Augusta, Ga.	1480
WREB	Holyoke, Mass.	930
WREC	Memphis, Tenn.	600
WREL	Lexington, Va.	1450
WREM	Jenkins, Ky.	1000
WREN	Jenkins, Ky.	1000
WREO	Ashtabula, Ohio	970
WREV	Reidsville, N.C.	1220
WREY	New Albany, Ind.	1290
WRFC	Athens, Ga.	960
WRFD	Worthington, Ohio	880
WRFS	Alexander City, Ala.	1050
WRGA	Rome, Ga.	1470
WRGM	Richmond, Va.	1540
WRGS	Rogersville, Tenn.	1370
WRHC	Jacksonville, Fla.	1400
WRHI	Rock Hill, S.C.	1340
WRHL	Rochelle, Ill.	1060
WRIB	Providence, R.I.	1220
WRIC	Richlands, Va.	540
WRIE	Erie, Pa.	1330
WRIG	Wausau, Wis.	1400
WRIM	Pahokee, Fla.	1250
WRIN	Rensselaer, Ind.	1560
WRIP	Rossville, Ga.	980
WRIS	Roanoke, Va.	1410
WRIT	Milwaukee, Wis.	1340

Call	Location	kHz
WRIV	Riverhead, N.Y.	1390
WRIZ	Coral Gables, Fla.	1550
WRJC	Maunston, Wis.	1270
WRJN	Racine, Wis.	1400
WRJW	Picayune, Miss.	1320
WRKB	Kannapolis, N.C.	1460
WRKD	Rockland, Maine	1450
WRKH	Rockwood, Tenn.	580
WRKL	New City, N. Y.	910
WRKM	Carthage, Tenn.	1350
WRKN	Brandon, Miss.	910
WRKO	Boston, Mass.	680
WRKT	Cocoa Beach, Fla.	1300
WRKV	Rockville, Conn.	800
WRLD	Lanett, Ala.- W. Point, Ga.	1490
WRMA	Montgomery, Ala.	950
WRMF	Titusville, Fla.	1050
WRMG	Red Bay, Ala.	1430
WRMN	Elgin, Ill.	1410
WRMS	Beardstown, Ill.	790
WRMT	Rocky Mount, N.C.	1490
WRNB	New Bern, N.C.	1490
WRNC	Raleigh, N.C.	1240
WRNG	N. Atlanta, Ga.	680
WRNL	Richmond, Va.	910
WRNY	Rome, N.Y.	1350
WROA	Gulfport, Miss.	1390
WROB	West Point, Miss.	1450
WROC	Rochester, N.Y.	1280
WROD	Daytona Beach, Fla.	1340
WROK	Rockford, Ill.	1440
WROL	Knoxville, Tenn.	1490
WROM	Rome, Ga.	710
WRON	Ronceverte, W.Va.	1400
WROS	Scottsboro, Ala.	1330
WROV	Roanoke, Va.	1240
WROW	Albany, N.Y.	590
WROX	Clarksdale, Miss.	1450
WROY	Carmi, Ill.	1460
WROZ	Evansville, Ind.	1400
WRPL	Charlotte, N.C.	1540
WRPM	Poplarville, Miss.	1530
WRR	Dallas, Tex.	1310
WRRR	Rockford, Ill.	1330
WRRZ	Clinton, N.C.	880
WRSA	Saratoga Sprgs., N.Y.	1280
WRSC	State College, Pa.	1390
WRSG	San German, P.R.	1090
WRSJ	Bayamon, P. R.	1560
WRSL	Stanford, Ky.	1520
WRSW	Warsaw, Ind.	1480
WRTA	Altoona, Pa.	1240
WRTH	Wood River, Ill.	590
WRTL	Rantoul, Ill.	1460
WRUF	Gainesville, Fla.	850
WRUM	Rumford, Maine	790
WRUN	Utica, N.Y.	1150
WRUS	Russellville, Ky.	610
WRVA	Richmond, Va.	1140
WRVK	Mt. Vernon, Ky.	1460
WRWD	Augusta, Ga.	1480
WRWH	Cleveland, Ga.	1380
WRXO	Roxboro, N.C.	1430
WRYM	New Britain, Conn.	840
WRYT	Boston, Mass.	950
WSAC	Fort Knox, Ky.	1470
WSAF	Sarasota, Fla.	1220
WSAI	Cincinnati, Ohio	1360
WSAJ	Grove City, Pa.	1340
WSAL	Logansport, Ind.	1230
WSAM	Saginaw, Mich.	1400
WSAN	Allentown, Pa.	1470
WSAO	Senatobia, Miss.	1550
WSAR	Fall River, Mass.	1480
WSAT	Salisbury, N.C.	1280
WSAU	Wausau, Wis.	550
WSAV	Savannah, Ga.	630
WSAY	Rochester, N.Y.	1370
WSAZ	Huntington, W.Va.	930
WSB	Atlanta, Ga.	750
WSBA	York, Pa.	910
WSBB	New Smyrna Beach, Fla.	1230
WSBC	Chicago, Ill.	1240
WSBR	Boca Raton, Fla.	740
WSBS	Gt. Barrington, Mass.	860
WSBT	South Bend, Ind.	960
WSBP	Chattahoochee, Fla.	1580
WSCM	Panama City Beach, Fla.	1290
WSCO	Taylorsville, Miss.	1280
WSCR	Scranton, Pa.	1320
WSCV	Peterborough, N.H.	1050
WSDR	Sterling, Ill.	1240
WSDS	Ypsilanti, Mich.	1480
WSEB	Sebring, Fla.	1340
WSEL	Pontotoc, Miss.	1440
WSEM	Donalsonville, Ga.	1500
WSEN	Baldwinsville, N.Y.	1050
WSER	Elkton, Md.	1550
WSET	Glen Falls, N.Y.	1410
WSEV	Sevierville, Tenn.	930
WSEW	Sellingsgrove, Pa.	1240
WSFB	Quitman, Ga.	1490
WSFC	Somerset, Ky.	1240
WSFR	Sanford, Fla.	1300
WSFT	Thomaston, Ga.	1220
WSFW	Seneca Falls, N.Y.	1110
WSGA	Savannah, Ga.	1400
WSGB	Sutton, W.Va.	1490
WSGC	Elberton, Ga.	1400
WSGN	Birmingham, Ala.	610
WSGO	Oswego, N.Y.	1440

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Name (please print) Age

Address

City

State Zip Code

306 M-7035

Call	Location	kHz
WSGW	Saginaw, Mich.	790
WSHB	Raeford, N.C.	1400
WSHF	Sheffield, Ala.	1290
WSHN	Fremont, Mich.	1550
WSHO	New Orleans, La.	800
WSHP	Shippenburg, Pa.	1480
WSIB	Beaufort, S.C.	1490
WSIC	Statesville, N.C.	1400
WSID	Baltimore, Md.	1010
WSIG	Mount Jackson, Va.	790
WSIP	Paintsville, Ky.	1490
WSIR	Winter Haven, Fla.	1490
WSIV	Pekin, Ill.	1140
WSIX	Nashville, Tenn.	980
WSIZ	Ocilla, Ga.	1380
WSJC	Magee, Miss.	810
WSJM	St. Joseph, Mich.	1400
WSJR	Modawaska, Me.	1230
WSJS	Winston-Salem, N.C.	600
WSJW	Woodruff, S.C.	1510
WSKE	Everett, Pa.	1050
WSKI	Montpelier-Barre, Vt.	1240
WSKT	Knoxville, Tenn.	1580
WSKY	Asheville, N.C.	1230
WSLB	Ogdensburg, N.Y.	1400
WSLG	Donaldsonville, La.	1090
WSLI	Jackson, Miss.	930
WSMA	Marine City Mich.	1590
WSLM	Salem, Ind.	1220
WSLR	Akron, Ohio	1350
WSLS	Roanoke, Va.	610
WSLT	Ocean City-Somers Pt., N.J.	1520
WSLV	Ardmore, Tenn.	1110
WSM	Nashville, Tenn.	650
WSMB	New Orleans, La.	1350
WSMD	La Plata, Md.	1560
WSME	Sanford, Maine	1220
WSMG	Greeneville, Tenn.	1450
WSMI	Litchfield, Ill.	1540
WSML	Graham, N.C.	1190
WSMN	Nashua, N.H.	1590
WSMT	Sparta, Tenn.	1050
WSMY	Weldon, N.C.	1400
WSNE	Cumming, Ga.	1410
WSNJ	Bridgeton, N.J.	1240
WSNO	Barre, Vt.	1450
WSNT	Sandersville, Ga.	1490
WSNW	Seneca, S. C.	1150
WSNY	Schenectady, N.Y.	1240
WSOC	Charlotte, N.C.	930
WSOK	Savannah, Ga.	1230
WSOL	Tampa, Fla.	1300
WSOM	Salem, Ohio	600
WSON	Henderson, Ky.	860
WSOO	Slt. Ste. Marie, Mich.	1230
WSOQ	No. Syracuse, N.Y.	1220
WSOY	Decatur, Ill.	1340
WSPA	Spartanburg, S.C.	950
WSPB	Sarasota, Fla.	1450
WSPD	Toledo, Ohio	1370
WSPF	Hickory, N.C.	1000
WSPR	Springfield, Mass.	1270
WSPT	Stevens Pt., Wis.	1010
WSRA	Milton, Fla.	1490
WSRC	Durham, N.C.	1410
WSRF	Ft. Lauderdale, Fla.	1580
WSRO	Marlborough, Mass.	1470
WSRW	Hillsboro, Ohio	1590
WSSA	College Park, Ga.	1570
WSSB	Durham, N.C.	1490
WSSC	Sumter, S.C.	1340
WSSO	Starkville, Miss.	1230
WSSV	Petersburg, Va.	1240
WSTC	Stamford, Conn.	1400
WSTH	Taylorsville, N.C.	860
WSTK	Woodstock, Va.	1230
WSTL	Eminence, Ky.	1600
WSTP	Salisbury, N.C.	1490
WSTR	Sturgis, Mich.	1230
WSTU	Stuart, Fla.	1450
WSTV	Steubenville, Ohio	1340
WSTX	Christiansted, V.I.	970
WSUB	Groton, Conn.	980
WSUH	Oxford, Miss.	1420
WSUI	Iowa City, Iowa	910
WSUN	St. Petersburg, Fla.	620
WSUX	Seaford, Del.	1280
WSUZ	Palatka, Fla.	800
WSVA	Harrisonburg, Va.	550
WSVL	Shelbyville, Ind.	1520
WSVM	Valdese, N.C.	1490
WSVP	West Warwick, R.I.	1450
WSVS	Crewe, Va.	800
WSWN	Belle Glade, Fla.	900
WSWS	Berea, Ky.	1500
WSWV	Pennington Gap, Va.	1570
WSWW	Platteville, Wis.	1590
WSYB	Rutland, Vt.	1380
WSYD	Mt. Airy, N.C.	1300
WSYL	Sylvania, Ga.	1490
WSYR	Syracuse, N.Y.	570
WTAB	Tabor City, N.C.	1370
WTAC	Flint, Mich.	600
WTAD	Quincy, Ill.	930
WTAE	Pittsburgh, Pa.	1250
WTAG	Worcester, Mass.	580
WTAI	Eau Gallie, Fla.	1560
WTAL	Tallahassee, Fla.	1450
WTAN	Clearwater, Fla.	1340
WTAP	Parkersburg, W.Va.	1230
WTAQ	LaGrange, Ill.	1300
WTAR	Norfolk, Va.	790
WTAW	College Station, Tex.	1150
WTAX	Springfield, Ill.	1240
WTAY	Robinson, Ill.	1570
WTBC	Tuscaloosa, Ala.	1230
WTBF	Troy, Ala.	970
WTBO	Cumberland, Md.	1450
WTBP	Parsons, Tenn.	1550
WTBQ	Warwick, N.Y.	1110
WTBY	Waterbury, Conn.	1590
WTCA	Plymouth, Ind.	1050
WTCB	Flomaton, Ala.	990
WTCH	Shawano, Wis.	960
WTCJ	Tell City, Ind.	1230
WTCM	Traverse City, Mich.	1400
WTCO	Campbellsville, Ky.	1450
WTCR	Ashland, Ky.	1420
WTCS	Fairmount, W.Va.	1490
WTCW	Whitesburg, Ky.	920
WTEL	Philadelphia, Pa.	860
WTGA	Thomaston, Ga.	1590
WTGR	Myrtle Beach, S.C.	1520
WTHB	Augusta, Ga.	1550
WTHD	Milford, Del.	930
WTHE	Mineola, N.Y.	1520
WTHI	Terre Haute, Ind.	1480
WTHM	Lapeer, Mich.	1530
WTHN	Thomaston, Ga.	1500
WTHU	Thurmont, Md.	1450
WTIC	Hartford, Conn.	1080
WTID	Newport News, Va.	1270
WTIF	Tifton, Ga.	1340
WTIG	Massillon, Ohio	990
WTIK	Durham, N.C.	1310
WTIL	Mayaguez, P.R.	1300
WTIM	Taylorville, Ill.	1410
WTIP	Charleston, W.Va.	1240
WTIQ	Manistique, Mich.	1490
WTIV	Titusville, Pa.	1230
WTIX	New Orleans, La.	690
WTJH	East Point, Ga.	1260
WTJS	Jackson, Tenn.	1390
WTKM	Hartford, Wis.	1540
WTKO	Ithaca, N.Y.	1470
WTKY	Tompkinsville, Ky.	1370
WTLB	Utica, N.Y.	1310
WTLK	Taylorsville, N.C.	1570
WTLN	Apopka, Fla.	1520
WTLO	Somerset, Ky.	1480
WTLS	Tallasee, Ala.	1300
WTMA	Charleston, S.C.	1250
WTMB	Wisconsin Rapids, Wis.	1460
WTMC	Ocala, Fla.	1290
WTNE	Trenton, Tenn.	1500
WTMJ	Milwaukee, Wis.	620
WTMP	Tampa, Fla.	1150
WTMR	Camden, N.J.	800
WTMT	Louisville, Ky.	620
WTNC	Thomasville, N.C.	790
WTND	Orangeburg, S.C.	920
WTNN	Millington, Tenn.	1380
WTNS	Coshocton, Ohio	1560
WTNT	Tallahassee, Fla.	1270
WTNW	Chapel Hill, N.C.	1530
WTOB	Winston-Salem, N.C.	1380
WTOC	Savannah, Ga.	1290
WTOD	Toledo, Ohio	1560
WTOE	Spruce Pine, N.C.	1470
WTON	Staunton, Va.	1240
WTOO	Bellefontaine, O.	1390
WTOP	Washington, D.C.	1500
WTOR	Torrington, Conn.	610
WTOT	Marianna, Fla.	980
WTOW	Towson, Md.	1580
WTPR	Paris, Tenn.	710
WTPS	Portage, Mich.	1560
WTOW	Towson, Md.	1570
WTOY	Roanoke Va.	910
WTQX	Selma, Ala.	1570
WTRA	Latrobe, Pa.	1480
WTRB	Ripley, Tenn.	1570
WTRC	Elkhart, Ind.	1340
WTRE	Greensburg, Ind.	1330
WTRI	Brunswick, Md.	1520
WTRL	Bradenton, Fla.	1490
WTRN	Tyrone, Pa.	1340
WTRO	Dyersburg, Tenn.	1330
WTRP	LaGrange, Ga.	620
WTRQ	Warsaw, N.C.	1560
WTRR	Sanford, Fla.	1400
WTRS	Dunellon, Fla.	920
WTRU	Muskegon, Mich.	1600
WTRX	Flint, Mich.	1330
WTRY	Troy, N.Y.	980
WTSA	Brattleboro, Vt.	1450
WTSB	Lumberton, N.C.	1340
WTSL	Hanover-Lebanon, New Hampshire	1400
WTSN	Dover, N.H.	1270
WTSV	Claremont, N.H.	1230
WTTB	Vero Beach, Fla.	1490
WTTC	Towanda, Pa.	1550
WTTF	Tiffin, Ohio	1600
WTTI	Dalton, Ga.	1530
WTTL	Madisonville, Ky.	1310
WTTM	Trenton, N.J.	920
WTTN	Watertown, Wis.	1580
WTTO	Toledo, Ohio	1520
WTTR	Westminster, Md.	1470
WTTS	Bloomington, Ind.	1370
WTTT	Amherst, Mass.	1430
WTUG	Tuscaloosa, Ala.	790
WTUP	Topelo, Miss.	1490
WTUX	Wilmington, Del.	1290
WTVB	Coldwater, Mich.	1590
WTVL	Waterville, Maine	1490
WTVN	Columbus, Ohio	610
WTVR	Richmond, Va.	1380
WTWA	Thomson, Ga.	1240
WTWB	Auburndale, Fla.	1570
WTWN	St. Johnsbury, Va.	1340
WTXL	W. Spgfd., Mass.	1490
WTYC	Rock Hill, S.C.	1150
WTYL	Tylertown, Miss.	1290
WTYM	East Longmeadow, Mass.	1600
WTYN	Tyron, N.C.	1550
WTYS	Marianna, Fla.	1340
WTZE	Tazewell, Va.	1470
WUBE	Cincinnati, O.	1230
WUDO	Lewisburg, Pa.	1010
WUFE	Baxley, Ga.	1260
WUFF	Eastman, Ga.	710
WUFO	Amherst, N.Y.	1080
WULA	Eufaula, Ala.	1240
WULF	Alma, Ga.	1400
WUMU	Gainesville, Fla.	1390
WUNA	Aquadilla, P. R.	1340
WUNE	Baton Rouge, La.	1550
WUNI	Mobile, Ala.	1410
WUNN	Mason, Mich.	1110
WUNO	Rio Piedras, P.R.	1320
WUNR	Brookline, Mass.	1600
WUOK	Cumberland, Md.	1270
WUPR	Utado, P.R.	1530
WUST	Bethesda, Md.	1120
WUSJ	Lockport, N.Y.	1340
WUWU	Gainesville, Fla.	1390
WVAB	Virginia Bch., Va.	1550
WVAK	Paoli, Ind.	1560
WVAL	Sauk Rapids, Minn.	800
WVAM	Altoona, Pa.	1430
WVAP	Burnettown, S.C.	1510
WVAR	Richwood, W.Va.	600
WVCB	Shallotte, N.C.	1410
WVCF	Windermere, Fla.	1480
WVCG	Coral Gables, Fla.	1080
WVCH	Chester, Pa.	740
WVEC	Hampton, Va.	1490
WVGT	Mt. Dora, Fla.	1580
WVIC	E. Lansing, Mich.	730
WVIM	Vicksburg, Miss.	1490
WVIP	Mt. Kisco, N.Y.	1310
WVJP	Caguas, P.R.	1110
WVJS	Owensboro, Ky.	1420
WVKO	Columbus, Ohio	1580
WVKY	Louisa, Ky.	1270
WVLC	Orleans, Mass.	1170
WVLD	Valdosta, Ga.	1450
WVLK	Lexington, Ky.	590
WVLY	Water Valley, Miss.	1320
WVMC	Mt. Carmel, Ill.	1360
WVMG	Cochran, Ga.	1440
WVMI	Biloxi, Miss.	570
WVMT	Burlington, Vt.	620
WVNA	Tuscumbia, Ala.	1590
WVNJ	Newark, N.J.	620
WVOB	Bel Air, Md.	1520
WVOC	Battle Creek, Mich.	1500
WVOE	Chadburn, N.C.	1590
WVOH	Hazelhurst, Ga.	920
WVOJ	Jacksonville, Fla.	1320
WVOK	Birmingham, Ala.	690
WVOL	Berry Hill, Tenn.	1470
WVOM	Iuka, Miss.	1270
WVON	Cicero, Ill.	1450
WVOP	Vidalia, Ga.	970
WVOS	Liberty, N.Y.	1240
WVOT	Wilson, N.C.	1420
WVOV	Huntsville, Ala.	1000
WVOW	Logan, W.Va.	1290
WVOX	New Rochelle, N.Y.	1460
WVOZ	Carolina, P.R.	1400
WVPO	Stroudsburg, Pa.	840
WVRC	Spencer, W. Va.	1400
WVSA	Vernon, Ala.	1380
WVSC	Somerset, Pa.	990
WVSM	Rainsville, Ala.	1500
WVVW	Grafton, W.Va.	1260
WVWI	Charlotte Amalie, V.I.	1000
WWAB	Lakeland, Fla.	1330
WWAM	Cadillac, Mich.	1370
WWBA	St. Petersburg, Fla.	680
WWBC	Cocoa, Fla.	1510
WWBD	Bamberg-Denmark, S.C.	790
WWBR	Windber, Pa.	1350
WWBZ	Vineland, N.J.	1360
WWCA	Gary, Ind.	1270
WWCC	Bremen, Ga.	1440
WWCH	Clarion, Pa.	1300
WWCM	Brazil, Ind.	1130
WWCO	Waterbury, Conn.	1240
WWDA	Wisconsin Dells, Wis.	990
WWDC	Washington, D.C.	1260
WWDR	Murfreesboro, N. C.	1080
WWGM	Nashville, Tenn.	1560
WWGO	Erie, Pa.	1450
WWGP	Sanford, N.C.	1050
WWGS	Tifton, Ga.	1430
WWHG	Hornell, N.Y.	1320
WWHY	Huntington, W.Va.	1470
WWIN	Baltimore, Md.	1400
WWIS	Black River Falls, Wis.	1260
WWIT	Canton, N.C.	970
WWJ	Detroit, Mich.	950
WWJB	Brooksville, Fla.	1450
WWJC	Superior, Wis.	1270
WWKE	Ocala, Fla.	1370
WWKO	Fair Bluff, N.C.	1480
WWKY	Winchester, Ky.	1380
WWL	New Orleans, La.	870
WWLE	Cornwall, N.Y.	1170
WWML	Portage, Pa.	1470
WWNC	Rochester, N.H.	930
WWNH	Rochester, N.H.	930
WWNR	Beckley, W.Va.	620
WWNS	Statesboro, Ga.	1240
WWNY	Watertown, N.Y.	790
WWOD	Lynchburg, Va.	1390
WWOK	Miami, Fla.	1260
WWOL	Buffalo, N.Y.	1120
WWOM	New Orleans, La.	600
WWON	Woonsocket, R.I.	1240
WWOW	Conneaut, Ohio	1360
WWPA	Williamsport, Pa.	1340
WWPF	Palatka, Fla.	1260
WWRL	New York, N.Y.	1600
WWSC	Glens Falls, N.Y.	1450
WWSD	Monticello, Fla.	1090
WWSF	Loretto, Pa.	1400
WWSR	St. Albans, Vt.	1420
WWST	Wooster, Ohio	960
WWSW	Pittsburgh, Pa.	970
WWTC	Minneapolis, Minn.	1280
WWUN	Jackson, Miss.	1590
WWVA	Wheeling, W.Va.	1170
WWWB	Jasper, Ala.	1360
WWWC	Wilkesboro, N.C.	1240
WWWF	Fayette, Ala.	990
WWWR	Russellville, Ala.	920
WWXL	Manchester, Ky.	1450
WWYN	Erie, Pa.	1260
WWYO	Pineville, W.Va.	970
WXAL	Demopolis, Ala.	1400
WXCL	Peoria, Ill.	1350
WXCO	Wausau, Wis.	1230
WXGI	Richmond, Va.	950
WXIT	Charleston, W.Va.	1490
WXKW	Troy, N. Y.	1600
WXLI	Dublin, Ga.	1230
WXLL	Big Delta, Alaska	980
WXLW	Indianapolis, Ind.	950
WXOK	Baton Rouge, La.	1460
WXOX	Bay City, Mich.	1250
WXPQ	Eatonton, Ga.	1520
WXMT	Merrill, Wis.	730
WXTN	Lexington, Miss.	1000
WXRF	Guayama, P.R.	1590
WXTR	Pawtucket, R.I.	550
WXUR	Media, Pa.	690
WXVA	Charles Town, W.Va.	1550
WXVI	Riviera Bch., Fla.	1600
WXVW	Jeffersonville, Ind.	1450
WXXX	Hattiesburg, Miss.	1310
WXYC	Ft. Myers, Fla.	1350
WXYZ	Detroit, Mich.	1270
WYAL	Scotland Neck, N.C.	1280
WYAM	Bessemer, Ala.	1450
WYBG	Massena, N. Y.	1050
WYCL	York, S.C.	980
WYDE	Birmingham, Ala.	850
WYDK	Yadkinville, N.C.	1480
WYFE	Rockford, Ill.	1150
WYGO	Corbin, Ky.	1330
WYHE	Bristol, Tenn.	1550
WYLD	New Orleans, La.	940
WYLO	Jackson, Wis.	540
WYMB	Manning, S.C.	1410
WYNA	Raleigh, N. C.	1550
WYND	Sarasota, Fla.	1280
WYNE	Appleton, Wis.	1150
WYNG	Goldsboro, N.C.	1300
WYNK	Baton Rouge, La.	1380
WYNN	Florence, S.C.	540
WYNR	Brunswick, Ga.	790
WYNS	Leighton, Pa.	1150
WYNX	Smyrna, Ga.	1550
WYNZ	Ypsilanti, Mich.	1520
WYOQ	Wyoming, Mich.	1530
WYOU	Tampa, Fla.	1550
WYPR	Danville, Va.	970
WYRE	Annapolis, Md.	810
WYRN	Louisburg, N.C.	1480
WYRU	Red Springs, N.C.	1510
WYSE	Inverness, Fla.	1560
WYSH	Clinton, Tenn.	1380
WYSL	Buffalo, N.Y.	1400
WYSR	Franklin, Va.	1250
WYTH	Madison, Ga.	1250
WYTI	Rocky Mount, Va.	1570
WYVE	Wytheville, Va.	1280
WYWY	Barbourville, Ky.	950
WYXI	Athens, Tenn.	1390
WYYY	Kalamazoo, Mich.	1470
WYZE	Atlanta, Ga.	1480
WZAM	Prichard, Ala.	1270
WZBN	Zion, Ill.	1500
WZEP	DeFuniak Sprgs., Fla.	1460
WZIP	Cincinnati, Ohio	1050
WZKY	Albermarle, N.C.	1580
WZOB	Ft. Payne, Ala.	1250
WZOE	Princeton, Ill.	1490
WZST	Leesburg, Fla.	1410
WZUM	Carnegie, Pa.	1590
WZYX	Cowan, Tenn.	1440

White's World-Wide Shortwave Stations

Prepared by Don Jensen

THOUGH our closest continental neighbor, South America is for many shortwave listeners a real problem area. As a result, too many SWLs ignore or studiously avoid what is one of the richest DX targets in the world.

Based on our mail, the complaints are quite similar. Stations are too hard to hear. They never broadcast in English. Why bother with them anyway, they never QSL.

These generalizations are broad, but not entirely untrue. Yes, many of the South American shortwave outlets are weak and hard to tune. Few transmit English programs. Obtaining verifications from them can be tough. Still these difficulties are not insurmountable. The personal satisfaction of overcoming these obstacles can be a real ego booster!

Perhaps the best way to go after South American DX is to cut your teeth on the easy ones, then, as you gain some experience, dig deeper for the rarer ones.

Most of the programming you'll hear will be in Spanish. Brazilian stations broadcast in Portuguese. Contrary to popular belief, there are a few English transmissions and announcements to be heard from these Latin Americans.

A year or two of high school Spanish will stand you in good stead, but even of you don't know the language, it isn't too hard to pick out a few key words from the station ID.

To start you off, here's our "No Sweat Guide to South America," listing some best bets from each of the countries currently broadcasting on shortwave.

● **Argentina**—An English transmission to North America, from Radiodifusion Argentina al Exterior (RAE), the government station in Buenos Aires, can be heard at 0600 GMT on 9,690 kHz.

● **Bolivia**—Try 5,025 kHz., around 0300 GMT for English announcements over missionary station, La Cruz del Sur, operating from La Paz, Bolivia's 12,000 foot high capital. Earlier you'll find Spanish programming.

● **Brazil**—Currently a good bet is Radio Rural, a station of the Brazilian ministry of agriculture at Rio de Janeiro. Programming in Portuguese is noted around 2000 to 2330 GMT, on 15,105 kHz.

● **Chile**—Chalk up this country in the south of South America by logging Radio Presidente Balmaceda in Santiago. Programming in Spanish again. Roll out of bed around 1000 GMT for this one.

● **Colombia**—With the Colombians you "pay your money and take your choice!" Plenty to choose from here. But two of the easiest are Transmisora Caldas, located at Manizales, 5,020 kHz., and Radio Sutatenza, a Roman Catholic missionary outlet, 5,075 kHz. For Colombian stations, any time during the early evening is good.

● **Ecuador**—It's HCJB! What more can be said? Of the many frequency/time combinations we could name, how about 11,740 kHz. at 0300 GMT?

● **French Guiana**—Here's an exception to the general rule. The language here is French, ob-

Propagation Forecast for October/November 1970

Prepared by C. M. Stanbury II

LISTENER'S STANDARD TIME	ASIA (except Near East)	EUROPE, NEAR EAST & AFRICA (N. of the Sahara)	AFRICA (S. of the Sahara)	SOUTH PACIFIC	LATIN AMERICA
0000-0300	31	(41), 49	31w, 60, 90e	41	(49), 60, 90
0300-0600	41, 49	(31-poor)	19w, 31e	49, 60	49, 60, 90
0600-0900	31	(16), 19	19	25, 31	49
0900-1200	19, 25	16, 19	19, 25	(25-poor)	25, 31
1200-1500	19, 25	16, 19	19, 25	(19-poor)	19, 25
1500-1800	19	25, 31, (49)	41w, 60, 90e	19, 25	25, 31
1800-2100	19, 25	31, 41, (49)	25, 31e, 60, 90w	(16), 19	(49), 60, 90
2100-2400	19, 25, (31w)	(31), 41, 49	60, 90	25, (31w)	(49), 60, 90

viously, not Spanish or Portuguese. The Office de Radiodiffusion-Television Francaise station at Cayenne may give you some trouble. It's not as easy to log as the preceding ones. Get up early, say 1000 GMT, and listen on 3,385 kHz.

● **Guyana**—This is the former British Guiana, so most programming is in English on Radio Demerara. But don't be startled if you hear some East Indian music programmed for Guyana's sizeable Asian community. When you're up tuning for French Guiana, look for this one just 20 kHz. lower on 3,365 kHz.

● **Paraguay**—This is probably the hardest of the South American countries to log on shortwave. About the only one now being heard is Radio Encarnacion operating on 11,945-47 kHz, around 0030 or 0100 GMT.

● **Peru**—A number of Peruvian stations are putting in good signals these days. One of the better ones is Lima's Radio Nacional del Peru, heard throughout the evening hours on 6,082 kHz.

● **Uruguay**—Like its neighbor, Paraguay, this country will give some trouble. We'll give you two to try here; SODRE, CXA18, a Montevideo station on 15,275 kHz., and Radio El Espectador on 11,835 kHz. You may find interference a problem, but try around 0100 to 0200 GMT.

● **Venezuela**—Many, many fine signals being heard now, but two of the best throughout the evening hours are Radio Barquisimeto on 4,990 kHz., and Radio Rumbos on 4,970 kHz.

How many can you log? Give yourself ten points for each South American country you can tune. If you score less than 50, revolting! Hit 120? Magnifico! If you're in between, keep trying!

This Issue's Shortwave Contributors

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Something for nothing? Not quite, but about as close as you can come these days is the interesting and highly useful little bulletin put out by Radio Sweden's "Sweden Calling DXers" program.

You may be familiar with this popular DX program aired weekly by Radio Sweden. But you might not know that a written summary of each week's script, with plenty of DX data, is airmailed—free—to listeners who ask to be put on the mailing list.

You are required, however, to send reports to the SCDX program, telling about some of your recent SWL loggings. You, and others like you, provide the information on new stations, frequencies and schedules that make up the popular program's content.

Write to "Sweden Calling DXers," Radio Sweden, S-105 10, Stockholm, Sweden.

WORLD-WIDE SHORTWAVE STATIONS

90-Meter Band—3200 to 3400 kHz

kHz	Call	Station Name	Location	GMT
3215	YVOE	Ondas Panamericanas	El Vigia, Venezuela	0500
3230	VRH8	R. Fiji	Suva, Fiji	0800
3240	—	R. Baghdad	Baghdad, Iraq	0300
3245	VL8BK	R. Kerema	Kerema, Papua/N. Guinea	1045
3245	YVKT	R. Libertador	Caracas, Venezuela	0200
3255	ELBC	Liberian Bc. Co.	Monrovia, Liberia	0600
3259	—	Nippon H.K.	Sendai, Japan	0900
3280	—	Windward Is. Bc. Svc.	St. Georges, Grenada	0130
3300	—	R. Nat. Republique Burundi	Bujumbura, Burundi	2030
3300	—	R. Belize	Belize, Br. Honduras	0300
3316	—	R. Sierra Leone	Freetown, Sierra Leone	2230
3322	VL9BA	R. Bougainville	Kieta, Bougainville Is.	1130
3325	YVRA	R. Monegas	Maturin, Venezuela	0130
3335	VL9CD	R. Wewak	Wewak, Papua/N. Guinea	1130
3346	—	R. Zambia	Lusaka, Zambia	0400
3355	HIBD	L. V. de La Romana	La Romana, Dominican Rep.	0200
3360	TGVN	L. V. de Nahuala	Nahuala, Guatemala	1100
3375	CR6RZ	Emis. Oficiol	Luanda, Angola	2315
3380	—	Malawi Bc. Corp.	Blantyre, Malawi	0400
3385	—	O.R.T.F.	Cayenne, Fr. Guiana	0930
3395	—	R. Clube Conquista	Vitoria de Conquisto, Brazil	0130
3910	—	Far East Network	Tokyo, Japan	

60-Meter Band—4750 to 5060 kHz

kHz	Call	Station Name	Location	GMT
4635	—	—	Dushanbe, U.S.S.R.	0100
4650	HCAK2	R. del Ecuador	Guayaquil, Ecuador	0615
4680	HCWE1	R. Nac. Espejo	Quito, Ecuador	0400
4691	—	R. Reloj	San Jose, Costa Rica	0140
4750	YDQ4	R. Republik Indonesia	Makassar, Indonesia	1230
4755	ZYY3	R. Brasil	Campinas, Brazil	0145
4767	HJDY	R. Catatumbo	Ocana, Colombia	0230
4770	ELWA	Sudan Interior Mission	Monrovia, Liberia	2230
4777	—	R-TV Gabonaise	Libreville, Gabon	0500
4780	HRRZ	R. Juticalpa	Juticalpa, Honduras	0345
4815	—	R-TV Voltaique	Ouagadougou, Upper Volta	0600
4825	HIFA	L.V. Fuerzas Armadas	Santo Domingo, Dominican Rep.	0100
4865	PRC5	R. Clube do Para	Belem, Brazil	0900
4870	—	R. du Dahomey	Cotonou, Dahomey	2145
4872	8FW20	R. Republik Indonesia	Sorong, Indonesia	1200
4890	VLT4	Australian Bc. Corp.	Port Moresby, Papua/N. Guinea	1130
4915	—	R. Ghana	Acra, Ghana	0600

kHz	Call	Station Name	Location	GMT
4920	VLM4	Australian Bc. Corp.	Brisbane, Australia	0800
4926	EAJ206	R. Ecuatorial	Bata, Rio Muni	0500
4932	—	Nigerian Bc. Corp.	Benin City, Nigeria	2300
4938	OAX9E	R. Tropical	Tarapoto, Peru	0130
4950	—	R. Malaysia Sarawak	Kuching, Sarawak	1300
5010	—	Forces Bc. Svc.	Singapore	1300
5025	CP75	La Cruz del Sur	La Paz, Bolivia	0300

49-Meter Band—5950 to 6200 kHz

kHz	Call	Station Name	Location	GMT
6000	—	Bc. Svc. Saudi Arabia	Riyadh, Saudi Arabia	0300
6005	—	R.I.A.S.	Berlin, Germany	0300
6020	—	R. Nederland Relay	Bonaire, Neth. Antilles	2345
6030	—	Suddeutscher Rundfunk	Muhlacker, Germany	0520
6035	—	R. Monte Carlo	Monte Carlo, Monaco	0530
6037	TIFC	Faro del Caribe	San Jose, Costa Rica	0300
6045	HOU31	L.V. del Baru	David, Panama	1015
6060	—	RAI	Caltanissetta, Sicily	0300
6065	PRL	R. Nac. de Brasilia	Brasilia, Brazil	0930
6065	—	R. Sweden	Stockholm, Sweden	0215
6080	ZL7	R. New Zealand	Wellington, New Zealand	0930
6085	DMR24	Bayerischer Rundfunk	Munich, Germany	0555
6090	—	R. Luxembourg	V. Louvigny, Luxembourg	2245
6097	—	R. Mogadiscio	Mogadiscio, Somalia	0330
6100	—	R. Australia	Melbourne, Australia	1115
6115	OBZ40	R. Union	Lima, Peru	0500
6125	—	R-TV Belge	Brussels, Belgium	0050
6140	XERUU	R. Univ. Chihuahua	Chihuahua, Mexico	0530
6155	—	Far East Network	Tokyo, Japan	0930
6170	YVKG	R. Nac. de Venezuela	Caracas, Venezuela	0200
6172	HJLW	Ecos del Combeima	Ibague, Colombia	0500
6185	—	Trans World Radio	Bonaire, Neth. Antilles	0320
6250	EAJ205	Emis. Sta. Isabel	Sta. Isabel, Fernando Poo	2130

41-Meter Band—7100 to 7300 kHz

kHz	Call	Station Name	Location	GMT
7044	—	R. Iran	Teheran, Iran	0330
7105	—	R. Nac. de Espana	Madrid, Spain	2040
7107	—	Thai TV Co.	Bangkok, Thailand	1100
7115	—	R. Thailand	Bangkok, Thailand	1045
7125	—	R. Warsaw	Warsaw, Poland	0500
7150	—	Springbok R.	Johannesburg, South Africa	0430
7170	—	R. Noumea	Noumea, New Caledonia	0830
7215	—	R. Abidjan	Abidjan, Ivory Coast	2330
7225	DZ19	Far East Bc. Co.	Manila, Philippines	1745
7240	—	R. Belgrade	Belgrade, Yugoslavia	2215
7245	—	R. Rep. Mauritanie	Nouakchott, Mauritania	0815
7270	—	R. Malaysia Sarawak	Kuching, Sarawak	1200
7275	—	V. of Nigeria	Lagos, Nigeria	0615
7290	—	R. Vilnius	U.S.S.R.	2255
7345	—	R. Prague	Prague, Czechoslovakia	0230
7406	—	R. Peking	Peking, China	0800

31-Meter Band—9500 to 9775 kHz

kHz	Call	Station Name	Location	GMT
9540	ZL2	R. New Zealand	Wellington, New Zealand	0600
9575	—	R.I.A.	Rome, Italy	0600
9580	—	V. of the Philippines	Manila, Philippines	1000
9600	—	R. Tashkent	Tashkent, U.S.S.R.	1200
9630	—	R. Prague	Prague, Czechoslovakia	0200
9635	—	R. Singapura	Singapore	1200
9640	—	V. of Free Korea	Seoul, Korea	1100
9645	—	R. Norway	Oslo, Norway	0300
9655	OAX9G	R. Nor Peruana	Chachapoyas, Peru	0330
9660	YVLK	R. Rumbos	Caracas, Venezuela	2230
9675	ZYT29	R. Diario de Manha	Florianopolis, Brazil	0935
9690	LRA32	R.A.E.	Buenos Aires, Argentina	0600
9695	—	R. RSA	Johannesburg, South Africa	2330
9695	ZYB22	R. Rio Mar	Manaus, Brazil	1030
9695	—	R. Nat. Khmer	Pnom Penh, Cambodia	1330
9702	—	R-TV Niger	Niamey, Niger	0700
9705	ZYZ24	R. Maua	Rio de Janeiro, Brazil	0930
9710	HCJB	V. of the Andes	Quito, Ecuador	0330
9715	—	R. Nederland Relay	Bonaire, Neth. Antilles	0530
9720	—	Swiss Bc. Corp.	Berne, Switzerland	0515
9725	—	R. Sweden	Stockholm, Sweden	0330
9730	—	R. Berlin International	Berlin, E. Germany	0100
9745	XERM	R. Mexico	Mexico City, Mexico	0500
9770	—	Oesterreich R.	Vienna, Austria	0000
9833	—	R. Budapest	Budapest, Hungary	0130
9850	—	R. Cairo	Cairo, Egypt	2230
9945	—	R. Peking	Peking, China	2230

25-Meter Band—11700 to 11975 kHz

kHz	Call	Station Name	Location	GMT
11672	—	R. Pakistan	Karachi, Pakistan	2000
11695	—	R. Peking	Peking, China	2030
11700	—	R. Kiev	U.S.S.R.	0030
11705	—	R. Sweden	Stockholm, Sweden	2300
11710	—	R. Australia	Melbourne, Australia	1200
11750	—	BBC Relay	Tebrau, Malaysia	1400
11760	—	R. Havana	Havana, Cuba	0500
11765	—	R. Pyongyang	Pyongyang, N. Korea	0900
11785	—	R. Baghdad	Baghdad, Iraq	2110
11785	—	Deutsche Welle	Cologne, W. Germany	0435
11790	—	R. Lebanon	Beirut, Lebanon	0230
11795	WINB	World International Bc.	Red Lion, USA	2115
11795	—	Libyan Bc. TV	Tripoli, Libya	1930
11825	—	R. Tahiti	Papeete, Tahiti	0600
11830	ZL19	R. New Zealand	Wellington, New Zealand	1045
11835	4VEJ	R. Evangelique	Cap Haitien, Haiti	2330
11835	—	R-TV Algerienne	Algiers, Algeria	2030
11866	—	R. Lubumbashi	Lubumbashi, Congo	1920
11875	—	R. Nac. de Nicaragua	Managua, Nicaragua	0500
11890	DZE9	Far East Bc. Co.	Manila, Philippines	0900
11890	ETLF	R. V. of the Gospel	Addis Ababa, Ethiopia	0530
11900	—	R. Malaysia	Kuala Lumpur, Malaysia	1100
11910	—	R. Budapest	Budapest, Hungary	0400
11920	DZF2	Far East Bc. Co.	Manila, Philippines	1130
11925	—	Deutsche Welle	Cologne, W. Germany	2300
11935	—	R. Portugal	Lisbon, Portugal	0330
11955	KGEI	V. of Friendship	Belmont USA	0400
11955	—	O.R.T.F.	Paris, France	0100
11970	—	Windward Is. Bc. Svc.	St. Georges, Grenada	0130

19-Meter Band—15100 to 15450 kHz

kHz	Call	Station Name	Location	GMT
15013	—	V. of Vietnam	Hanoi, N. Vietnam	2000
15048	—	R. Liberation	Clandestine	2030
15083	—	R. Euzkadi	Clandestine	2130
15105	—	All India R.	Delhi, India	1630
15105	ZYZ32	R. Rural	Rio de Janeiro, Brazil	2300
15110	XERR	R. Comerciales	Mexico City, Mexico	0100
15120	—	Vatican R.	Vatican City	1500
15135	—	R. Cairo	Cairo, Egypt	2100
15150	CE1515	R. Corporacion	Santiago, Chile	0100
15155	ZYB9	R. Sao Paulo	Sao Paulo, Brazil	0030
15160	TAU	R. Ankara	Ankara, Turkey	2200
15165	—	Syrian Bc. Svc.	Damascus, Syria	2030

WHITE'S SHORTWAVE SECTION

kHz	Call	Station Name	Location	GMT
15165	ETLF	R. V. of the Gospel	Addis Ababa, Ethiopia	1500
15170	—	R. Veritas	Manila, Philippines	1430
15175	LLM	R. Norway	Oslo, Norway	2115
15185	—	Far East Bc. Assoc.	Victoria, Seychelles	0345
15185	OIX4	Finnish Bc. Co.	Pori, Finland	1815
15200	—	R-TV Belge	Brussels, Belgium	2300
15230	—	R. Ceylon	Colombo, Ceylon	0100
15245	—	R. Kinshasa	Kinshasa, Congo	0400
15250	—	R. Bucharest	Bucharest, Rumania	0730
15275	4VWI	R. Evangelique	Cap Haitien, Haiti	0100
15310	—	R. Sofia	Sofia, Bulgaria	2030
15345	—	N.B.I.	Athens, Greece	2000
15365	—	R. Nac. Espana Relay	Tenerife, Canary Is.	0300

16-Meter Band—17700 to 17900 kHz

kHz	Call	Station Name	Location	GMT
17605	—	R. Peking	Peking, China	0230
17705	—	All India R.	Bombay, India	0430
17720	—	R-TV Belge	Brussels, Belgium	0000
17720	—	V. of Free China	Taipei, Taiwan	0230
17750	—	R. Kuwait	Kuwait	0500
17795	—	R.A.I.	Rome, Italy	0330
17825	—	R. Japan	Tokyo, Japan	0100
17830	—	Swiss Bc. Corp.	Berne, Switzerland	1530
17840	—	R. Prague	Prague, Czechoslovakia	2000
17890	—	V. of Free China	Taipei, Taiwan	0315

13-Meter Band—21450 to 21750 kHz

kHz	Call	Station Name	Location	GMT
21485	—	R. Australia	Melbourne, Australia	0000
21515	DZI9	Far East Bc. Co.	Manila, Philippines	0315
21580	—	O.R.T.F.	Paris, France	2030
21590	—	Windward Is. Bc. Svc.	St. Georges, Grenada	2100
21605	—	R. Afghanistan	Kabul, Afghanistan	1230
21640	—	R. Japan	Tokyo, Japan	0200
21655	—	R. Norway	Oslo, Norway	0700
21695	—	R.A.I.	Rome, Italy	1600
21740	—	R. Australia	Melbourne, Australia	0130

White's Emergency Radio Station Listings for Ohio—Part 1

SCIENCE AND ELECTRONICS furnishes this exclusive listing of Ohio, Part 1, emergency radio stations as an aid to our many readers now engaged in the fascinating and rapidly growing hobby of monitoring emergency radio communications. Part 2 will follow in our next issue. We have and will be publishing similar lists devoted to different metropolitan areas in forthcoming issues so that you'll be able to accumulate a sizable array of this difficult-to-obtain data. Refer to the index on page 77 for our 1969/1970 program of emergency radio station listings.

If you desire to obtain similar lists from other areas in the United States that have not been published in this magazine, then we suggest you write to Communications Research Bureau, Box 56, Commack, N.Y. 11725. They may have a list of emergency radio services that covers your locality. Include a stamped, self-addressed envelope with your request.

Due to space limitation, small town listings for the State of Ohio have been omitted. However, the Communications Research Bureau (see above) does offer a more complete (if not complete) listing for Ohio!

All frequencies are megahertz (MHz). unless otherwise noted.

OHIO STATE POLICE

Mobile channels: 39.56 42.76 44.86 45.02 45.10 45.22 45.30

Base channels:

39.42	KQA397
39.46	(Intersystem) KQA397 KQB356-61 KQD483 KQD842
39.56	KQM677
39.58	KQK498 KQM677
42.42	KQA350 KQA397 KQB359 KQB362 KQB385 KQD847
42.56	KFN545 KQA397 KQA794 KQB356-7 KQB365 KQB368 KQB371-2 KQB376 KQB380-1 KQB386 KQD483 KQD534 KQD884
45.02	(Primary Channel- All Stations)
45.10	(Liquor Control Enforcem) KEL515
45.22	KAS608 KAU698 KAW777 KDA397 KJK677 KLW329 KQE895 KQF851-2 KQG699 KQK322 KQK325
45.30	KQG699
45.86	(Interstation) KFV805 KGL488 KQA397 KQB358 KQB361 KQB364 KQB366 KQB373 KQB378-9 KQB384 KQC951 KQD412-3 KQD443 KQD842 KQD940
155.13	KQA397 KQK498
155.37	(Intersystem) KQA397 KQB356-9 KQB361 KQB383 KQD842 KQD866 KQK498
155.46	KAZ426 KLR494 KQA397 KQB360 KQB363 KQB369 KQB377 KQE902
155.475	KEU956
155.61	KQA397
155.655	KLR233
155.685	KH195
155.805	KFA433
159.15	KQK87
167.825	KOG50 KQH63
453.35	KQJ30
458.35	KQJ29

Base locations/callsigns:

Akron	KQA794
Ashland (Univ)	KQE487
Ashtabula Co	KCU766
Athens	KQB549
Auglaize Co	KQD866
Belle Fontaine	KQB382
Berea	KQF386
Bucyrus	KQD842
Cambridge	KQB359
Canfield	KQD413
Chardon	KQD412
Chillicothe	KJK677 KQB386
Circleville	KAZ426
Cleveland	KLR233
Liq Contr-	KEL515
Clinton Co	KGL534 KGL551
Columbus	KLS492 KLW329 KH195 KQB360 KQD943
Dayton	KQB370
Defiance	KQB372
Delaware	KQD843
Eaton	KJB227

Elyria	KQB380
Fairfield Co	KGB369
Findlay	KQB356
Fremont (Univ)	KQC951
Gallpolis	KQB365
Garfield Hts	KEM640
Georgetown	KQB364
Grafton	KDA397
Grn Sprgs Hnr Cmp	KQK325
Guernsey Co	KJS943-4
Hamilton	KQB379 KQH63
Hamilton Co	KFK554
Hebron	KQB363
Jackson	KQD483 KQG50
Lake Co	KCW700
Lancaster Indr Schl	KQG699
Lebanon	KGL488
Corr Inst-	KQF852
Liberty Ctr-	
Maumee Youth Cmp	
Lima	KQB387
State Hosp-	KAW777
Lisbon	KQB373
London	
Pris Farm-	KQF851
Bur Crim Inv & ID-	KQK498
Loudonv Mohican Youth Camp-	KAS608
Madison Co	KCV373
Mansfield	KQB378
Reformat-	KQE895
Marietta	KQB362 KQO299
Marion	KQB374
Corr Inst-	KQK322
Massillon	KQB357
Monroe Co	KQK87
Mt Carmel	KQD940
Mt Vernon	KQB377
Muskingum Co	KCV372
New Albany	KQB360 KEU956
	KFA433
New Philadel	KQB385
Norwalk	KQB375
Ottawa	KCV375
Piqua	KQB383
Portsmouth	KQB368
Preble Co	KFK555
Ravenna	KQB384
Sandusky	KFV805
Sandusky Co	KCV376
Scale House	KCJ789
S Bloomfield	KLR494
S Point	KQD534 KQJ29-30
Springfield	KQA352
Strasburg	KQO298 KQO300
Tiffin	KQM677
Toledo	KQD884
Van Wert	KQB381
Walbridge	KQ8371
Warren	KQB361
Weymouth	KFN545
Wilmington	KQB358
Wintersville	KQA350
Wood Co	KCV374
Wooster	KQB376
Xenia	KQD443
Zaleski Youth Cmp	KAU698
Zanesville	KQD847
portable base	KQA397

OHIO TURNPIKE POLICE

(road maint channels: 47.22 47.34)

Mobile channels: 154.71 156.09

Base channels:

154.71	KCU230
155.685	KQE577-84
155.79	KQE577-84
156.09	KBQ761-75 KCJ654-68 KCU230 KGJ673 KQE585-601
159.15	KQE577-84

Base locations/callsigns:

Amherst	KCJ660-1
Berea (HQ)	KCU230
Boston Hts	KQE598 (at Rt 8)
Brecksville	KCJ666-7 (at Rt 21)
	KQE597
Canfield	KQE577
Columbia	KQE591 (at Rt 20)
Elmore	KQE582
Elyria	KQE580
Freedom	KQE578
Fremont	KBQ758 (at Rt 53)
	KQE592
Hudson	KBQ761
Kunkle	KQE584
Maumee	KBQ760 (at Rt 20)
	KQE588
Milan	KQE593 (at Rt 250)
Montpelier	KBQ759 (at Rt 15)
	KQE590
New Springfld	KCJ668-9
Newton Falls	KQE600 (at Rt 5)
N Jackson	KQE601 (at Rt 18)
N Lima	KQE585 (at Rt 7)
N Olmstead	KBQ755
N Ridgeville	KQE595 (at Rt 10)
Norwalk	KBQ757
Parkertown	KQE581
Petersburg	KQE586
Ravenna	KCJ664-5
Richfield	KQE579
Stony Ridge	KQE587 (at Rt 120)
	KQJ673
Strongsville	KQE596 (at Rt 42)
Swanton	KCJ656-7 KQE583
Vickery	KCJ658-9
Wauseon	KQE589 (at Rt 108)
W Unity	KCJ654-5
Woodville	KCJ662-3
Youngstown	KBQ756

MAJOR MUNICIPAL/COUNTY

Note: Specific stations operated by county agencies can be found listed under their respective cities in this listing. The following codes are used in this listing: CDC—County Civil Defence; FD—Fire Department; FDC—County Fire Station; LG—Local Government; LGC—County Local Government; PD—Police Department; PDC—County Police or Sheriff.

POLICE/FIRE DEPTS

Ada		PD	KQG423	155.13
		PD	mobile	154.89
Addyston		PD	KQG332	155.13
		PD	mobile	154.89
Adelphi		FDC	KAX776	154.13
		FDC	KQK75	154.445
Adena		PD		39.58
Akron	Chan A	PD	KQA784	156.21
	Chan A	PD	mobile	159.03
	Chan B	PD	KQA784	156.21
		PD	mobile	155.97
		PD		460.50
		PD		460.325
		PD		460.375
	Univ	PD	KQI436	151.895
		PDC	KQB328	39.58
		PDC	KQB328	39.62
		PDC	KQF451	same
		PDC	mobile	39.74
		PDC		460.10
		PDC		460.175
		PDC		460.251
		PDC		460.425
		LG	KQH702	45.64
		LG	KGW694	46.58
		LG	KJN739	45.58
		LG		453.30
		LG		453.40
		FD	KQA880	33.74
		FD	KQA880	33.86
		FD	KQA880	153.83
Alledonia		LGC	KBV803	46.58
		LGC	KBV807	46.58
Alliance		PD	KQA905	155.61
		PD	mobile	155.85
		LG	KEK305	154.965
Amelia		LGC	KQI689	45.22
		FD	KDJ479	33.94
Amherst		PD	KQF986	39.58
		PD	KQF986	155.61
		LG	KIZ395	155.745
		FD	KQJ411	154.37
Anderson Twp		PD	mobile	39.58
		FD	KFA434-6	154.13
Ansonia		PD		39.58
		FD	KQG850	154.19
Arcanum		LG	KJW457	155.925
		FD	KQC980	154.19
Arlington Hts		PD	mobile	39.58
		LG	mobile	158.76
		FD	KQI339	154.25
Ashland		PD	KQB709	155.61
		LG		27.275
		FD	KQI229	154.07
Ashtabula		PD	KQB540	155.61
		PDC	KDC276	155.13
		PDC	mobile	154.89
		LG	KFB807	155.085
		FD	KDX436	154.37
Athens		PD	mobile	39.58
		PDC	KQH408	39.58
		FD	KQG581	46.42
Aurora		PD	KQH507	39.58
		LG	KGL647	154.04
Austintown Twp		PD	KQC860	155.13
		PDC	KQD756	39.58
		LG	KDV403	155.745
Avon		PD	KDF567	155.61
		FD	KFN525	154.37
Avon/Lake		PD	KQA675	155.61
		LG	KBF832	154.98
		FD	KCL526	154.37
Bainbridge		PD	KEY980	39.58
		FD	KQE972	33.94
		FDC	KAX774	154.13
		FDC	KQK72	154.445
Barberton		PD	KQB536	155.61
		LG	KDQ330	155.10
		LG	KDU556	158.805
Barnesville		PD	KQF702	39.58

WHITE'S EMERGENCY

	FD	KDT323	33.94
Batavia	PDC	KDX445	39.58
	PDC	KQB932	155.37
	FDC	KDS620	33.94
Bath Twp	PD	KLK535	39.34
	PDC	KJK556	39.58
	PDC	KJK556	39.62
	PDC		460.10
	PDC		460.175
	PDC		460.25
	PDC		460.425
	FD	KQF420	33.86
" (Fairborn)	PD	KE0310	39.58
" "	FD	KDQ319	154.07
" (Lima)	FD	KQH550	154.37
Bay Village	PD	KQA774	155.61
	PD	mobile	155.85
	LG	KGP673	46.58
	LG	KFI573	154.98
	FD	KAP967	154.25
Beachwood	PD	KJE337	39.42
	PD	KJE337	155.535
	LG	KJB963	46.58
	LG	KQK355	158.76
	FD	KIZ571	46.46
Beavercreek Tp	PD	KEY903	39.58
	PD	KGK568	39.58
	LG	KDB417	453.10
	LG	KPI28	458.10
	FD	KQD726	46.18
Bedford	PD	KDZ380	39.42
	PD	KQB388	155.13
	PD	mobile	39.58
	PD	mobile	154.89
	FD	KCU835	46.46
Bedford Hts	PD	KGJ684	39.42
	LG	KEM572	46.58
	FD	KCR246	46.46
Bellaire	PD	KQA837	155.61
	PD	mobile	155.85
Bellbrook	PD	KUA778	39.58
	FD	KQI690	154.07
Bellefontaine	PD	KQD767	155.70
	PDC	KQA776	39.58
	LG	KFR717	158.925
	FD	KDV724	46.46
Bellevue	PD	KQB410	39.58
	FD	KDS698	46.06
Belleville	FD	KQR438	153.77
	FD	KQR438	154.25
Beloit	PD	KFT540	155.415
	FD	KFI652	154.07
Belpre	PD	mobile	39.58
	PD	mobile	155.49
	PD	mobile	156.15
	FD	KQE319	46.14
Bentleyville	PD	mobile	39.42
	FD		46.46
Berea	PD	KQB373	155.61
	LG	KDZ394	156.00
	FD	KAT244	154.25
Bethel	PD	KQD762	39.58
	FD	KBW422	33.94
Bettsville	PD	KQJ273	39.58
	FD	KFM390	46.06
Bexley	PD	KJC964	154.65
	PD	KJC964	155.25
	LG	KJU885	154.115
Blanchester	PD	KFA428	39.58
	FD	**KDY273**	**33.94**
Boardman Twp	PD	KFG437	155.13
	LG	KCT637	155.94
	LG	**KQK491-2**	**155.94**
Boston Hts	PD	KQE907	39.58
	FD	KJL606	33.86
Bowling Green	PD	KQA251	39.58
Univ	PD	KBD554	155.31
	PDC	KET263	39.58
	LG	KDR360	155.025
	LG	KL0385	155.025
	LGC	KQM691	155.145
	LGC	KJW781	155.82
	LGC	KQK541	155.82
	LGC	mobile	158.94
	FDC	KQH447	153.89
Bradford	PD	KQF372	155.13
	FD	KQF369	154.19
Brecksville	PD	KQH857	39.22
	PD	KQH857	39.42
	LGC	KUH78	458.35
	LGC	KUH78	458.55
	FD	KDL890	46.10
	FD	KDL890	46.48
Bridgeport	PD	KQH824	155.61

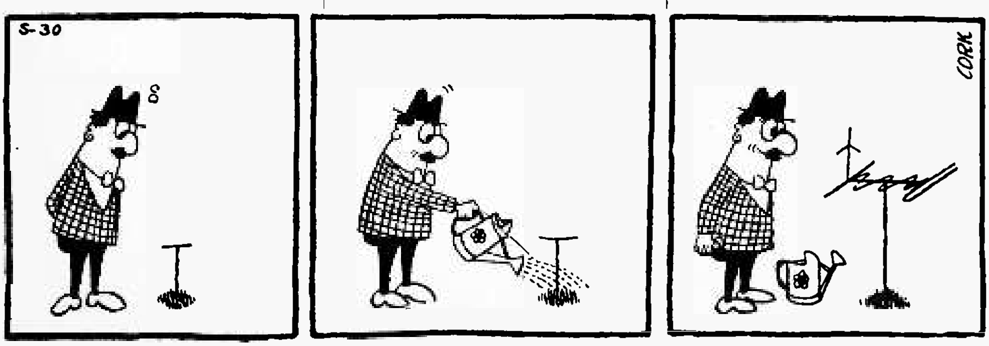
	PD	mobile	155.85
Brilliant	PD	KQE916	39.58
	FD	KDE672	33.94
Brimfield Twp	LG	KBM926	154.10
	FD	KBM641	154.13
Broadview Hts	PD	mobile	39.02
	PD	mobile	39.22
	FD	KCI982	46.10
Brookfield	PDC	KLH986	39.58
	PDC	KLH986	155.13
Brookfield Tp	PD	KAX358	155.13
	FD	KAF982	154.25
Brooklyn	PD	KQB514	39.02
	FD	KCK534	46.10
Brooklyn Hts	PD	mobile	39.02
	PD	mobile	39.42
	FD		46.10
Brook Park	PD	KQD294	39.02
	PD	KQD294	155.61
	LG	KGV278	154.025
	FD	KDG265	46.10
Brookville	PD	KQE878	155.61
	PD	mobile	155.85
	FD	KQF357	154.19
Brunswick	PD	KBE478	155.13
	PD	mobile	154.89
	PD		460.025
	PD		465.025
	LG		45.08
	LGC	KCK532	45.32
	LGC	KFZ889	45.32
	FD	KQG663	46.38
Bryan	PD	KQF877	155.61
	PDC	KQB391	39.50
	PDC	KQB391	39.58
	FD	KQE354	154.145
	FD	KQE354	154.25
Bucyrus	PD	KQA229	39.58
	PDC	KCN703	39.58
	LG	KEL382	154.025
	FD	KCR956	154.25
Burton	PD	KJP296	39.58
	LGC	KCR240	45.48
Cadiz	PD	mobile	39.58
	PDC	KQA604	39.58
	FDC	KCY204	33.94
Caldwell	PD	mobile	39.58
	PDC	KQD890	39.58
	FD	KDV398	33.90
Cambridge	PD	KQA501	39.58
	FD	KDN598	33.90
Camden	PD	KJN786	155.13
	PD	mobile	154.89
	FDC	KQH304	154.19
Campbell	PD	KLL532	158.82
	PD	KLL533	155.37
	PD	mobile	158.91
Canal Fulton	PD	mobile	44.86
	PD	mobile	45.02
	FD	KGP722	33.82
Canfield	PD	KFN589	155.37
	LG	KFN596	155.055
Canton	PD	KQB528	158.79
	PDC	KQA925	39.50
	PDC	mobile	39.38
	LGC	KGK543	158.94
	FD	KQH355-64	154.25
	FDC	KDE280	33.82
Canton Twp	LG	KGJ697	155.745
	FD	KQM648	33.82
Carey	PD	KQE300	39.58
	FD	KQG966	154.43
Carlisle	PD	KQJ331	39.58
	PD	KQJ331	155.13
	PD	mobile	154.89
	FD	KJR290	154.145
Carlisle Twp	LGC	KBR977	45.44
	FD	KQD948	154.37
	FDC	KEL346	154.37
Carrollton	PDC	KQA503	39.58
	FDC	KDE636	33.94
Castalia	PD	KAW776	39.58
	FD	KDK806	46.06
Cedarville	PD	mobile	39.58
	FD	KCL752	154.07
Celina	PD	KQG358	155.13
	PDC	KQD624	39.58
	FD	KQG357	154.31
Center Twp	LG	KLK638	155.775
	FD	KDV791	153.89
Centerville	PD	KLM600	453.80
	PD	KDX484	155.37
	LG	KQJ948	45.08
	FD	KQF294	154.13
Chagrin Falls	PD	KF0945	39.42
	PD	KF0945	39.58

	FD	KQH289	46.46
Chardin	PD	KBC200	39.58
	LGC	KCR230	45.48
	FD	KBT793	46.14
Cheviot	PD	mobile	39.58
	FD	KBZ422	33.82
Chillicothe	PD	KQA412	155.13
	PD	mobile	159.03
	PDC	KQB924	39.58
	LG	KBB987	155.715
	FD	KQG214	154.13
	FDC	KAX777-8	154.13
	FDC	KQC74	154.445
Chippewa/Lake	LGC	KFZ888	45.32
	FD	KQG659	46.38
Christiansburg	PD	KQE829	39.58
	FD	KCT631	154.19
Cincinnati	PD	KQA387	155.64
	PD	KQA387	156.15
	PD	KQA387	158.85
	PD	KLY957	460.10
	PD	KLY957	460.20
	PD	KLY957	460.25
	PD	KLY957	460.275
	PD	KLY957	460.325
	PD	KLY957	460.425
	PD	mobile	155.70
	PD	mobile	156.09
	PD	mobile	158.91
	PD	mobile	159.15
O.S.U.	PD	KDU588	453.80
	PDC	KCU760	39.14
	PDC	KQA230	39.14
	PDC	KEQ81	458.50
	PDC	mobile	39.30
	LG	KLS617	453.35
	LG	KMM50-4	458.35
	LG	KFR658	155.76
	LG	KQI919	155.76
	LGC	KJY795	158.76
	LGC	KGY327	158.805
	LGC	KQH803	158.82
	FD	KQC767	153.83
	FD	KQC767	154.07
	FD	KQC767	154.01
Airport	FD	mobile	153.89
Airport	FD	mobile	154.19
	FDC	KQI316	33.90
	FDC	KCU761	33.90
	FDC	KES95	458.50
	FDC	mobile	33.58
Circleville	PD	KQA304	155.61
	PD	mobile	155.85
	PDC	KQA930	39.58
	FDC	KF0822	33.86
Clarksburg	FDC	KAX773	154.13
	FDC	KQK71	154.445
Clay Twp	PD	mobile	39.58
	FD	KFB981	33.74
	FD	KFB989	33.74
Clay Center	PD	mobile	39.58
	FD	KDR759	33.86
Cleveland	PD	KQA550	37.18
	PD	mobile	37.34
	PD	KQA550	155.01
	PD		460.125
	PD		460.15
	PD		460.225
	PD		460.275
	PD		460.35
	PD		460.40
	PD		460.45
	PD		460.475
	PD		460.50
	LG	KFI606	154.10
	LG	mobile	155.925
	LG	KQK354-5	158.76
	LGC	KUH75	458.35
	LGC	KUH75	458.55
	LGC	KUH75	458.60
	LGC	KUH75	458.70
	LGC	KUH91	same
	FD	KQA216	33.58
	FD	KQA216	33.90
	FD	KQA216	153.83
	FD	KQA216	153.95
	FD	KQA216	154.01
Cleveland Hts	PD	KQA605	39.98
	LG	KDB535	46.54
	FD	KBU407	154.19
Cleves	PD	KQI286	155.13
	PD	mobile	154.89
Clifton	PD	mobile	39.58
	FD	KFI454	154.07
	FD	KFI545	154.37
Clinton Twp	PD	KDX462	39.50
	FD	KQK542	33.86

	FD	KFV837	33.86
	FD	mobile	46.06
Clyde	PD	KQB413	39.58
	FD	KDN458	46.06
Coldwater	PD	KLK592	155.13
	FD	mobile	154.31
Columbiana	PD	KQD240	39.58
	PD	KQE708	39.58
Columbus	PD	KQC792	154.65
	PD	KQC792	155.25
	PD	KQC792	155.55
	PD	KLU406	same
	PD	KLH948-9	same
	PD	KQG724-7	155.25
	PD	KQG724-7	155.55
	PD	KDU619	same
	PD	KFT461	same
	PD	KQB503	same
	PD	KQB670	same
	PD	KQJ695	same
	PD	KLU406	154.71
	PD	KLU406	155.58
	PD	KLH948-9	same
	PD	KLU406	154.83
	PD	KQB503	155.58
	PD	mobile	154.95
O.S.U.	PD	KDU588	453.50
	PDC	KQB505	39.58
	PDC	KIZ323	453.05
	PDC	KIZ323	453.60
	LG	KJU222	154.965
	LG	KJU222	158.82
	LG	KQH832	same
	LG	KQH832	453.30
	LG	mobile	158.955
	FD	KBS995-7	153.77
	FD	KBS995-7	154.31
	FD	KGT551	same
	FD	KIZ255	same
	FD	KJS922	same
	FD	KQB728-30	same
	FD	KQC959	same
	FD	KQD581	same
	FD	KQG723	same
	FD	KQI314-5	same
	FD	KQJ696-7	same
	FD	KQL763	same
Columbus Grv	PD	KIZ245	39.58
	FD	KLI233	143.25
	FD	KQW294	154.25
Concord Twp	LG	KQJ240	453.75
	FD	mobile	33.86
Conneaut	PD	KQB741	155.61
	LG	KFD493	154.04
	FD	KQI424	154.13
Cortland	PD	KJY658	155.13
	FD	KQH276	33.78
Coshocton	PD	KQB544	155.61
	PDC	KQH306	39.58
	FD	KQH325	154.19
Coventry Twp	PDC	KJK555	39.58
	PDC	KJK555	39.62
	FD	KBK516	33.86
Covington	PD	KQD768	155.37
	PD	KJN913-4	155.055
	FD	KQD769	154.19
Crestline	PD	KQB660	39.58
	LG	KLK689	45.52
	FD	KCR958	154.25
Cridersville	PD	KLG487	39.42
	PD	KLG487	39.58
	FD	KBR505	153.89
	FD	KBR505	153.89
	FD	KDG31	153.89

Crooksville	PD	KQG786	39.58
	FD	KDG843	33.98
Cuyahoga Falls	PD	KQB731	155.49
	LG	KJY824	45.20
	LG	KQI222	154.10
	FD	KQF712	154.37
Cuyahoga Hts	PD	KQA936	39.42
	FD	KDC872	46.48
Dalton	PD	KQE626	39.58
	FD	KQF272	154.43
Dayton	PD	KQA624	154.725
	PD	KQA624	158.73
	PD	mobile	158.97
	PDC	KQA451	155.61
	PDC	KQA451	155.67
	PDC	KDG336	155.67
	PDC	KDG336	155.415
	PDC	mobile	155.91
	LG	KBF824	154.98
	LGC	KBD563	155.10
	FD	KQC889	153.89
	FD	KQC889	154.43
Defiance	PD	KQA361	155.61
	PDC	KQE954	39.58
	LG	KDS679	155.715
	FD	KDA369	154.25
Delaware	PD	KQB504	39.58
	PD	KQB504	155.49
	PD	mobile	158.91
	PDC	KQF707	39.46
	PDC	KQF707	39.58
	PDC	KQF707	39.72
	LG	KQI211	155.76
	FD	KCQ241	33.86
Delta	PD	KQC678	39.58
	FD	KCW652	33.52
Deshler	PD	KJR306	39.58
	FD	KCL533	154.13
Dover	PD	mobile	39.34
	LG	KDN546	45.28
Doylestown	PD	KQI718	39.58
	FD	KGW812	154.43
	FD	KQH555	154.43
E Cleveland	PD	KQA214	155.13
	PD	mobile	158.97
	FD	KBW834	154.19
	FD	KDY295	154.25
Eastlake	PD	KQA883	39.58
	LG	KGP774	153.98
	FD	KD0269	46.14
E Liverpool	PD	KQB864	155.61
	FD	KBG515	154.07
E Palestine	PD	KQB584	39.58
	LG	KDT383	45.12
Eaton	PDC	KQA797	155.13
	PDC	mobile	154.89
	FD	KDA342	33.94
	FDC	KQH301	154.19
Edgerton	PD	KQG614	39.58
	FD	KLS498	154.25
Edon	PD	KAT808	39.58
	FD	KJE264	154.25
Elmore	PD	KQF910	39.58
	FD	KQG604	33.86
Elyria	PD	KQA377	155.73
	PDC	KQB217	39.58
	LG	KJR253-5	155.955
	FD	KDG902	154.13
Elyria Twp	LG	KDT359	155.10
	FD	KDF531	154.37
Englewood	PD	KQK596	155.13
	LG	KFB928	155.745
	FD	KAS415	154.13
Euclid	PD	KQB221	39.86
	PD	KQB221	39.90

	PD	KQB221	39.94
	LG	walkie	39.06
	FD	KDK784	46.50
	FD	KDK785	46.52
Fairborn	PD	KQA899	155.535
	PD	mobile	154.785
	LG	KQJ371	153.95
	LG	KQJ371	158.775
	FD	KLK541	154.205
Fairfield	PD	KEY960	155.37
	LG	KDY431	154.965
	LG	KDY431	155.085
	FD	KFA439	154.37
	FD	KFA439	154.415
	FD	KBH752	154.37
Fairport	PD	KQA863	39.58
	FD	KCX999	46.14
Fairview Pk	PD	KQA404	155.61
	PD	mobile	155.85
	LG	KDX493	158.94
	FD	KAP968	153.83
	FD	KAP968	154.25
Fayette	PD	KQC899	39.58
	FD	KDA373	33.82
Findlay	PD	KQC759	155.61
	PDC	KQB926	39.58
	LG	KCL235	155.76
	FD	KQH416	154.25
Fletcher	PD	KQF730	39.58
	FD	KDD980	154.19
Florence Twp	FD	KJE264	154.25
	FD	KLZ205	154.25
Ft Recovery	PD	mobile	155.13
	FD	mobile	154.31
Ft Shawnee	PD	KLH950	39.42
	PD	KLH950	39.58
	LG	KLY865	46.56
Fostoria	PD	KQC820	39.58
	FD	KDS692	46.06
Frankfort	FDC	KAX775	154.13
	FDC	KQK73	154.445
Franklin	PD	KQB351	155.13
	PD	KQG727	155.25
	LG	KDU558	154.10
Fremont	PD	KQB409	39.58
	LGC	KQW449	453.475
	FD	KDN427	46.06
Gahanna	PD	KQJ234	39.58
	FD	mobile	33.86
Galion	PD	KQB225	39.58
	LG	KJH211	39.18
	FD	KCR959	154.25
Gallipolis	PD	KQA360	39.58
	PDC	KAY954	39.58
Gambier	FD	KIZ484	33.86
	FDC	KQS555	33.86
Garfield Hts	PD	KQA854	39.42
	PD	mobile	39.58
	FD	KDJ549	46.48
Garrettsville	PD	mobile	39.58
	FD	KBR483	154.13
Gates Mills	PD	mobile	39.42
	FD	KDZ323	154.19
Geneva	PD	KDX522	155.13
	FD	KQH834	154.13
Geneva/Lake	PD	KFK584	155.13
	LG	KBG277	154.085
	FD	KQH843	154.13
Germantown	PD	KQE729	155.13
	PD	KQK357	155.82
	PD	mobile	154.89
Gettysburg	PD	KQC783	39.58
	FD	KQG848	154.19
Gibsonburg	PD	KQG783	39.58
	FD	KDQ318	46.06



WHITE'S EMERGENCY

Girard	PD	KQD920	155.13
	FD	KDN529	154.43
Glenwillow Vlg	PD	mobile	39.42
	FD		46.46
Grandview Hts	PD	KQG687	155.07
	PD	mobile	39.58
	PD	mobile	154.65
	FD	KDQ270	153.89
Granger Twp	PDC	KJV267	460.20
	FD	KC0369	46.38
Granville	PD	KCZ856	39.58
	FD	KBW856	33.86
Greenfield	PD	KQD320	39.58
	FD	KDN609	33.94
Greensburg	FD	KBK517	33.74
	FD	KBK517	33.86
	FD	KLW311	same
Green Springs	PD	KQD902	39.58
	FD	KDN457	46.06
Greenville	PD	KQA462	39.58
	FD	KB0791-2	154.19
Grove City	PD	KQF365	39.38
	PD	KQF365	39.42
	LG	KDC338	45.28
	FD	KAR328	33.86
Groveport	PD	KFX269	39.58
	LG	KLJ221	39.10
	FD	KAY990	33.86
	FD	KAY990	33.90
Hamden	FD	KQS505	46.14
	LGC	KBV811	46.58
Hamilton	PD	KQA527	156.21
	PD	mobile	155.97
	PDC	KQE927	154.80
	LG	KJP540	153.785
	LG	KQJ399	154.025
	CDC	KLU443	45.44
	LGC	KQU214	453.90
	LGC	WAU76	458.90
	FD	KQA879	154.13
	FDC	KBH629	154.37
Hartford	PD	KJS745	155.13
	FD	KBZ960	33.86
Heath	PD	KET240	39.58
	PD	KET240	154.74
	PD	mobile	158.79
	LG	KDT265	155.715
	LG	KSA76	158.865
	FD	KLR398	33.86
Hicksville	PD	KQJ300	39.58
	FD	KGJ725	154.25
Hilliards	PD	KQH286	39.54
	PD	KQH286	39.58
	FD	KJP275	33.86
	FD	KQJ862	33.86
Hillsboro	PD	KQE379	39.58
	PDC	KCQ234	39.58
	FD	KQD861	33.94
Hiram	PD	KLD730	39.58
	PD	KLD730	39.66
Holgate	PD	mobile	39.58
	FD	KCL529	154.13
Howland Twp	PD	KFZ911	155.13
	FD	KQH979	33.78
Hubbard	PD	KQF250	155.13
	PD	mobile	154.89
	LG	KBW784	154.04
Hudson	PD	KBX488	155.37
	PD	mobile	39.58
	LG	KBW785	155.715
Huntington Twp	FDC	KIZ394	154.131
	FDC	KHH62	154.445
Huron	PD	KQF511	39.46
	PD	KQF511	39.58
	FD	KDR779	46.06
Independence	PD	KE0311	39.22
	PD	KE0311	39.42
	LG	KJY899	153.80
	FD	KRB528	46.48
Ironton	PD	KQA330	155.565
	PDC	KCW381	39.58
	PDC	KET21	453.15
	PDC	KET22	458.15
	LG	KJI628	154.04
	LG	KAW377	155.94
	LGC	KQJ55	453.35
Jackson	PD	KQB910	39.58
	PD	KQG209	39.58
	LG	KDN611	155.10
Jefferson	PD	KDD957	39.58
	PDC	KQA528	155.13
	FD	KQH862	154.13
	FDC	KQI455	154.13
Jewett	PD	KQC858	39.58
	FD	KDE249	33.94
Johnstown	PD	KJK546	39.58
	FD	KCZ887	33.86
Junction City	PD	KEP589	39.58
	FD	KJS791	33.86
	FD	KJS791	33.98
Kent	PD	KQH262	155.13
	PD	mobile	154.89
Univ	PD	KCN665	155.31
	LG	KLM598	155.835
	FD	KBR484	154.13
Kenton	PD	KQA596	155.13
	PD	mobile	154.89
	PDC	KAU711	39.58
	FD	KQK704	153.89
Kettering	PD	KQE355	155.49
	PD	mobile	154.83
	PDC	KQJ558	155.67
	PDC	KQJ558	156.03
	LG	KDN606	158.835
	LGC	KBD563	155.10
	LGC	KBD563	158.94
	FD	KQC979	154.235
Kingston	FDC	KAX772	154.13
	FDC	KQK70	154.415
Lafayette Twp	PDC	KJV268	460.30
	FD	KQI813	46.38
Lakemore	PD	KUA723	37.04
	FD	KJN691	33.86
Lakeside	FD	KJU891	33.86
	FD	KQH232	33.86
Lakewood	PD	KQB421	155.61
"Ch 1"	PD	KQB421	460.025
"Ch 2"	PD	KQB421	460.075
	LG	KLY204	155.895
	FD	KQC991	154.25
Lancaster	PD	KQA804	39.58
	PD	KQA804	39.74
	PDC	KJU869	39.96
	LG	KAY867	155.94
	FD	KQK326	46.42
	FDC	KCU306	33.86
Lebanon	PD	KQB671	155.13
	PD	mobile	154.89
	PDC	KQD731	39.58
	LG	KDT368	155.88
	LGC	KCQ262	45.48
	LGC	KEY819	158.925
Leetonia	PD	KQC504	39.58
	FD	KPM486	154.07
LeRoy	LG	KRC574	155.775
	FD	KQG662	46.38
Lewisburg	PD	KBW803	155.13
	PD	mobile	154.89
	FD	KQG231	154.19
Lexington	PD	KJD224	39.58
	FD	KFT564	154.25

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Li'l Blitzer

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of each lead that will slip over the connecting pins on the flashtube. Form the stiff wire to hold the tube about ½-in. in front of the tie strip and connect to the lugs on each end.

Form the reflector from a scrap of bright aluminum, stainless steel or a polished tin can. The reflector is 1⅝ x 1-in. before rolling it around a broomstick to form a concave reflector. Notch each end on the center line to clear the connecting leads. Solder or cement a solder lug midway along the bottom edge so that it can be placed over the mounting screw for the tie strip, thus holding the reflector in position behind the flashtube.

Solar Cell. The plastic box in which the solar cell (SC1) is shipped is ideal to use as a final housing for it in this application. Cement the cell to the clear plastic half of the container so that the active surface faces out when the container is closed. Use Duco or a similar clear cement for this.

The cathode tab of silicon-controlled rectifier SCR1 is soldered directly to the back of SC1. Cut the tabs of SCR1 to about half original length and connect the red (+) lead of the solar cell to the gate of SCR1. The black (−) lead of the solar cell connects to the ungrounded primary terminal of T1 and the cathode of SCR1. The anode of SCR1 connects to the juncture of R3 and R4. A red and a black wire twisted together runs from the solar cell/SCR assembly to the main assembly to interconnect them. A Vee notch cut with a hot soldering iron permits feeding the leads out of the enclosure when its back is snapped in position.

The solar cell assembly must be capable of being oriented in all directions to ensure that the flash from the master flashtube reaches it directly and with a reasonable amount of intensity. Though not shown in the photos of the model we suggest you use an universal joint used to mount a desk pen on the base of the desk set. If you can't find one in a handicraft shop you certainly can rob one from an inexpensive desk set.

The four AA cell plastic battery holder fits inside the housing for the basic unit. A conventional 9 V transistor battery connector should be used between the battery holder and the electronics sub-assembly to provide quick disconnect and reconnect.

Testing Li'l Blitzer. Insert four fresh AA cells in the battery holder, plug it into the flash unit and turn *on* S1. If your ears are sharp you may be able to hear a very slight humming from the T1 end of the assembly. In about 10 seconds the *ready lamp* should light, indicating that C1 is now charged again and Li'l Blitzer is ready to fire the flashtube. Fire your master flash lamp a few feet away from Li'l Blitzer and observe the flash of Blitzer's flashtube, that is, of course, assuming you did a good job of building Li'l Blitzer. If it doesn't fire check connections of various components for mistakes in wiring. Be sure diodes D1 and D2 and capacitor C1 are properly polarized and the batteries are correctly inserted and deliver a full 6 VDC output.

Using Li'l Blitzer. The unit can be hand-held and pointed where the additional light is wanted. Just be sure that SC1 is facing the master flash which triggers Li'l Blitzer.

You should mount a standard tripod socket on the bottom of Li'l Blitzer to assist in placing it exactly where it's needed. You might like to equip your Li'l Blitzer with a clamp and universal joint like those furnished with portable lamps.

CAPACITY VS. WATT-SECONDS

C1 in μF	Watt-Seconds Output
80	6.0
100	7.5
150	10.3
200	15
250	18.8
300	22.5
350	26.3
* 400	30

* Maximum rating of FT1

We used an 80-μF capacitor at C1 which produces about 6 watt seconds of light. You may use up to 400 μF for this capacitor which will increase output accordingly. We've included a chart that gives approximate watt-seconds output for various sized capacitors, starting at 80 μF and increasing up to 400 μF (which produces 30-watt-seconds of light, the maximum output attainable from the MFF45S flashtube used).

Once you've checked out Li'l Blitzer and are assured it's working properly, close up its box and have some fun trying it out on a new batch of photos. ■

Positive Feedback

Continued from page 7

is reason enough to lock down Channel 11 as calling Channel No. 1.

This Editor call upon all CB clubs throughout the nation to promote Channel 11 as the principal calling channel for all stations. This would cause some small financial burden, because many organizations have placed highway signs at strategic locations urging the use of Channel 9. These must come down immediately and new ones must be substituted for them as soon as possible. It is incumbent upon the clubs to inform their members of this action and to encourage them to use Channel 11. For it's through the action of individual clubs in concert with *REACT* that CBers will be unified and consolidated into one efficient organization. Through practice by concerted effort, the FCC may eventually legalize Channel 11 as the general calling channel. Let's all get behind *REACT* and see if we can pull this one off! ■

Digitalock

Continued from page 68

And remember to run a lead to the *Reset* input from flip-flop 1 to pin R.

By now you must be anxious as all get-out, wondering if those black plastic 14-legged jobs do anything. Go ahead and apply power to 'em. With the jumper from point V on our functional diagram, reset flip-flop 7. Its Q output should be low. Temporarily jumper points Q and Q′ together; with flip-flops 1-6 set, flip-flop 7 should set automatically. Its Q output should zip up. If you've wired your circuit up to K1, and associated components, you'll see the relay pull in.

Now let's do an about face. The relay should drop out, and flip-flop 7 reset, when the lead from point V is touched to the *Reset* input of any of the input flip-flops 1-6. Yes, Virginia, it really works!

Complete your perfboard assembly by wiring the monostable. This stage consists of gates G4 and G5 and transistor Q2. Incidentally, you can vary the automatic reset delay time. Wire a 2200-ohm resistor in series with a 100,000-ohm potentiometer, and substitute this combination in place of resistor R5.

The components specified in our Parts List provide a maximum delay of 25 seconds. For longer time delays you can increase the capacity of C14. But don't increase the value of R5 beyond 100,000 ohms or erratic operation may result.

Assuming *DigitaLock* has a clean bill of health, proceed with the final phases of construction. Two wiring options are available. The first is the automatic reset provision, which resets the lock after a specified period of time. If you want this option, build the device as shown, and jumper points X and X′ together. Without the jumper, *DigitaLock* opens after the correct combination is entered. It's reset by depressing one of the four buttons not used in entering the combination.

If you don't need the auto-reset feature, you can save some scratch by eliminating resistors R3-6 and capacitors C11-15. Also forget about transistor Q2, and the wiring to gates G4 and G5 of IC5.

The second option reminds us of that hair coloring ad proclaiming only your hairdresser knows for sure. *DigitaLock* provides autoprogramming by jumpering terminal points Q and Q′. This means if you add *Program Enter Switch* S11, you'll greatly increase the odds against someone not knowing the combination from tripping the circuit. Switch S11 is guaranteed to give your neighborhood burglar-in-residence gray hair fast!

When you are connecting up your digit input switches S1 through S10, remember, the first digit in the combination should set flip-flop 1. The second digit, or second switch, sets flip-flop 2, and so on down the row. Any 6-digit number works here, but don't let any digit repeat itself.

Any digit switches that aren't used in the combination should be connected to terminal point R.

Suppose you don't want a combination with six digits. *DigitaLock's* flexibility is on your side—all you have to do is connect the first flip-flops in the line. Connect all unused *Set* inputs to +3.6 volts through 1500-ohm resistors.

DigitaLock's Shakedown Cruise. With metal joint agleam and hull freshly covered, you're ready to send your *DigitaLock* down the ways. First step's christening her, so go ahead, Cap'n, flip on the power! After entering your combination and depressing switch S11, the relay will pull in.

Depressing any button not used in the combination causes K1 to drop out immediately. For added security, an opaque plastic or metal shield can be placed over the key sender. Add this fillip if you want to hide the combination, as it's being entered into *DigitaLock*, from unauthorized eyes.

Even if you had Maxwell Smart's smarts you'd still want *DigitaLock* to continue its operation during a power failure. Referring back to our schematic, you'll see you need an extra relay, a few spare parts, and four alkaline batteries. Alky batteries can power our *DL's* innards for more than 48 hours; more than enough time to boggle burglars. ■

RCA Oscilloscope

Continued from page 72

It's an electrical fact of life that all components age. RCA clearly gave the matter some thought by grouping the critical calibration adjustments so they're accessible through holes in the cover. These adjustments include *DC Balance,* Horizontal and Vertical fixed *Sweep Frequency* adjustments, and *Astigmatism* control.

Showing You the Way. The instruction manual accompanying the WO-505A is jampacked with useful information. You'll find construction details, and use of an easy-to-assemble Vectorprobe. That'll come in mighty handy for those tricky color TV alignment procedures that are very common.

Photos clearly illustrate actual waveforms you should see in TV receivers. And pictorial charts further guide you through the TV receiver's thicket by illustrating representative waveforms for both horizontal adjustment and overall alignment check.

The scope's 1-megohm input impedance is obtained through the use of field effect transistors (FETs). Horizontal input's also high impedance; again an FET does the trick.

The term solid state means different qualities to different test gear manufacturers. In RCA's case, it translates as lightweight test gear. And WO-505A's true to form as the scope weighs in at 25 lb. Solid state also spells cool running in their dictionary. Once you adjust WO-505A (after a minute or two of warm-up time) it holds its adjustments hour after hour.

In fact, this scope's notably free of bounce and jitter. What you see is a trace essentially as stable as you'd find on a lab-quality job.

Power consumption for the unit is a rock-bottom 30 watts. What's more, a WO-505A could easily be powered off a DC to 117-VAC inverter, if field use dictates. Which all goes to show that if you can't heft a back-breaking chassis to your scope, now at least you can tote your scope to the chassis.

Extending WO-505A's Usefulness. A dual-action probe is supplied with the scope. It's RCA's WG-400A model. By flipping a built-in switch, you can measure DC or low-frequency (up to 500 kHz) AC waveforms. This eliminates the nuisance of having to stop in midstream to change probes.

You've also got two probe accessories to choose from. One's an RF probe, WG-302A, which extends your measurement capability from 500 kHz up to 250 MHz. You'll need this baby if you do much poking around the latest state-of-the-art ham gear.

The other probe makes sure you don't get a charge out of its operation. Type WG-354A gives the wherewithal you want for hunting around high-voltage circuits (TV horizontal sweep generators, for instance) with confidence. This capacitive voltage-divider probe lets you conquer those high volts—up to 5 kV's worth.

The suggested list price for RCA's WO-505A oscilloscope is $298.50. For more information write to RCA Electronic Components and Devices, Building H-23-2, Harrison NJ 07029. ■

Cassie

Continued from page 60

ary leads and the leads running to switch S2. Don't forget to run a ground lead from amp to supply.

After you've soldered and screwed the amp and power supply in place, fasten the power transformer to the baffle's bottom with a couple of wood screws. A 3-lug terminal strip should be placed under a convenient transformer mounting foot to make your chores easier.

Having consulted our astrologer-in-residence, we decided to buy a handful of ¼-in. round-head screws for those remaining mounting jobs. While you're hanging around the hardware store, buy four #6 fiber washers. They'll reside at each corner of the amp between the printed circuit board and the speaker cabinet. It wouldn't be especially smart if you crack your amp's PC backbone as the mounting screws are tightened. And as a final cutting remark, our astrologer told us to dress the amplifier output wires to a reasonable length for future connection to the speaker.

You've now reached the last step in decorating our tonal tortoni. Handle your Coaxial Caruso with TLC as you mount it in place. Finally, garnish the speaker lugs with amp output leads. Mamma mia, bel canto! ■

Spook Patrol

Continued from page 70

ly double the effectiveness of their city's hard-working police department by adding 35 sets of mobile eyes, ears and voices to the on-duty fleet of police cruisers

It's in the Record! The duty operator at the headquarters console, on October 31 tells it like it was: "Traffic was pretty wild when the gang went on station at 5:00 P.M.—everybody calling in, checking his equipment, confirming his location, etc. After we got settled in and the "business" calls started coming, I did most of the relaying by telephone to the police station. Dick Kramer, our city Traffic Engineer (KBL4848), who is a member of our club, also used his FM radio to relay to the police cars. He is on the police net with the city and, of course, our CB network. We worked on channel 17 and just about everybody who operates CB in this area knows about the Spook Patrol and stayed off the channel. When somebody who hadn't gotten the word came on, we told them what we were doing and they cooperated by using another channel or staying off the air.

"Some of the calls were pretty interesting Our mobiles reported two firearms incidents—one, a woman, apparently got carried away with the spirits of Hallowe'en and was banging away at nothing in particular with a pistol.

"Another guy, who hadn't caught the trick or treat spirit—especially the "trick" part, took off after a bunch of bigger kids with a rifle; they had thrown a bottle through the window of his house. One of our mobiles spotted this action and we got the police in quickly before any harm was done.

"Another group of about 50 kids was on the golf course shooting off some real heavy-gauge firecrackers and cherry bombs. Fireworks are illegal in the city limits, so we got a police car headed out there before somebody got hurt. It was a pretty active evening. As a CB'er, it was a lot of fun, but mostly it made us feel good because we know we did some good."

It is doubtful if many residents of Huntsville realize how much good is done by these men who volunteer their time, equipment, and private cars to Operation Spook Patrol. Although the city has doubled in population and nearly doubled in area since the Spook Patrol was inaugurated eight years ago, incidents requiring direct police action have steadily declined. Operation Spook Patrol is well publicized in newspapers and radio a week before Hallowe'en. Every kid knows about it. Those 35 unmarked cars with barely-visible little antennas unobtrusively patrolling the city's 107 square miles have a restraining effect.

On major roads entering Huntsville's city limits the Emergency Citizen's Band Monitors, Inc., have erected REACT signs and the club's emblem. Incorporated in the ECBM emblem is the Latin phrase, "Pro bono publico." Its translation, "For the good of the public", is most appropriate. ■

Great Men of Science

Continued from page 26

Michael soon showed that he could make money. As an "expert witness" in cases involving chemistry and electricity in one year he earned the equivalent of about $6,000 from attorneys.

Friends encouraged him to make a career in the law courts. With a little effort, they said, he could multiply his income 500%.

To the disgust of most of his friends, Faraday abandoned this activity. Faced with a choice, he decided in favor of the Royal Institution—at a salary of £100 (about $600) a year "plus house, coals, and candles."

His experiments with electricity began about 1821, continued for more than a decade.

Links between the strange new force and magnetism had already been discovered. It was known that a flow of current can be made to produce a magnetic field.

If electricity could create magnetism, it seemed to Faraday only logical that magnetism could generate electricity. Most scientists with whom he discussed this notion laughed at it. Well trained in the knowledge of their day they knew this experiment had been tried without success.

Faraday had the advantage of ignorance. He didn't know his concept was ridiculous.

So he wound wire around one segment of a 6-inch soft iron ring and attached the coil to a battery. Another coil halfway around the ring was linked with a galvanometer. Current flowing through the first coil, he reasoned, should produce a magnetic field that would induce a flow of electricity in the second coil.

On August 29, 1831, he recorded: "Success!"

Analyzing his results, Faraday correctly reasoned that the magnetic field itself didn't start electricity flowing. It was the process of creating or breaking the field that did the trick.

How could his phenomenon be made to yield a continuous current?

Faraday wound wire around a paper cylinder, inserted and then withdrew a bar magnet. Each time the magnet moved the galvanometer pointer was deflected. But pushing and pulling a magnet by hand was awkward business.

Eleven days later he mounted a 12-inch copper disc on an axle, then rotated this crude armature between poles of a big magnet. Continuous current flowed!

Self-taught Michael Faraday had for the first time in history converted mechanical energy into electricity. He had perfected essential elements of the dynamo, transformer, and electric motor.

Once his work was shown to be sound, Faraday turned to other interests. He applied for no patents, formed no corporations. Money didn't appeal to him. Neither did honors. He turned down invitations to knighthood and presidency of the Royal Society.

In keeping with his aim in life he died "plain Michael Faraday," poor in pounds but rich in satisfaction that single-handed he had ushered mankind into the electrical age.

—*Webb Garrison*

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