43 Different, Entertaining, Make-It-Yourself Projects

RADIO-TV Experimenter

ublished by
ience and Mechanics Magazine

75c
o. 559

RADIO-TV Experimenter

VOLUME SEVEN CONTENTS

Cover by Dick Locher

Curt Johnson, Handbook Editor
Herb Siegel, Assistant Editor, Handbooks
Bill Wadkins, Assistant Art Director, for Handbooks
Thomas A. Blanchard, Radio-TV Editor

SCIENCE AND MECHANICS PUBLISHING COMPANY

450 East Ohio Street **Chicago 11, Illinois**

The Radio-TV Experimenter contains a selection of the most popular electronics projects and radio and TV maintenance articles that have appeared in *Science and Mechanics Magazine*, plus a number of projects and helpful articles on the same subjects appearing for the first time.

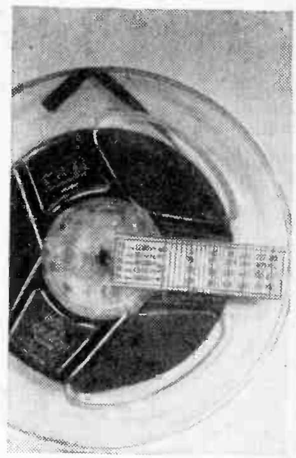
Science and Mechanics Handbook Annual No. 2, 1959—No. 559

"Visible File" for Records

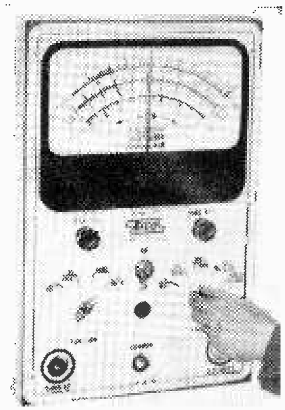
• This 3-panel wrought iron folding screen has 15 compartments, each holding up to seven 12-in. LP albums. Each assembled panel measures 6 ft. high, 12½ in. wide and 2½ in. thick, interlocks with adjoining panel and adjusts to desired screen position. Mitred compartment corners make records easily accessible from any angle of screen, front or back. Priced at $29.95 plus express charge on delivery, the screen is available from Leslie Creations, Dept. 178, Lafayette Hill, Penna.

Tape Recording Timer

• Timing any type of recording tape is easy with a new timer. Available as a ruler (50¢) with any 7-in. tape reel or as a 7-in. reel ($1.75), the timer also carries a conversion table that shows how much recording time is left on the reel. By using a timer on each reel you can see at a glance both how much recording time is left and how much you have recorded. Manufactured by General Transcription of America, Dept. HMG, 1830 S.W. Fourth St., Miami 35, Fla.

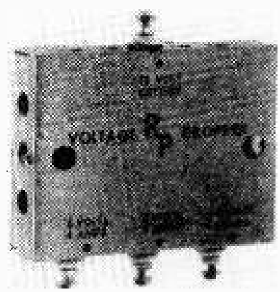


Demonstrator Teaches Voltmeter Use



• Teaching students the operation of a vacuum tube voltmeter is eased when the *VTVM Dynamic Demonstrator* is used. Simulating the Eico #221 VTVM in all its functions and ranges, the 13-in. meter scale makes classroom viewing possible. The demonstrator, measuring 14¾ by 23 by 3½-in., can be placed atop a desk or wall mounted. Priced at $10, the unit is available to teachers of physics and electronics from the Electronic Instrument Co., Inc., Dept. FME, 33-00 Northern Blvd., Long Island City 1, New York.

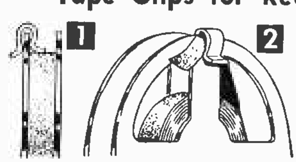
6 Volts from a 12-Volt Battery



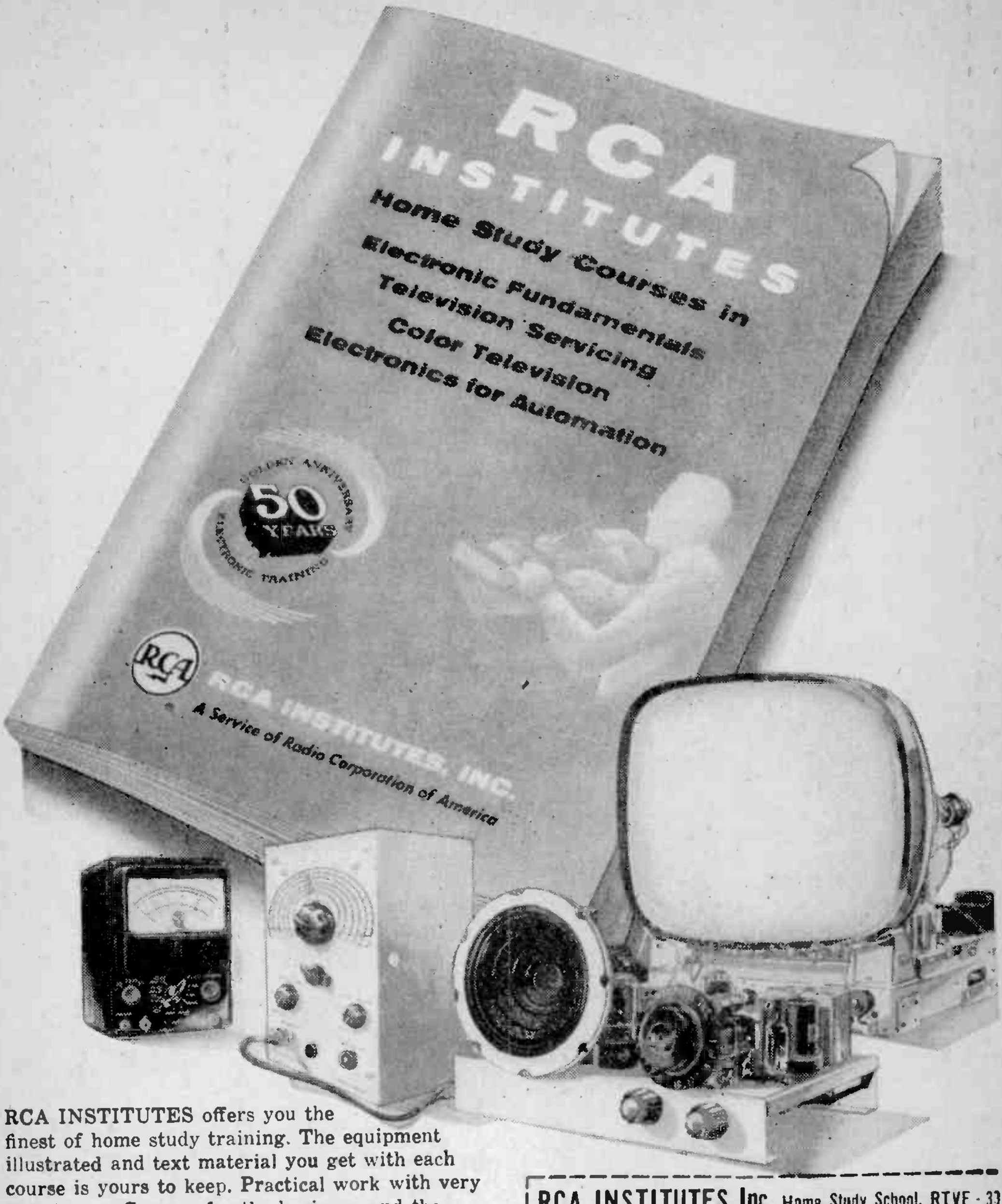
• Those shelf-bound 6-volt accessories can now go back in service with your 12-volt battery if you use the new *612* voltage dropper. Easy to install, the 4⅛ by 3⅛ by 1-in. unit supplies the necessary 6-volt power for radios, trailers and what have you. The unit has nickel-chrome resistance elements terminating at four ceramic terminals.

To use the 612 dropper, connect the hot battery terminal to the voltage dropper terminal marked "12 Volt Battery," then connect those 6-volt accessories to the terminals marked with the ratings of 4 amps, 6 amps and 8 amps. The 612 comes complete with the necessary hardware and instructions, costs $4.95 from the manufacturer, Rue Products, Dept. SM, 1628 Venice Blvd., Venice, Calif.

Tape Clips for Recording Fans

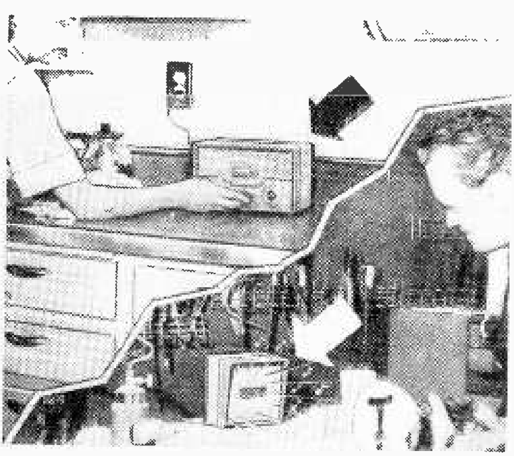


• Keeping recording tape on the reel is the job of Robins *Tape Clips*, TC-12. When reel is full, one edge of the clip holds the tape (1); when reel is partly empty, plastic clip holds end of tape to reel (2). Available at hi-fi dealers for 35¢ a dozen, the recording tape clips are made by Robins Ind. 36-27 Prince St., Flushing 54, N. Y.


RCA
INSTITUTES
Home Study Courses in
Electronic Fundamentals
Television Servicing
Color Television
Electronics for Automation
GOLDEN ANNIVERSARY
50 YEARS
ELECTRONIC TRAINING
RCA
RCA INSTITUTES, INC.
A Service of Radio Corporation of America

Combination Radio-Intercom

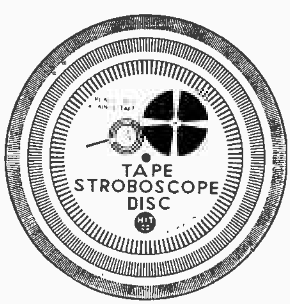
• With the *Aristocom*, you can enjoy either a radio program or a two-way conversation with someone in another area of the house. Costing $33.95, the Aristocom consists of a 5-tube ac-dc superhet receiver with self-contained speaker.



The wooden case measures 9¾ by 6 by 5⅝ in., is covered with a washable whipcord fabric in a choice of blue and grey or coral and grey combination. A switch, shown in the photo between the usual volume control and radio tuning knobs, provides either radio programs to the external speaker or intercommunication.

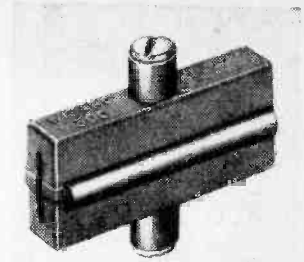
Finished in matching colors and fabric, the external speaker measures 6¼ by 6 by 4⅙ in. deep at the top, tapering to 3½ in. at the bottom. Its 50 feet of wire must be plugged into the socket in the rear of the radio. Additional speakers up to a total of four can be added to the set by purchasing a multiple speaker selector ($6.75) and additional external speakers ($6.75). Sets are available through radio stores or the manufacturer, Aristocom Corp., Dept. RB, 5720 W. Armitage Ave., Chicago 39, Illinois.

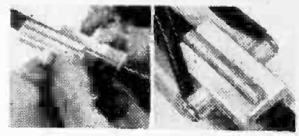
Strobe for Tape Recorders



• A new stroboscope clocks tape recorder speeds of 3¾, 7½, and 15-inches per second. As usual with strobes, the viewing must be done with 60 cycle alternating current, a fluorescent light providing easiest reading. Costing $4.95, the strobe will be sold by tape recorder dealers, according to the manufacturer, the H. & T. Company, Dept. DH, P.O. Box 6041, Montgomery 6, Alabama.

Multiple TV Sets on One Antenna





• The *Wizard 300* TV-FM set coupler is said to operate 20 sets from one antenna without amplification in normal signal areas. Permanent outlets may be installed throughout the building so sets may be moved from room to room or as many sets as outlets operated simultaneously. Neither strength nor quality of the signal is affected by other sets in operation.

The Wizard slides onto the antenna line and requires no splicing. The device picks up signals from the antenna line in much the same manner that the antenna picks up the signal from the transmission tower. By the use of electromagnetic coupling, insertion loss is greatly reduced, making it possible to operate the several sets from one antenna. The Wizard 300 is for 300 ohm flat line and lists for $1.95; the 450 is for any open line where the conductors are spaced 1 in. or more and lists for $3.30 a pair. They are made by the Charles Engineering, Inc., Dept. KJ, 6053 Melrose Ave., Los Angeles 38, Calif.

Pint-Sized Electric Organ

• This 18-lb. electric chord organ has a 3-octave range, with 37 keys and 12 chord control buttons. The left hand of the "musician" produces the full chords with a delicate 1-finger touch while the right hand seeks out the melody. Though built on the same principle as standard organs, this tiny mite can be mastered in a few minutes by following the instructions in the music book that comes with the organ.

Available in walnut or blond mahogany, the organ sells for $129.95. A Deluxe model, at $159.95, is equipped with microphonic pick-up and phono-jack for amplification through TV speakers and phonographs or through PA systems. Additional music books containing 25 songs each are available at $1.50 a book. Organs are manufactured by the Magnus Organ Corp., Dept. RDI, Livingston, New Jersey.

GOOD JOBS . . . MORE MONEY SECURITY . . . ALL CAN BE YOURS

YOU are needed in the great modern Television-Electronics industry. Trained technicians are in growing demand, at excellent pay, in sales and service, manufacturing, broadcasting, telecasting, communications, research, and many other important branches of the field. National Schools Master Shop-Method Training, with newly added lessons and equipment prepares you in your spare time right in your own home for these fascinating opportunities. OUR OUTSTANDING METHOD IS PROVED BY THE SUCCESS OF GRADUATES ALL OVER THE WORLD!

YOUR TRAINING IS ALL INCLUSIVE

We prepare you for a long list of job opportunities. Thousands of TV and Radio receivers are being sold every day—more than ever before. And, now, Color TV is here. Applications of Electronics in industry—AUTOMATION—are growing in tremendous strides. The whole field is alive—opening up new, important jobs rapidly. National Schools complete training program qualifies you in all phases of the industry.

YOU EARN WHILE YOU LEARN

Many students pay for their entire training—and more—with spare time earning. We'll show you how you can, too! Early in your course you receive material that shows you how to earn extra money servicing TV and Radio receivers, appliances, etc., for friends and acquaintances.

YOU GET EVERYTHING YOU NEED

Clear, profusely illustrated lessons, shop-tested manuals, modern circuit diagrams, practical job projects—all the valuable equipment shown above—many other materials and services—consultation privilege with our qualified staff, and Graduate Employment Service. EVERYTHING YOU NEED for outstanding success in Electronics.

INDUSTRY NEEDS YOU. NATIONAL SCHOOLS WILL TRAIN YOU. SEND FOR FACTS TODAY NO OBLIGATION.

YOU LEARN BY SHOP METHOD . . . you do servicing, circuit analysis, and do over 100 down-to-earth experiments. You build a Superhet Receiver and a modern TV Receiver, from the ground up, including a new, big screen picture tube. You also receive a professional, factory-made MULTI-TESTER. All of this standard equipment is yours to keep . . . at just one low tuition.

RESIDENT TRAINING AT LOS ANGELES

If you wish to take your training in our Resident School at Los Angeles, the world's TV capital, start NOW in our big, modern Shops, Labs and Radio-TV Studios. Here you work with latest Electronic equipment - - professionally installed - - finest, most complete facilities offered by any school. Expert, friendly instructors. Personal attention. Graduate Employment Service. Help in finding home near school - - and part time job while you learn. Check box in coupon for full information.

Approved for GI Training

NATIONAL SCHOOLS
LOS ANGELES 37, CALIF.

FREE! VALUABLE BOOK & SAMPLE LESSON —Just Send Coupon!

NATIONAL SCHOOLS
TECHNICAL TRADE TRAINING SINCE 1905
LOS ANGELES 37, CALIFORNIA

GET FAST SERVICE—MAIL NOW TO

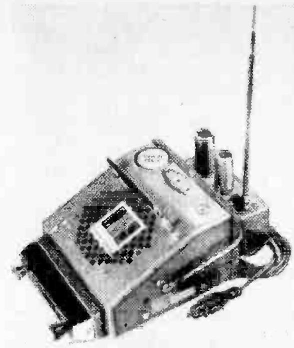
NATIONAL SCHOOLS, DEPT. RKK-39
4000 S. FIGUEROA ST.
LOS ANGELES 37, CALIF.

Rush free TV-Radio "Opportunity" Book and sample lesson. No salesman will call.

NAME ____________ AGE ______
ADDRESS ____________
CITY ________ ZONE ____ STATE ______

☐ Check if interested ONLY in Resident School training at Los Angeles.
VETERANS: Give date of Discharge ______

Timing Devices for Races



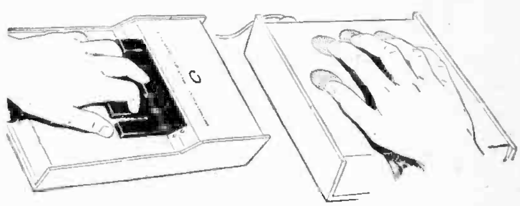
Rally-Verter shown attached to rear of car radio.

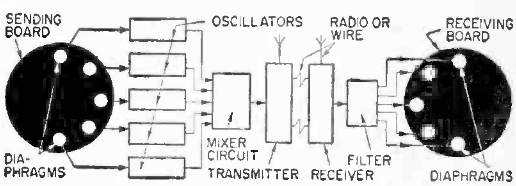
• Two new devices are being marketed for use in accurate timing from cars. The *Rally-Verter* ($29.50) a compact short-wave converter, equips any car radio to receive 5000 kc time signals from radio station WWV (National Bureau of Standards) and 7335 kc signals from CHU (Dominion Observatory near Ottawa, Canada).

The Checkpointer ($69.50) is a portable receiver with attached converter for use at checkpoints or by contestants. It comes equipped with carrying handle, detachable telescoping antenna and cord with plug fitting any cigarette lighter receptacle. On both models one switch changes reception from broadcast to time signals. Devices are made by CGS Laboratories, Inc., Dept. JGB, Ridgefield, Conn.

Teletac for Handicapped

• The deaf, blind-deaf and deaf-dumb will be able to "talk" and "hear" easily and quickly via an electronic touch system *(Teletac)* developed by Prof. Joseph Hirsch (see illustrations above) of Los Angeles State College. The sender spells out his words on the five keys of the transmit-





ter, using different combinations of keys and frequencies and varying the intensity and duration of vibrations picked up by listener on his finger-tips which are resting on the diaphragms of the receiver. The device can be operated by remote radio control over any distance. Teletac is made on order by The Cardinal Instrumentation Corp., Dept. SM, 4201 Redwood Ave., Venice, Calif., for prices ranging from $100 to $300.

Camouflaged Mike for Candid Recording

• With the appearance and wearability of a wristwatch, this crystal microphone is ideal for investigative work by detection agencies and for "candid" recording. Case is chrome plated with gold-finish numerals and hands. The strap is made of tan leather.

The thin flexible cable is 6½ ft. long, may be run up the coat sleeve to a concealed poche-type portable tape recorder or any high impedance tape recorder or amplifier mike pickup. Mike sensitivity is quite high and tiny perforations around the back of the watch case permit omni-directional sound pickup. Known as the *PA-47 Wrist-Watch* crystal microphone, the unit is sold for $5.95 by Lafayette Radio, Dept. RWT, 165-08 Liberty Ave., Jamaica 33, N. Y.

Shut-Off for Hi-Fi's

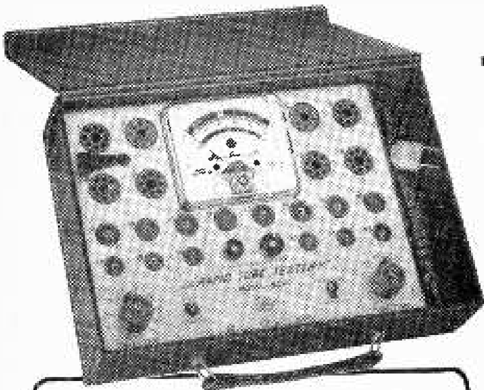
• Featuring automatic shut-off for the phono after the last record is played, the *Music Minder* switch makes it possible for you to lapse into the arms of Morpheus with nary a care. Should you not need the automatic feature, set the switch to the "manual" position. Housed in a drawn steel case with brown hammertone finish, the Music Minder lists at $11.95, according to the manufacturer, the CBC Electronics Co., Inc., Dept. GA, 2601 N. Howard St., Philadelphia.

Monophonic or Monaural?

• Monophonic is the word to use when discussing high-fidelity sound, not monaural, according to a spokesman of the Institute of High Fidelity Manufacturers. While conventional high-fidelity recording does engrave the sound on both walls of the record groove, the result when reproduced is heard by both ears and is thus single-sound (monophonic), not "one-eared" (monaural). Also, the temptation to equate stereo with binaural should be suppressed, according to this spokesman. The correct term is stereophonic ("solid sound").

SUPERIOR'S NEW MODEL 82A

A truly do-it-yourself type TUBE TESTER



Model 82A — TUBE TESTER . . . Total Price $36.50 — Terms: $6.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

TEST ANY TUBE IN 10 SECONDS FLAT!

1. Turn the filament selector switch to position specified.
2. Insert tube into a numbered socket as designated on our chart (over 600 types included).
3. Press down the quality button—

THAT'S ALL!

Read emission quality direct on "BAD-GOOD" meter scale.

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. Don't let the low price mislead you! We claim Model 82A will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine before you buy policy.

To test any tube, you simply insert it into a numbered socket as designated, turn the filament switch and press down the quality switch—THAT'S ALL! Read quality on meter. Inter-element leakage if any indicates automatically.

Specifications

- Tests over 600 tube types.
- Tests 0Z4 and other gas-filled tubes.
- Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings.
- Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence.
- Dual Scale meter permits testing of low current tubes.
- 7 and 9 pin straighteners mounted on panel.
- All sections of multi-element tubes tested simultaneously.
- Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

Model 82A comes housed in handsome, portable Saddle-Stitched Texon case. Only $36.50

(Picture Tube Adapter available for $5.50 additional)

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

Try it for 10 days before you buy. If completely satisfied then send $6.50 and pay balance at rate of $6.00 per month for 5 months.—No Interest or Finance Charges Added. If not completely satisfied return to us, no explanation necessary.

MOSS ELECTRONIC, INC.
Dept. D-567 3849 Tenth Ave., New York 34, N. Y.

☐ Please rush one Model 82A. If satisfactory I agree to pay $6.50 within 10 days and balance at rate of $6.00 per month. If not satisfactory, I may return for cancellation of account.

☐ Include Picture Tube Adapter at $5.50.

Name..

Address..

City........................ Zone........ State..........

All prices net. F.O.B., N.Y.C.

New Symtronic Method

NOW! EARN MONEY IN TV SERVICING WITHIN ONE SHORT WEEK!

Make $5 to $10 Per Call IMMEDIATELY!

Here is the announcement our Engineering Staff has waited 5 years to make! Here is the final "break-through" in the television industry's giant efforts to perfect a simplified TV servicing system that eliminates the need for expensive training and long study! If you've thought about learning TV Service and Repair . . . if you've awaited any opportunity to have a prosperous, secure business of your own, then this is possibly the most important bulletin you'll ever read!

WHAT *IS* THE AMAZING NEW SYMTRONIC TRAINING METHOD?

Symtronic is a dynamic new concept based on the known fact that **only a certain number of things can go wrong with any given set.** For the first time these troubles, and their causes, have been isolated into three main groups. Through a comprehensive, but easily understood crossindexing system it's now possible to pin-point the trouble in one of the 3 groups in a matter of seconds! What previously required long schooling is now available to you **immediately** through the amazing Symtronic System. Our Free Sample Lesson shows how the Symtronic Method will work on your own set, or a friend's. Write for it today!

SYMTRONIC CUTS STUDY TIME . . . SAVES TREMENDOUS EXPENSE!

You want to get started **servicing** TV sets, not **building** them! So, why spend long months studying under old fashioned, outdated methods . . . learning things you'll never use? Why buy lots of equipment to practice with when you don't need it? With the Symtronic System the COMPLICATED TECHNICAL THEORY IS ALREADY TAKEN CARE OF BY OUR OWN SCIENTISTS! There is nothing more you need in this line. What we give you is practical, down-to-earth know-how based on our many years of solid, scientific experience! Our revolutionary Symtronic methods let you compete **immediately** with servicemen who have had years of experience!

FIELD-TESTING PROVES EFFICIENCY OF SYMTRONIC METHOD!

Our exclusive new training technique does not deal with "gimmicks" or "gadgetry." It was perfected over a five-year period by two of the most respected electronic scientists in the TV field, in cooperation with every major TV manufacturer in the United States! Even TV Servicemen trained by the old costly, time-consuming methods, were amazed by our Symtronic training technique. Typical of the general reaction was the comment of Mr. D. B. K., owner of a TV Repair Shop in Reseda, Calif. As he put it, ". . . I only wish your training was available when I went into TV Servicing. Would have started making money a lot sooner . . . Would have saved me hundreds of dollars . . . believe your Symtronic method will revolutionize TV Repair schooling." Furthermore, this dynamic new method was first field-tested among 3000 men and women. Results proved conclusively that anyone of average intelligence could learn to diagnose and service virtually any given malfunctioning set under our system almost immediately! Fantastic? Perhaps, but remember, nearly all significant improvements are based upon simplification. This theory finds its broadest expression in our Symtronic training methods!

SYMTRONIC PUTS YOU IN YOUR OWN BUSINESS NOW!

Imagine—with our amazing training method you know everything needed to handle any make of TV set, within one short week! And, without buying any expensive tools or equipment. You learn at home—spare time. A few evenings of fascinating reading is all it takes. This is fact . . . not fiction. In just 7 days or less you will have sufficient knowledge and ability, and confidence in yourself, to make from $5 to $10 per service call—earn $150 a week, working out of your home! Here, unquestionably, is your chance of a lifetime to get into the booming TV business . . . to enjoy the freedom and security that comes with a successful business of your own!

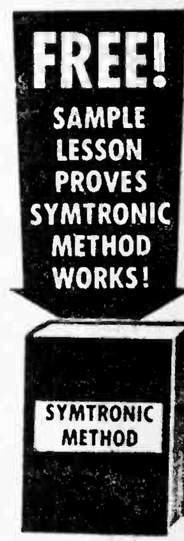
COMPLETE SYMTRONIC BUSINESS PLAN PROVIDES "BLUEPRINT TO SUCCESS"

To make our training program the most practical available, we also offer a complete Business Plan developed by leading advertising and business consultants. Step-by-step, you learn how to get business, how to operate from your home, how to charge, how to keep records, etc.—a complete "Blueprint to Success" that explains fully how to start, conduct, and expand your own TV Service Business. In short, we not only offer the most streamlined, effective TV training available, but a tested and proved Business Plan that eliminates all guesswork. Here, surely, is a "Business Package" that may easily bring you all the good things you desire . . . a practical education with a lifetime of value!

CASH IN ON THIS BIG PROFIT, BIG FUTURE INDUSTRY!

TV servicing is a multi-million dollar industry and it's growing like wildfire! To keep pace, thousands of qualified Servicemen are urgently needed each year. The pay is big and there's no limit to your future success. **Television is here to stay!** In this field, too, you get **paid for what you accomplish, not how long you work. $5 to $10 per call is the usual** service charge . . . even though the job may take only a few minutes! Add to this the almost 100% profit on tubes and parts and you can easily see how Symtronic can put you into the big money practically overnight!

APPLY THE SYMTRONIC METHOD TO YOUR OWN SET, OR THAT OF A FRIEND'S — prove to yourself that our amazing Symtronic method is all we say. What better proof exists! Send us your name and address today, and we'll rush you a free sample lesson along with complete information on our Symtronic training technique. Read this lesson carefully . . . apply it to your own set or a friend's, and you'll convince yourself that the Symtronic method can bring you a successful TV Servicing Business within one short week! Clip and mail coupon today—**supply of free lessons is limited!**



RUSH COUPON TODAY

and you will ALSO receive free details on how you can obtain a complete "Business in a Package" (that will virtually put you in the TV Repair business with a total investment of five dollars). Wholesale Catalog of TV parts and equipment; Franchise opportunities, etc., etc., all sent free—

RUSH COUPON TODAY!

MAIL TODAY FOR FREE LESSON

TV Servicing Systems
Dept. C-872, 1038 So. LaBrea Ave.
Los Angeles 19, California

Please rush proof that your Symtronic TV Training Method is all you say. Send Free Lesson and complete details, without obligation. (No salesman will call.)

Name ....

Address ....

City .... Zone... State ....

AMAZING ELECTRONIC DISCOVERY!

PORTABLE, TRANSISTORIZED TAPE RECORDER . . . COSTS LESS THAN THE DOWN PAYMENT ON MANY STANDARD RECORDERS

Here's the new, low-priced, battery-operated tape recorder you've been waiting for! Powered by ordinary flashlight batteries and transistors—a finely engineered instrument—not a toy! It is multi-staged utilizing Transistors for superb tone clarity. Truly portable—weighs less than 2 lbs.

CAN SAVE YOU MANY TIMES ITS COST THE VERY FIRST TIME YOU USE IT.

$37⁵⁰

Complete with Microphone-Listening Device, Private Listener, Sample Reel of Tape, Deluxe Fitted Attache Type. Simulated Leather Carrying Case, Set of Batteries. FREE! Extra 225 ft. Reel of Recording Tape!

You'll find a thousand and one uses for this amazing tape recorder. Use it as a dictating machine—to cut your office and home work in half. Use it to record sales meetings, interviews, group discussions, on the spot reactions wherever you go! Use it for wonderful new fun with your children and family—to store up memories that will never grow dim! It makes the perfect gift to give or get!

WHAT LEADING MAGAZINES SAY

Cosmopolitan — *"The Last Word! . . . Capture baby's first words or a memorable family occasion. Dictate letters, reports, speeches. You can even re-record phono discs and radio and TV shows!"*

Popular Mechanics — *"Provides low cost, variable speed recording and playback."*

V.F.W. Magazine — *"Imagine a precision-made, battery-operated tape recorder that weighs only two pounds, yet sells for this amazing low price."*

Send Check or Money Order. If COD—send $3.00 deposit

FILNOR PRODUCTS INC., Dept. M-71 101 W. 31 St., N.Y. 1, N.Y.

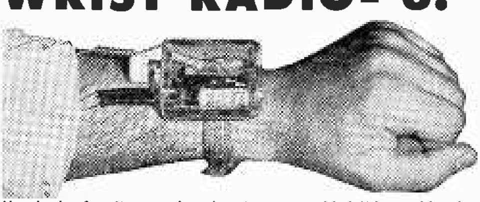
AMAZING TRANSISTOR

RING RADIO

$3.49

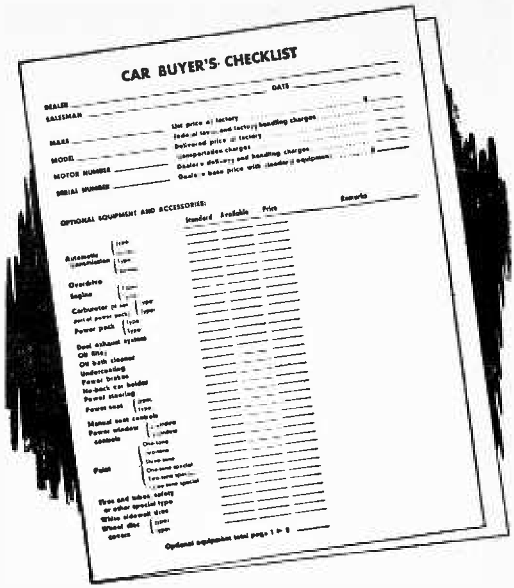
Here is the smallest and most novel transistor radio ever! Easily assembled circuit employs PNP transistor amplifier and micro-diode detector. Ferrite inductor tunes standard broadcast band. Power supplied by novel, self-contained dry charge galvanic cell for which materials are included. This unique kit available only from us. Ideal for school projects, experimenters, and all interested in novel devices. EVERYTHING needed to assemble the Ring Radio (plastic case, diode, transistor, etc., etc.) sent postpaid for ONLY $3.49. Use your own earphone or order below our specially priced precision midget phone.

WRIST RADIO-$3.95



Hundreds of radio experimenters have assembled this combination Wrist, Pendant & Pocket Clip TRANSISTOR RADIO with great success. Complete set of parts includes PNP Transistor, micro-glass diode, plastic case, bakelite chassis plate, ferrite inductor tuner, knob, ceramic capacitor, pocket clip, hardware, hookup wire, etc.—ALL for $3.95 postpaid. Set works on a 1½ v., 12¢ battery sold by hearing aid dealers in your town. Uses any standard magnetic earphone or we'll furnish precision 8000 ohm hearing aid phone (retail price: $8; not a cheap import) for only $3.49. Illustrated instructions. All orders shipped 1st Class Mail U.S. & Canada. Sorry, no COD's.

ELECTRO-MITE® —SPRINGDALE 636-Y, CONN.



PAY LESS The Next Time You Buy a New or Used Car

Protect Yourself with a CAR BUYER'S CHECKLIST

When you're shopping for a car, you can't afford **not** to know **everything** about the deal offered you by one dealer as compared to that offered by others.

Nine times out of 10, uncertainty, a poor memory—or a dealer's intentional vagueness of language—is going to cost you money.

Get it in writing, make certain you know exactly what kind of deal each dealer you've seen is prepared to make. Check off every item, term, condition and cost.

Then, in the quiet and privacy of your home, compare deals, do your own pencil work—and **save money**.

Use the Car Buyer's Checklist, a 4-page, simple but comprehensive form designed by the editors of SCIENCE AND MECHANICS to help you make the best and most economical new or used car buy. Every item covered, every cost itemized, every condition cost-assessed.

Three Checklists for 50¢ or a packet of eight for $1.00

SCIENCE AND MECHANICS

450 East Ohio St., Dept. 5595, Chicago 11, Ill.

SCIENCE and MECHANICS' DO-IT-YOURSELF LIBRARY

- Boat Builder's Handbook
- Build It Yourself
- Car Owner's Handbook
- Craftsman's Handbook
- Craftwork
- Do-It-Yourself Handbook
- Home Electrical Handbook
- Home Owner's Handbook
- Home Workshop Handbook
- 1001 How-to Ideas
- How to Start a Successful Small Business
- Income Opportunities
- Model Craft Handbook
- Photo Craftsman
- Repairing Home Appliances
- Science Experimenter
- Sportsman's Handbook
- Toys and Games You Can Make

Boy's Bike Radio

By HOMER L. DAVIDSON

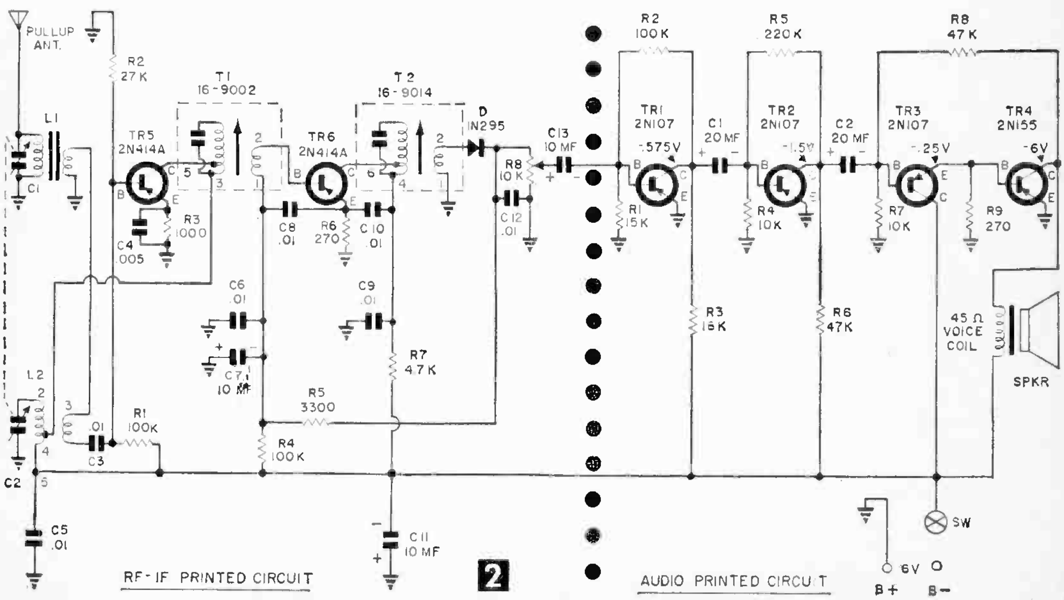
Have radio, will travel with this compact superhet receiver. Stripes were painted on plastic case by masking with tape and using paint from spray cans obtainable at hardware and 5- and 10-cent stores.

HERE is a small radio that will make the bike-riding contingent in your family very happy. Bracket-mounted to the bicycle, the homemade plastic case has the set's speaker mounted upward so that music or voice travels up to the rider for clear, loudspeaker-volume listening pleasure.

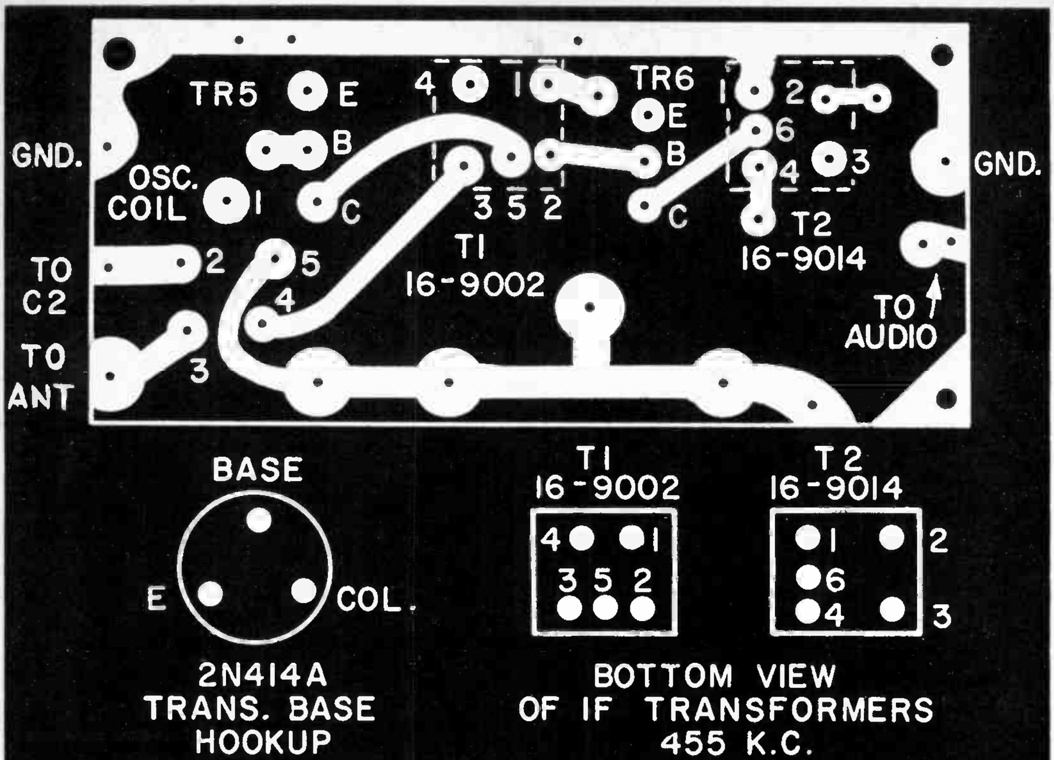
The small size of the set is due to the use of printed circuit boards, two of them, an RF-IF section and an audio section (See Figs. 2, 3, and 4).

A small ferrite antenna coil picks up the RF broadcast signal; this signal is tuned by C1. A small pull-up antenna, added to the circuit for greater signal strength, provides enough signal strength so that the receiver does not have to be turned in the direction of the signal for adequate volume. One section of a discarded rabbit-ear TV antenna can be used for the pull-up antenna.

The incoming RF signal is fed through one side of the oscillator coil to the base connection of TR5. The difference in frequency between the incoming signal and the oscillator frequency results in the intermediate frequency of 455 kilocycles.

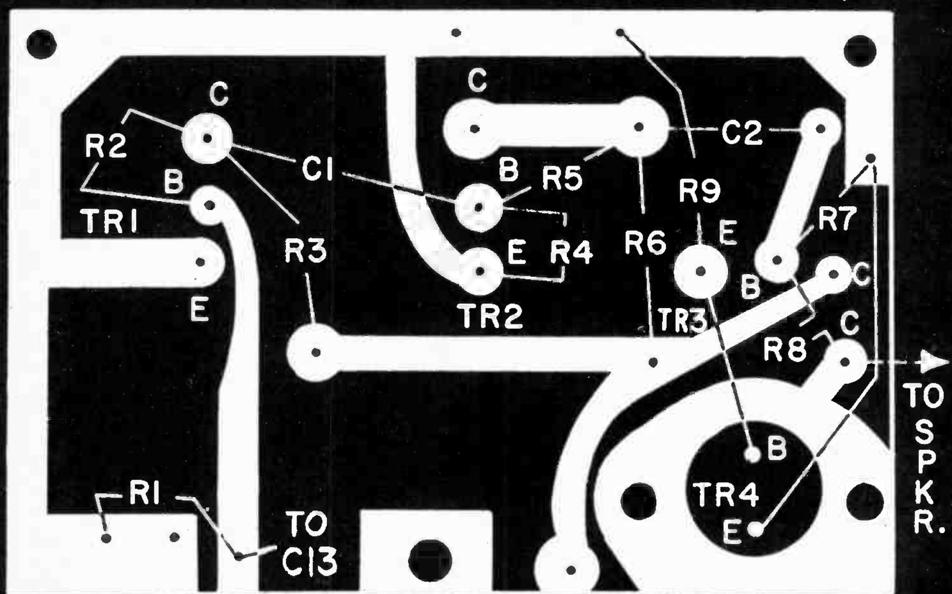


2



3 RF-IF PRINTED CIRCUIT (ACTUAL SIZE)

(WHITED AREAS COPPER PRINTED CIRCUIT)



COMPONENTS MOUNTED ON OPPOSITE SIDE SHOWN

4 AUDIO PRINTED CIRCUIT. (ACTUAL SIZE)

The two IF frequency stages, T1 and T2, amplify the signal, after which crystal diode D1 rectifies it to audio frequency. Volume control R8 controls the volume of the AF signal before it is delivered to the audio circuit. The RF-IF printed circuit is shown actual size in Fig. 3; the audio circuit in Fig. 4. These circuits can be traced with carbon paper directly upon the copper side of the PC board. First, wash the copper side of the board with soap and water so that no grease or residue will prevent the paint or tape resist from adhering to its surface.

After the circuit has been traced on the copper side, fill in the shaded areas with resist and let dry about three hours (or less if board is placed under a lamp or in an oven). Pour enough etchant solution into a small tray so that board will be covered, then place the board in the tray and agitate the tray to hasten etching. If the solution appears to darken, the paint resist is mixing with it and no harm is done. Keep agitating the tray for 20 to 30 minutes and then wash the etched board in running water. Pour the remaining etchant solution back into the bottle; it can be used again.

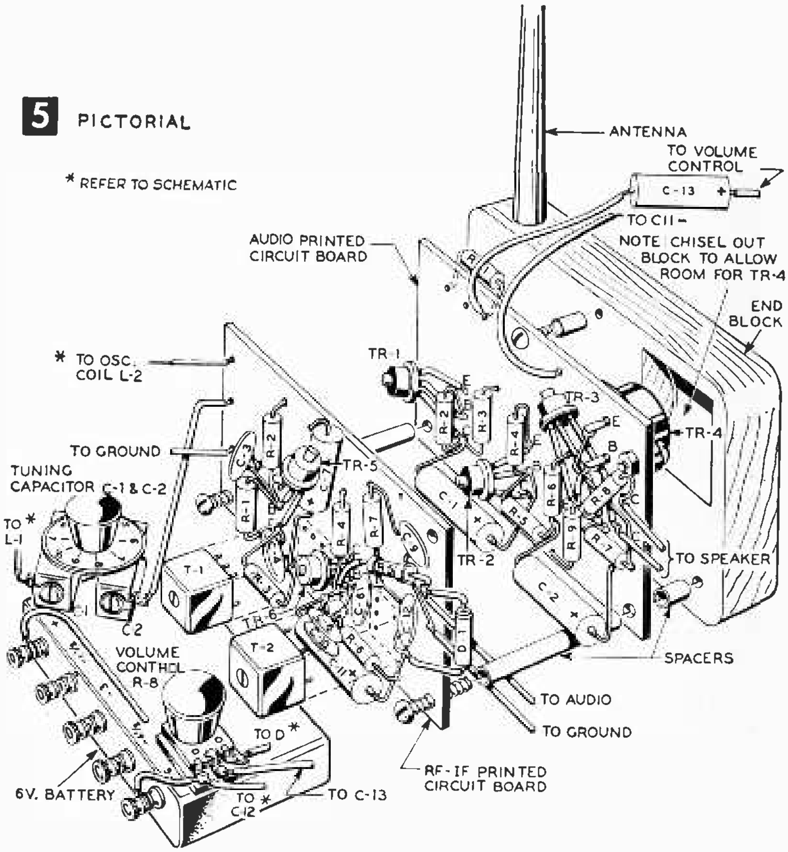
Now clean the etched plate with carbon tet or contact cleaner, wipe off all remaining paint resist and wash board again in soap and water. Wipe both surfaces dry and check to see that no connections are made between close copper terminals.

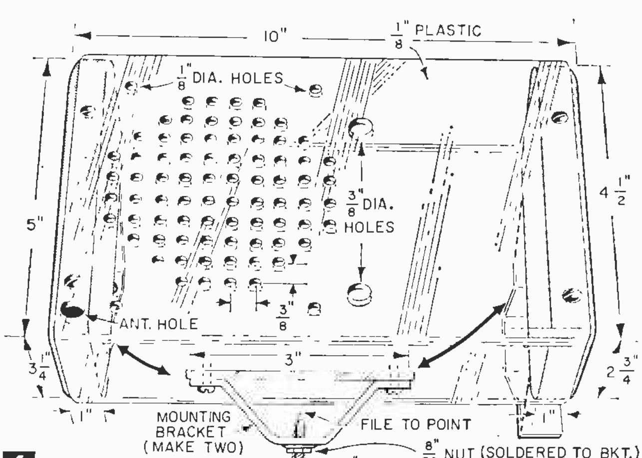
Next, take soldering paste and smear it lightly over the copper circuit. Then, with a soldering iron and rosin-core solder, tin the copper sides. When this is done, drill the small holes. A bit is included in technique-kit which comes with the boards (see Materials List) for drilling the small component mounting holes, a ¼-in. bit is used to drill the larger holes.

Now mount circuit components (see Figs. 2, 3, 4 and 5). Make transistor soldering connections next to last. I used small dia. spaghetti insulation over the transistor tinned leads and soldered them directly in place. With wiring completed, secure transistors with rubber bands.

Mount the variable resistor and switch last. The small prongs from the volume control can be soldered directly to the printed circuit. You can test the unit by simply hooking a phonograph directly into the input of the small amplifier.

5 PICTORIAL





6 CASE CONSTRUCTION

MATERIALS LIST—BIKE RADIO

RF & IF SECTION

Desig.	Description
L1	antenna coil (Lafayette MS264)
L2	oscillator coil (Lafayette MS265)
C1 & C2	RF & OSC Capacitor (Lafayette MS261)
C3, C5, C6, C8, C9, C10, C12	.01 mfd miniature capacitors
C4	.005 miniature capacitor
C7, C11, C13	10 mfd 25 v electrolytic capacitor
R1 & R4	100K, ⅛-watt fixed resistor
R2	27K, ⅛-watt fixed resistor
R3	1000 ohms, ⅛-watt fixed resistor
R5	3300 ohms, ⅛-watt fixed resistor
R6	270 ohms, ⅛-watt fixed resistor
R7	4.7K, ⅛-watt fixed resistor
R8	10,000 ohms, ⅛-watt fixed resistor
TR5, TR6	2N414A Raytheon transistors
T1	16-9002 455 IF transformer (Meisner)
T2	16-9014 455 IF transformer (Meisner)
D-1	IN295 fixed diode (Raytheon)

AUDIO SECTION

Desig.	Description
R1	15.000 ohms, ¼-watt carbon resistor
R2	100.000 ohms, ¼-watt carbon resistor
R3	18.000 ohms, ¼-watt carbon resistor
R4	10.000 ohms, ¼-watt carbon resistor
R5	220.000 ohms, ¼-watt carbon resistor
R6	47.000 ohms, ¼-watt carbon resistor
R7	10.000 ohms, ¼-watt carbon resistor
R8	47,000 ohms, ¼-watt carbon resistor
R9	270 ohms, ¼-watt carbon resistor
C1 & C2	20 mfd 50 v electrolytic capacitors
TR1, TR2, TR3	2N107 GE transistors
TR4	power CBS transistor 2N255
SPK	4" PM, 45-ohm voice coil operadio type
PC Board	3 x 4⅝" (see text)
6 v battery	Eveready No. 409 or Eveready No. 773

PRINTED CIRCUITS

Kit Number 5003P

(This kit has enough material to make up several experiments or projects), OR

1	PE-5 liquid etchant (pt.)
1	PRL liquid resist (oz.)
1	PCDXXXP copper laminated board
1	PCBXXXP copper laminated board

All materials available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.

Physical construction. The cabinet of the bike radio is constructed from ⅛-in. clear plastic. It is designed to fit between the two bike braces that go from the seat to the handle-bar assembly. Greater protection for it is found here and, also, the pull-out antenna will not be readily bumped. The cabinet measures 10 in. long and 5 in. wide at one end, tapering to 4½ in. at the other. The top of the cabinet is 3¼ in. deep at one end, tapering down to 2¾ in. at the other (see Fig. 6) to fit between the two braces.

First, make the two end blocks of 1-in. pine, rounding off all corners. Then cut a scrap width to a length so that when it is placed between the two ends and nailed, the overall length of this assembly is exactly 9½ in. This serves as a form for the plastic case.

Take a piece of pliable cardboard and wind around this form. Cut the cardboard to fit at both ends and to overlap at the center line about ½ in. Unwind it and use as a pattern to cut the plastic form by laying the plastic sheet under it and drawing around it with a pencil. Cut the plastic with a jigsaw, exercising extreme care so that it will not crack and split.

Now mold the plastic around the wooden blocks, form assembly by placing the sheet in an oven set to 400°F for a few minutes until it is pliable enough to go around these two blocks. Use gloves when bending it around. Before the plastic cools enough to take shape it has a tendency to roll off the form. To prevent this, tie a shoe lace at each end, and cinch them up as tightly as possible.

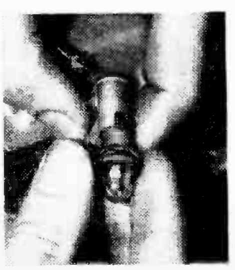
If the plastic should set before the bending is completed, simply put it back in the oven until it is workable again. Glue the case together at the bottom with chemical solution purchased with the polystyrene plastic material.

Now drill holes in the plastic for the speaker, tuning capacitor, volume control and to hold the wooden end blocks (see Fig. 6) and bolt the printed circuit boards together with long bolts and metal spacers made from discarded aluminum TV antenna rods. The audio printed board is screwed to the top wooden block end, the antenna is mounted and the lead-in soldered to it. Solder all extension wires (volume control, tuning capacitor and battery connections), insert battery and your bike radio receiver is ready to be fired up.

Use a signal generator to peak the RF and IF stages, or have a radio-TV serviceman do this. (See also "How to Align Superhet Circuits," page 66 of this handbook.) The IF stages can be peaked to the correct frequency by hooking the signal generator to pin 2 of the oscillator transformer. Short out C2 with clips and set the frequency to 455 *Kc*; the IF stages are now peaked to the correct frequency. The signal is next applied to the antenna circuit which is tuned to around 1400 kilocycles, the variable capacitor to be adjusted until the frequency appears. Adjust the oscillator core for maximum signal volume. The variable capacitor should be rocked back and forth here until the greatest signal volume is obtained. Then repeat the previous stages of peaking. Stations should be heard over the entire broadcast band.

When tuning and testing has been completed, mount the top end, with speaker, inside the case (solder small nuts to the speaker frame so they will not be hard to hold inside the case). Cut a slot in the plastic for the pullout antenna, mount it, and then the battery, fastening it by a strap to the bottom end block. To help the tuning capacitor hold on station when in use, place a rubber grommet over its shaft and press the knob down tightly against it and case. Place small homemade brackets (see Fig. 6) underneath the cabinet and screw setscrews into the wooden blocks and your receiver is mounted.

Grommet Pulls Radio's Pilot Light

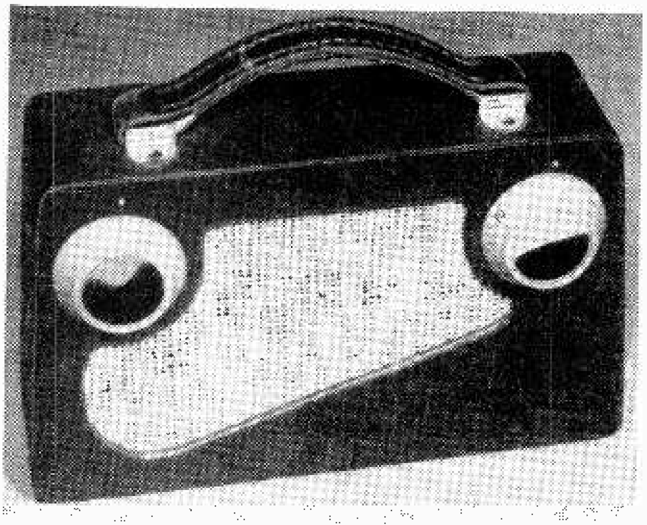


• It's no problem at all to remove a blown pilot light from its socket if you slip a rubber grommet over the bulb's slick glass envelope (see photo.) The snug-fitting grommet will grip the envelope's surface and provide an easy-to-turn "knob".

Six-Transistor Portable Superheterodyne

Small enough to fit into a cigar box, this set still has a much larger speaker than would be found in most commercial transistor radios

By THOMAS A. BLANCHARD



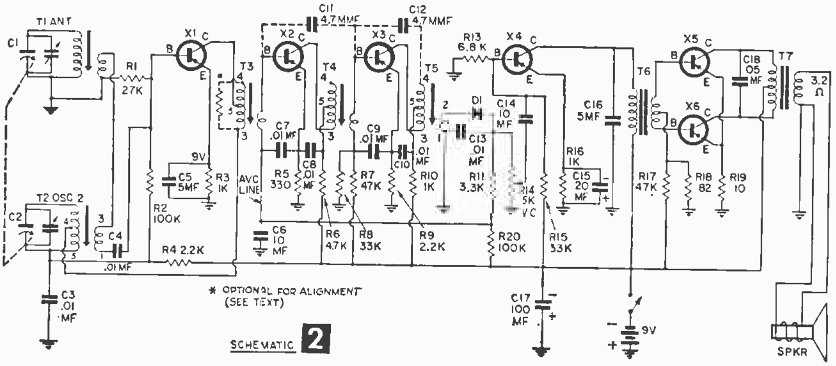
Completed set chassis mounts in this modern cabinet with woven gilt-straw grille. Plastic control knobs are push-on type. Chassis mounts vertically. Set may be powered by eight penlite cells wired in series as well as by a #266 pack.

COMMERCIAL transistor sets have pared down dimensions to the very minimum through use of printed-wiring chassis boards. Here, however, is a small six-transistor superhet which employs only standard components—no printed circuits—and is still small enough to fit into a cigar box or small modern cabinet (see photo above for kit cabinet). Its circuit (see Fig. 2) employs a two-gang variable capacitor for tuning the transistor converter circuit, there are two 455 *kc* IF stages, a germanium diode detector, audio driver, and push-pull audio output. Power is provided by a #266 Eveready 9 *v* battery (which has up to 250 hours intermittent life).

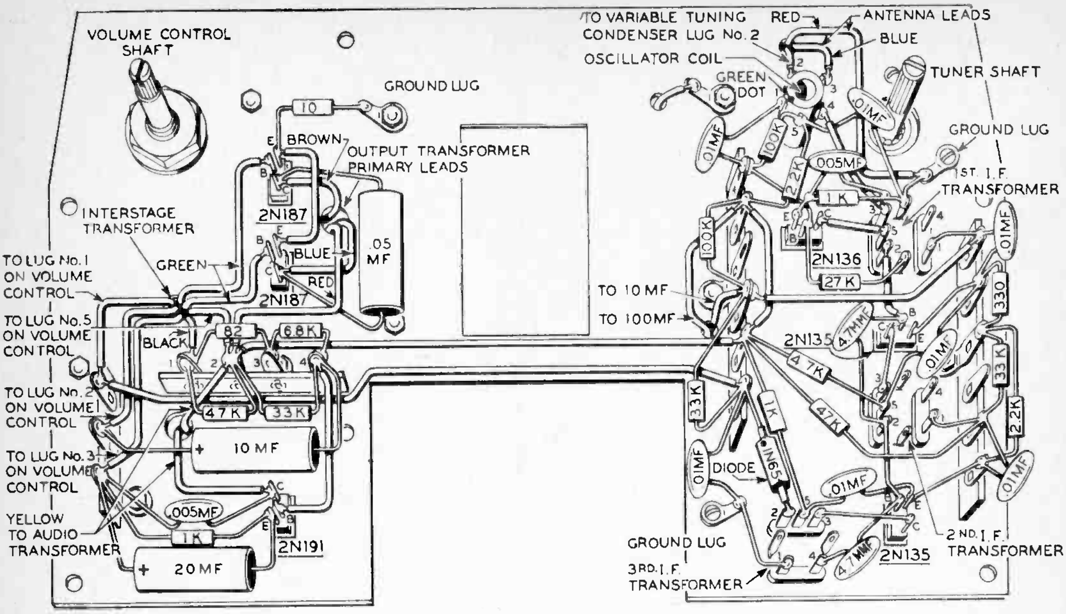
The chassis follows the flat-plate design now employed by many TV sets. Four ½ x ½ x 1 in. wood blocks glued inside the cabinet allow the chassis to be screwed rigidly in place in a vertical position. The flat plate greatly simplifies wiring since in most instances the component leads themselves are long enough for connections. However, since these leads are bare, plastic insulating sleeving (radio spaghetti) should be used on all wires except those terminating on chassis ground lugs. Both local and mail-order parts houses can furnish a complete set of parts including cabinet and punched chassis for a fraction of the cost of the individual items (see Materials List).

The chassis plate measures 5 x 8½ in. and may be of #14 steel or aluminum. The tapered cabinet sides require that the upper corners of the plate be trimmed. (With a rectangular carrying case, trimming wouldn't be necessary.) Make a rectangular opening 1⅞ x 2⅛ in. in the lower center of the plate to allow room for the battery (see Fig. 3). A unique method for reducing the bulk of the set's 4-in. PM speaker is the rectangular opening through which the magnet projects. This hole is located ⅜ in. above the battery cut-out, and measures 1¼ x 1¾ in. The speaker is supported by three screws (1¼ x 6-32) on ¼ x 1 in. metal spacers.

Cut openings for the IF transformers ½-in. square and mount each transformer firmly grounded to the chassis by means of the end-can mounting lugs. Holes for the transistor sockets measure ⅛ x 11/32 in. Sockets are inserted in the opening and secured with a locking ring which snaps in place.



SCHEMATIC 2



3 PICTORIAL

As soon as all stationary parts (coils, transformers, tuner, volume control, speaker and tie-strips) have been mounted to the chassis, begin wiring. Except for the speaker and ferrite loop antenna, all parts are mounted with 1/4 in. 6-32 machine screws and nuts. The antenna coil is mounted on 1-in. spacers or standoffs with the rod secured by fiber clamps placed under the standoff screwheads.

Complete all connections made with solid leads first, leaving the installation of resistors and capacitors until last. Make leads as short and direct as possible (see Pictorial, Fig. 3), keeping wires close to the chassis. The small 4.7 mmf. ceramic coupling capacitors connected to the interstage IF (2nd) and output IF (3rd) stages should be placed as close to chassis as possible. Positions of other capacitors is not critical so long as it approximates that shown in Fig. 3.

Because of the minute size of the IF transformer and transistor socket lugs, bulky soldering irons or guns do not lend themselves to neat construction. Use one of the inexpensive pencil-type soldering irons when working with transistor circuits. Good solder is very important, too. The best available to the experimenter is Kester's "Resin-5."

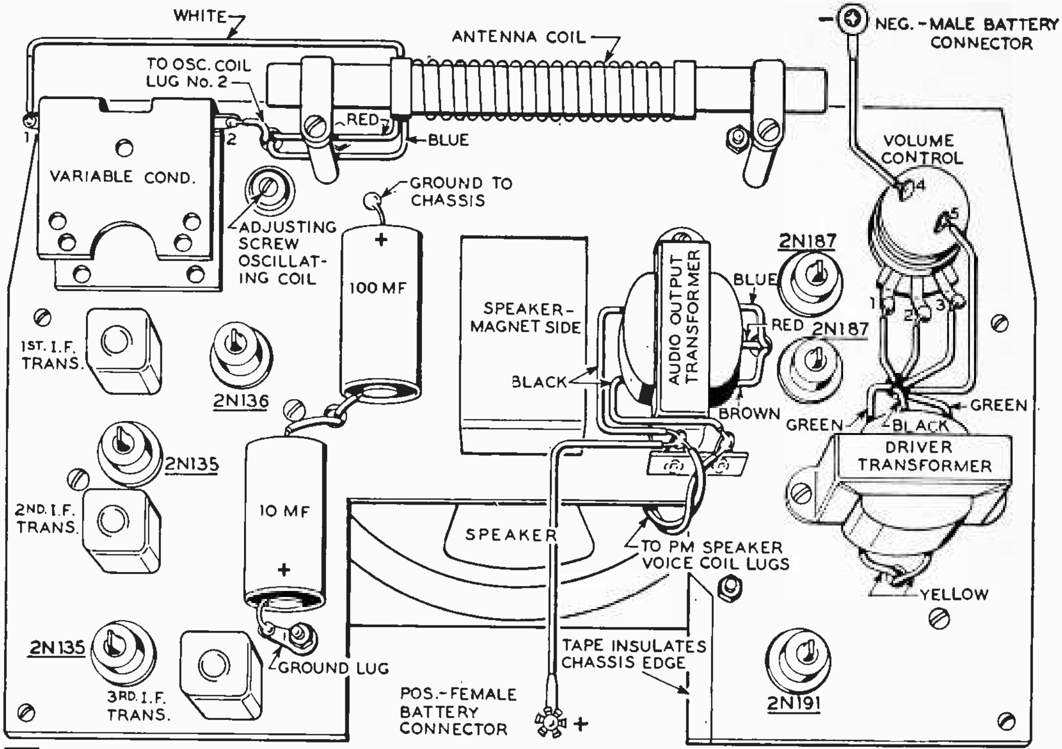
Having ascertained that all wiring is correct, insert transistors into their sockets. Next, connect the battery—but first apply a strip of tape along the right-hand edge of the chassis opening so that battery connectors do not short circuit.

Of course the receiver should be properly aligned. Alignment instructions for transistor superheterodyne receivers will be found in the article "How to Align Superhet Receivers," page

MATERIALS LIST—PORTABLE SUPERHET

No. Req.	Description
1	T-1—ferrite rod ant. Coil: 3/8" dia. x 5 3/8" long
1	T-2—5-wire transistor oscillator coil
2	T-3, T-4—1st (input) & 2nd (interstage) IF transformers (Automatic #BS725G)
1	T-5—3rd (output) IF trans. (Automatic #BS726G)
1	T-6—audio driver trans. (Stancor #A-4292, etc.)
1	T-7—audio push-pull output trans. (Stancor #A3856, etc.)
1	X-1—GE 2N136 transistor (converter)
2	X-2, X-3—GE 2N135 transistors (1st & 2nd, IF)
1	X-4—GE 2N191 transistor (audio driver)
2	X-5, X-6—GE 2N187 transistors (audio output)
1	D-1—germanium diode detector; 1N64 or 1N48
6	transistor sockets
1	chassis plate, aluminum 5 x 8 1/2", #14 gage
misc.	hardware & tie strips as indicated in Pictorial, Figs. 3 and 4
	Resistors
1	R-1—27K, 1/2 watt composition resistor
2	R-2, R-20—100K 1/2 watt composition resistor
3	R-3, R-10, R-16—1K, 1/2 watt composition resistor
2	R-4, R-9—2.2K, 1/2 watt composition resistor
1	R-5—330 ohms, 1/2 watt composition resistor
2	R-6, R-17—4.7K, 1/2 watt composition resistor
1	R-7—47K, 1/2 watt composition resistor
2	R-8, R-15—33K, 1/2 watt composition resistor
1	R-11—3.3K, 1/2 watt composition resistor
1	R-13—6.8K, 1/2 watt composition resistor
1	R-14—5K ohm volume control with switch
1	R-18—82 ohm composition 1/2-watt resistor
1	R-19—10 ohm composition 1/2-watt resistor
	Capacitors
1	C-1, C-2—2-gang Variable Tuning Capacitor (11-235 mmf. Ant. Section. Osc. Section 11-111 mmf.)
7	C-3, 4, 7, 8, 9, 10 & 13—.01 mfd. ceramic disc capacitors
2	C-5, C-16—.005 mfd. ceramic disc capacitors
2	C-6, C-14—10 mfd., 25v, electrolytic capacitors
2	C-11, C-12—4.7 mmf. ceramic disc capacitors
1	C-15—20 mfd., 25v. electrolytic capacitors
1	C-17—100 mfd., 25v. electrolytic capacitors
1	C-18—.05 mfd. paper tubular capacitor
1	4-in. PM Speaker with 3.2 ohm voice coil and V magnet

This set, known as the Arkay Model TR-6 is available in kit form coast to coast from radio supply houses for $33.95. Or write Radio Kits, Inc., 120 Cedar St., New York 6, N. Y., for literature and name of nearest dealer.



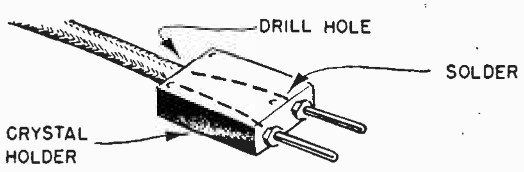
4 PICTORIAL

66 of this handbook. However, a quick check to determine that the wiring is correct can be made as follows: Wind two turns of insulated wire around the lead end of the ferrite antenna coil and attach the other bared end to a metal object such as the finger stop of a telephone. Turn on the set to full volume and rotate the tuner until a station is heard.

The oscillator which mounts in a rubber grommet on the chassis, contains an adjustable tuning screw or slug. Turn this screw with a plastic blade screwdriver. (A suitable tool for this purpose can be made by filing the end of a plastic crochet needle.) A point will be found where the signal becomes strong. A second adjustment can be made by turning the trimmer screw of the Osc. section of the tuner.

A transistor set does not have the sensitivity or tone quality of a vacuum-tube receiver; a 4-tube battery superhet will outperform any 6- or 7-transistor superhet—*but*, a transistor radio's low operating cost, and unusual freedom from operating breakdowns offset its shortcomings. And to further offset its shortcomings, a flexible lead can be tucked inside the set for providing coupling between the antenna rod and an external antenna as afforded by any metal object. In addition, when only the loop is used, mounting it as far away from the chassis as possible will improve reception. In commercial sets, the antenna coil is frequently enclosed in the plastic carrying handle. This set could be so modified if the builder desired, by replacing the leather grip with a length of plastic tubing mounted on plastic standoffs. The loop would be protected and concealed by the tubing.

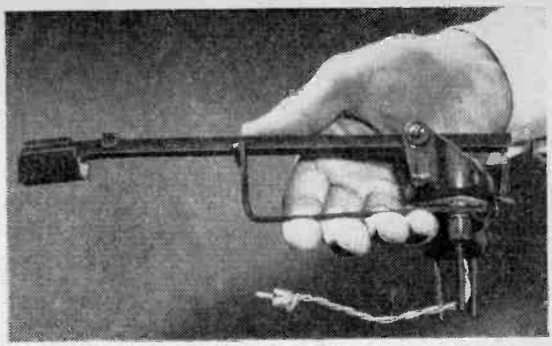
Crystal Holder Is Handy Connector



• After a crystal holder of the type used in a radio transmitter or communications receiver has seemingly outlived its usefulness, use it in conjunction with a suitable crystal socket to make a handy two-conductor connector. Simply drill holes through the top of the holder to receive wire leads, and solder the wire ends to the holder prongs inside as shown in the diagram.—J.A.C.

• Place TV tubes in hard rubber basins, available at surplus stores, for safe keeping while trying another tube or handling other repairs on the set. The hard rubber is less likely to damage the tube than metal containers.—H. LEEPER.

Hi-Fi Tone Arm *and* *Moving-Coil* Pickup



With the investment of a few hours' time and a modest outlay in parts and material, the advanced hobbyist can experience the thrill of constructing his own high-quality moving-coil pickup and tone arm.

By JOHN E. TURNER

You get all music from your records that you pay for when you build this hi-fi tone arm and pickup. Inset shows assembly of arm lift.

IN PRINCIPLE, phonograph arms and pickups are comparatively simple devices, and the hi-fi enthusiast who possesses a reasonable amount of mechanical skill—and patience—can construct the integrated unit described in this article without trouble, and *with* the satisfaction of having made an arm and pickup whose performance, by listening tests, compares favorably with better-quality, expensive commercial counterparts.

The pickup *can* be installed in the arms of most commercial record changers, but experience has shown that results may then not be entirely satisfactory because of the high compliance and sensitivity of the stylus-coil mechanism. Specifically, the pressure of the pawl which activates the change cycle on many types of changers will cause considerable distortion when records with eccentric center holes are played. Unquestionably, best performance is realized if the arm described in this article is used with the pickup accompanying it.

Construction. In addition to basic hand tools (hacksaw, file, needlenose pliers, diagonal cutters, tin snips, soldering gun), you'll also need the following (to complete the rather delicate construction of the stylus-moving coil subassembly): a pair of small pointed forceps, two or three small sewing needles, and a lens with a magnification of about 5 diameters, preferably mounted on a stand so that hands will be free.

The majority of the materials and parts, used in this project (see Materials List), are obtainable at the local hardware store and from radio-supply houses at relatively low cost. The matching transformer, however, which must necessarily be of high quality to insure good reproduction, entails somewhat greater expense. Likewise, a diamond tip is rather costly, but when one considers its advantages over all other phono points, it represents a modest investment.

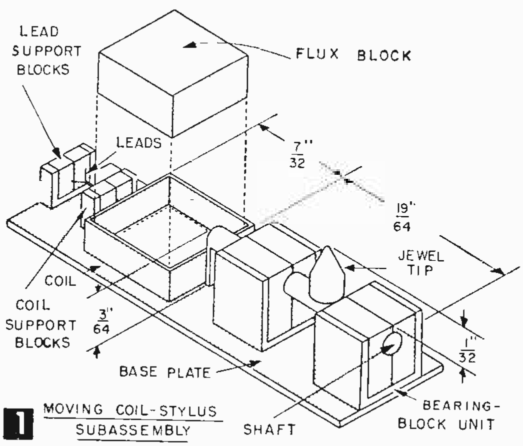
The Pickup. Begin construction by drilling out the rivet in the magnetic door latch assembly (see Materials List) and removing the magnet and two pole pieces. From one of the steel pole pieces cut out a 1/8 x 3/16 in. block. This will be the flux block, and it may have to be filed down later to provide adequate clearance for the moving coil. Then, from the same material, cut two pole pieces measuring approximately 5/32 x 3/8 in. Be sure to file all edges of the block and pole pieces to remove burrs.

Now, remove both ends from a cleaned tin can, slit it longitudinally, and cut off the upper and lower seams. Then flatten the can, and lay out and cut out the base plate of the moving coil-stylus subassembly (see Fig. 1). If a Heppner magnetic latch is used, make the base plate 5/32 x 1 in. to fit the magnet (Fig. 2). Any curvature remaining in the tin plate after flattening can be eliminated by squeezing the base plate between the jaws of a pair of needlenose pliers.

The bearing-block clips, coil-support-block clips, and lead-support-block clips (see Fig. 1) are cut from a strip of tin plate 3/32 in. wide. They are formed with a pair of needlenose pliers and cut to length with a pair of diagonal cutters. Because of some variation in the thickness of the rubber bands used for the block assemblies, clip openings will have to be determined from the specifications of the materials on hand, but they will be roughly 1/16 in. The bearing block clips must be about 7/64 in. high and their top edges will be flush with the cover assembly when the unit is completely assembled. Again, it may be necessary to make small adjustments in dimensions by filing. Make the lead-support block clips and coil-support block clips about 1/32 in. shorter, since they must fit below the dust cover.

Scribe a center line on one surface of the base plate to facilitate positioning of the clips (Fig. 1) and tentatively position components with a dab of airplane glue. When every component is properly aligned, solder the flux block *first* since it will require the most heat. Then solder all the clips in place, the bearing block front clip flush with the edge of the base plate, the second clip about 5/64 in. behind it. Leave about 11/32 in. between the rear bearing block clip and the coil-support block clip. If the last clip is located flush with the rear edge of the base plate there will be about 3/16 in. space for connecting the leads.

Now, place the base-plate assembly on the edge of the magnet and fit the pole pieces as shown in Fig. 2. They must be directly opposite the flux block with their top edges flush with the surface of the block. When they have been accurately located, secure them with airplane cement. (Since all the components of this pickup are very small, airplane glue must be applied sparingly; this can be best accomplished with a fine sewing needle.)



1 MOVING COIL-STYLUS SUBASSEMBLY

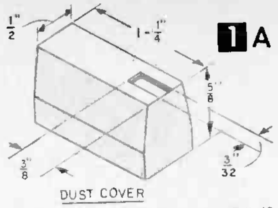
Unbraid a short length of 12-strand picture wire, stretch a single strand with needlenose pliers, and cut off a piece about 1 in. long. Although the finished shaft is only 11/32 in. long, it will be easier to mount the jewel if it is not trimmed to length and formed until later. See Fig. 3 for details on removing the jewel tip. The metal plate in Fig. 3 can also be made from tin plate. A 1/16-in. hole drilled in it (a little smaller if number drills are available) permits the jewel to pass into the balsa block as it is forced out the shank with the tip of a fine sewing needle. Usually it will be necessary to scrape away the cement securing the tip to the shank. A GE 1-Mil Diamond (4G-01D) is suggested, since it is reasonably priced, available from most electronics supply houses and comparatively easy to remove from its mounting.

After the jewel tip has been separated from its shank, carefully remove it from the balsa block with the moistened tip of a sewing needle. Do not attempt to pick it up with a pair of forceps unless you are very adept with this instrument. A squeeze at the wrong moment may cause it to fly out of your grasp and it is exceedingly difficult to find in a 9 x 12-ft. room. Lay the shaft on the balsa block and apply a small drop of airplane cement at a point midway between its ends, carefully pick up the jewel (with the needle) and push it into the drop of cement. This operation will take a little practice—and a steady hand, since the quantity of cement is small and it will dry rather fast. After the jewel has been positioned, and before the cement has hardened too much, carefully align the tip perpendicular to the shaft and then do not handle it again until the bond is secure.

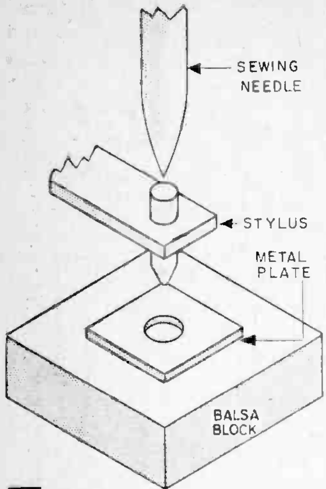
At intervals of 15 minutes, or so, apply airplane cement very sparingly to the joint between the jewel and the shaft. Two, or at the most three, additional applications of cement should be sufficient to insure a good joint. After the cement has thoroughly hardened, inspect the shaft assembly to see if the jewel is oriented perpendicular to the shaft. A misalignment of 3° or 4° will not be too serious, but if it is out of line more than this, dissolve the cement with nail polish remover and do the job over again.

When inspection indicates that the shaft assembly is satisfactory, cut one end of the shaft about 9/64 in. from the jewel and the other end 13/64 in. from the stylus. Bend 3/64 in. of this longer end downward as shown in Fig. 3 and the shaft-jewel assembly is ready for mounting.

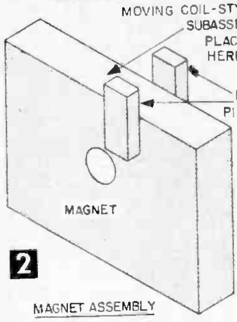
Wind the moving coil on a balsa wood block cut to the dimensions indicated in Fig. 4. Pass a mandrel of common stove wire through the block and cement it on both sides. Wrap a layer of kitchen aluminum foil around the block before starting the coil of wire, then wind roughly an inch of No. 40 magnet wire around the left side of the mandrel to form one lead of the coil. Wind the coil itself in two layers with a total of 21 turns. It is not essential that the coil be



1A



3 SETUP FOR REMOVING JEWEL TIP



2 MAGNET ASSEMBLY

as perfect as shown in Fig. 4, but it should be as thin as possible to facilitate alignment of the coil within the air gaps. When 21 turns have been wound around the form, twist the free end of the wire around the right side of the mandrel and paint the coil with airplane dope, using a fine sewing needle for this job. When the dope has dried, remove the coil from the block by slipping off the layer of aluminum foil. When the coil has been freed from the block, peel the foil from the inside of the coil and strip off any excess dope that may be hanging from the edge of the coil. Finally, dip the coil directly in the dope and blot the excess with a piece of facial tissue. As soon as the coil is dry, mount it (Fig. 1).

Make the bearing blocks and support blocks from a rubber band, making them oversize to begin with and then trimming them flush with the top of the clips after the shaft and leads have been inserted. (Spread the clips slightly before insertion of these parts, re-applying pressure afterwards by compressing them with a pair of forceps.) Insert the shaft assembly by spreading apart the portion of the rubber block extending above the clip and then pushing the shaft down to a point just below the top edge of the clip. Swing the shaft around so that the stylus is perpendicular to the base plate, then squeeze the clips with a pair of forceps just enough so that the shaft will not slip out of the blocks. Finally, trim off the blocks with a razor blade. Remember, the compliance of the stylus-coil mechanism is a function of the block pressure.

Now place the base-plate assembly on the magnet and inspect the air gap between the pole pieces and the flux block. It should be between 3/64 in. and 1/16 in. If the coil is a little thicker than it should ideally be, enlarge the gap by filing down the sides of the block. Be sure to clean away any filings so they will not plug the air gap. When the gap has been adjusted, mount the coil by first slipping the leads between the coil-support blocks. If the coil does not at first fit perfectly within the air gap, even though it may be large enough, re-form it with a couple of sewing needles; it is quite soft, and adjusting its shape is not difficult. When it has been determined that the coil fits properly cut a few shims from a 3 x 5 file card and fit them around it to keep it perfectly centered during cementing. Cement the front end of the coil (opposite the leads) to the shaft (Fig. 1), and while the cement is drying, squeeze together the coil-support block clips and trim off the excess rubber. As soon as the cement has hardened, remove the shims and test the movement of the stylus-coil assembly by deflecting the jewel with the tip of a needle. The coil should swing freely through a reasonable arc with a very light touch of the needle. If it does not, reshape it until it does. Although the attraction of the magnet appears to hold the moving coil-stylus subassembly quite securely, it is best to apply a little cement to both surfaces before mounting the base plate permanently to the magnet.

The dust cover (Fig. 1A) is also made of tin plate and is of two-piece construction. The sides and bottom are made from a single strip, 1¼ in. wide, and formed as shown. The width of the bottom will vary depending on the magnet used, but will be about ⅜ in. Lining the inside of the cover with a thin blotting paper will decrease resonance. Solder the end piece to the sides and bottom from the inside. With a small file, remove any solder that oozes through.

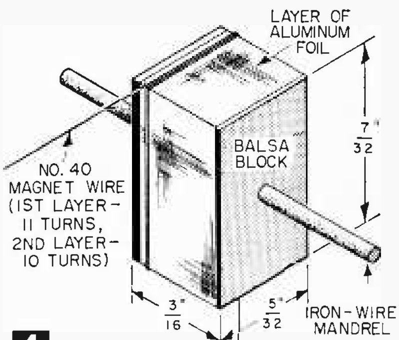
Paint the dust cover and attach transformer leads, and the moving-coil pickup is completed.

Building the Tone Arm. Cut a piece of Reynolds "Do-It-Yourself" aluminum channel 10¼ in. long and make a notch in one end (see Fig. 5). If the magnet from a Heppner Power Latch is used, this notch should be ¼ in. wide by 1¼ in. long. If a magnet of a different size is used, the notch should be layed out to provide approximately 1/16 in. clearance between the channel and the pickup assembly. Drill two 3/32-in. holes 8 7/32 in. from the notched end of the channel and at a point about 3/16 in. from the opposite end drill a 7/64-in. hole. Then, 1¾ in. from the notched end lay out and remove a 16° sector and bend the channel as shown in Fig. 5. Finally, drill two 7/64-in. holes on either side of the cut. (The attachment of the arm lift will stabilize the joint.)

Lay out, cut out, and form the arm lift from a piece of aluminum or copper sheet. Dimensions for it are not critical, except that it should extend out over the channel far enough to permit easy handling of the arm. Secure it to the channel with two 3-48 screws. Next, cement two 1/8-in. ball bearings into the pair of holes previously drilled in the sides of the arm. In the event that the ball bearings available are larger or smaller than the size suggested, simply alter the size of the holes drilled for the vertical pivots to allow the bearings to be recessed to about 1/3 of their diameter.

Make the counterbalance spring adjusting stud from a 3-48 x 3/4 in. machine screw by cutting off the head. Flatten the cut end of the screw and drill a hole with a No. 67 drill. One end of the counterbalance spring will be attached here.

Remove the wheel from a Colson, double ball-bearing, plate-type caster. From a length of 1/8-in. bronze welding rod cut a piece 1/4 in. long and drill a No. 67 hole close to one end. Then solder this pin to the body of the caster at the rear as shown in Fig. 5. The other end of the counterbalance spring anchors here. Using a 1/8-in. drill, carefully dimple the ends of two 6-32 machine screws and then insert them in the axle holes of the caster body using a flat washer and nut on either side. The oversize holes provide for alignment of the arm. Turn in the pair of screws so that the arm is held securely, but at the same time pivots freely on its vertical axis. Form the arm rest from two pieces of 1/8-in. bronze rod. Make the rest high enough to support the arm approximately parallel to the motor board and solder it to the base plate of the caster.



4 SET-UP FOR WINDING MOVING COIL

The counterbalance spring must be fairly soft to provide the arm with the correct degree of vertical sensitivity. A soft tension spring of 15/64 in. dia. and cut to a length of about 1/2 in. will provide the proper action and degree of adjustment. Twist a hex nut down on the counterbalance spring stud, insert the stud in the arm, and fit a second nut on top.

MATERIALS LIST—TONE ARM AND PICKUP

No. Req.	Description
1	caster (Colson, double ball bearing, plate type, w/2" wheel, Elyria, Ohio)
2	ball bearings (approx. 1/8")
1 lgth	1/2" x 1/4" aluminum channel (Reynolds "Do-It-Yourself")
1	tin can
1	soft spring (1/2 x 15/64")
1	bronze welding rod (1/8")
1	high-fidelity audio output transformer (Stancor A-8072, or equivalent)
1	1-mil stylus (GE 4G-01D)
1	No. 19 rubber band
1	magnetic power latch (Heppner Sales Company, Round Lake, Ill.)
	6–32 machine screws and nuts; 3–48 machine screws and nuts; 3/16" stove bolts and nuts; 3/16" flat washers; sheet cork (1/8" or 1/4"); No. 40 magnet wire; Litz wire (5 x 44); 12-strand picture wire; airplane cement; dampening jelly (silicone base type, or Black & Decker Lubricant, Cat. No. U-2194); plastic electricians tape; stranded hookup wire; enamel (for finishing); airplane dope (any color); rosin core solder.

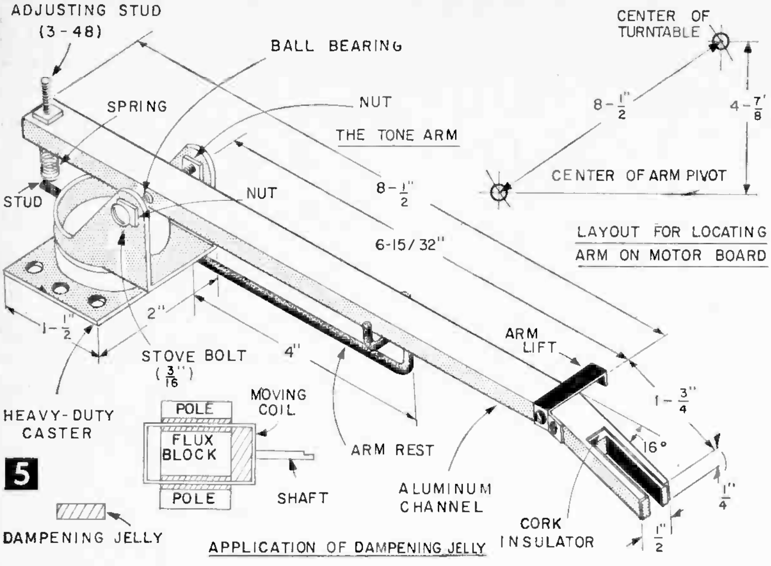
Hook the spring into the holes provided in the bottom stud and adjusting stud. Do not bother to adjust the spring tension until assembly has been completed.

The pickup is isolated from the aluminum channel with a cork insulator. Although the insulator is 1/4 in. thick, it can be made from two layers of 1/8-in. cork sheet available at most auto supply stores. First cut the pieces to fit the inside of the channel and then cut the slot just wide enough to hold the pickup snugly. Glue the two layers together and then glue them to the inside of the channel with airplane cement.

Final Assembly. Slide the pickup assembly into the cork insulator and position the upper edge of the magnet 1/8 in. above the insulator. Turn the arm over and secure the pickup with 4 drops of airplane cement. Cut two 15-in. lengths of Litz Wire (5 x 44), and twist them together. Strip and tin one end of the twisted leads and slip them between the lead support blocks. Squeeze the clips together and trim off the excess rubber band with a razor blade. Splice the Litz-wire leads and coil leads together and carefully solder the joints. From a spool of plastic electrician's tape, cut off six pieces 3/16 x 1/2 in. Use these strips to hold the lead in place along the inside of the channel. Allow the twisted leads to drop down from the arm at a point about 1/4 in. in front of the counterbalance spring assembly.

Carefully stretch the lead down and cut it 1 in. below the base plate of the caster. Now strip and tin this end and check the lead, soldered connections and coil for continuity. If the circuit is correct, slip on the dust cover and make preliminary adjustment of the counterbalance spring tension. Tighten the spring until the stylus pressure is approximately 2 grams. This unit is exceedingly sensitive and it may be possible to decrease the stylus pressure a little more after the arm has been mounted on the motor board.

A high-fidelity output transformer is used to match the low internal resistance of the moving coil to the input of the first preamplifier tube grid. Twist the leads of the primary and attach a phono jack. The primary side should be attached to the preamplifier input with a well-shielded cable, such as RG-59U. With an ohmmeter (or using the manufacturer's color code) select the pair of secondary with the lowest impedance, twist them together and install a second phono jack. The remaining leads will not be used and may be clipped off. The remainder of the lead between the arm and the matching transformer is made from stranded hookup wire, but is not prepared until the exact



5

pearance, dictate placing the transformer at a reasonable distance from the pickup. In our high-fidelity installation, the matching transformer is located on the bottom shelf of the cabinet, concealed behind a row of records. Signal loss is negligible if the transformer is placed as much as three feet away, so this allows considerable flexibility in the arrangement of individual units.

After a suitable location for the matching transformer has been determined, make a pair of twisted leads from braided hook-up wire of sufficient length to reach from the transformer to the under side of the motor board. Splice one end of the lead to the secondary of the transformer and secure a phono plug to the other. Then, attach the primary of the transformer to the preamplifier with shielded cable.

A light silicone-base jelly is the most satisfactory dampening agent, but, unfortunately, this material is rather difficult to obtain through ordinary sources of supply. Two alternatives are available: 1) salvage the jelly from a discarded pickup; 2) use a substitute material. Black and Decker lubricant (Catalog No. U-2194) works satisfactorily, but it does evaporate slowly and must be reapplied from time to time.

Turn the arm over and remove the dust cover. Using a fine sewing needle apply the jelly sparingly to the areas indicated in Fig. 5B. Now connect the arm to the lead from the transformer and turn on the amplifier. After it has warmed up, make a preliminary test of the pickup by carefully running a finger across the stylus. If the quantity of dampening jelly applied is optimum, a rather deep rumble will be heard from the speaker. If the sound is highly resonant, more jelly will have to be added. If gain is poor, chances are that too much jelly has been applied. Use the sewing needle to remove excess jelly a little at a time and make the finger test frequently.

Playing a disc, of course, is the real test. In general, too little dampening jelly will cause resonance and permit excessive needle talk; too much will attenuate the highs and reduce gain. When preliminary tests indicate that the pickup is functioning correctly, replace the dust cover and bolt the arm to the motor board. Check to see if the arm is level by rotating it about 30° away from the turntable. If the arm remains in position, it is level; if it swings toward the turntable, tighten the bolt on the left; if it turns

location for the matching transformer has been selected.

Mounting and Adjustment. The layout for locating the arm is shown in Fig. 5A. Although the caster plate is stamped with six holes, only three stove bolts are required to mount the unit securely to the motor board. Three-sixteenth in. bolts fit the plate nicely; their length will be dependent on the thickness of the motor board and the height to which the caster base will have to be shimmed up. Vertical and leveling adjustment are provided for by a combination of 3/16-in. flat washers and a 1/8-in. cork shim. Enough flat washers should be slipped over the portion of the stove bolts between the plate and the motor board to raise the arm high enough so that the jewel tip will ride perpendicular to the record surface. Level the arm by tightening the mounting bolts and compressing the cork shim.

Locate the arm and drill the mounting bolt holes in the motor board, but do not actually mount the unit until it has been given a preliminary test. Also bore a 3/8-in. hole in the motor board directly under the center of the arm pivot; the arm lead will pass through this opening. Next, cut two 5-in. lengths of stranded hookup wire, strip and tin both ends, and twist them together. Solder a phono plug to one end and push the other up through the center of the cork shim. Pull the wire through the shim about 1/2 in. and bend at a right angle. This will prevent the lead from pulling out and will protect the Litz-wire lead from any strain. Solder the Litz-wire lead to the short section of hook-up wire and check continuity with an ohmmeter.

To minimize resistance losses, locate the matching transformer as close as possible to the source (the moving coil). Other considerations, such as isolation from magnetic fields and apaway from the turntable, screw down the bolts on the right. Check the stylus pressure with a gauge and adjust to about two grams pressure. A coat or two of enamel to suit your own taste completes the unit.

Operation of the Unit. The design of a moving-coil pickup is simplicity itself. The modulations of the record grooves cause the stylus to swing laterally. This motion is imparted to the coil through the shaft, to which the jewel is cemented. The rubber blocks function both as a fulcrum and a restoring mechanism. The actual force in dynes required to deflect the stylus was not measured by the author, but compliance is high as indicated by the excellent low-frequency response of the pickup. It should be noted that the rubber blocks also provide sufficient vertical compliance to overcome much of the "pinch" effect.

The moving coil generates a feeble current and because the internal resistance of the source is so low a reversed audio output transformer must be used to match the coil to the high resistance of the preamplifier input. To prevent the loss of high- and low-audio frequencies, a good quality high-fidelity output transformer is essential for this application. If you can obtain an input transformer used with some commercial low-level pickups, so much the better, as some savings can be realized.

Tests indicate that this pickup will track satisfactorily with a stylus pressure of 2 grams. This low tracking force will significantly increase the life of records. Best undistorted output appears to be obtained when the unit feeds into 22,000 ohm load.

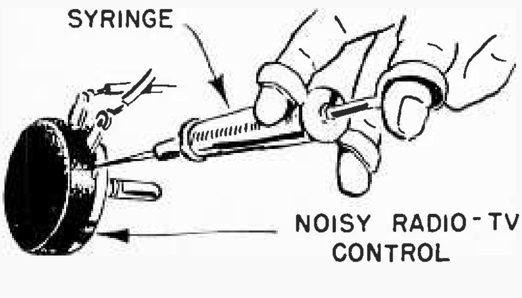
The placement of the matching transformer and lead dress are critical as this type of pickup is quite sensitive to external sources of hum. The transformer may be located either above or below the motor board but must be far enough away to isolate it from the magnetic field of the phono motor. Hum pickup is further minimized by twisting together all leads. Repositioning the transformer and making slight changes in lead dress may make considerable difference where hum is a problem.

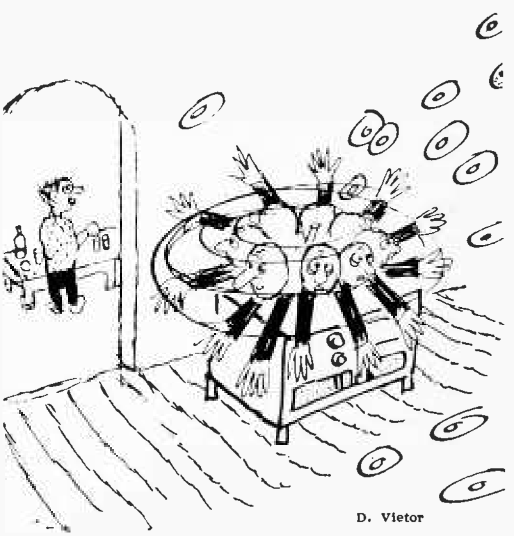
That portion of the lead between the pickup and tone-arm base must be very flexible so that there is no interference with the radial movement of the arm. Because the tracking pressure is so low, the arm does not readily overcome even slight lateral stresses—such as may be caused by the flexing of the leads—without inducing distortion. Litz wire was selected because it is very soft and therefore ideal for this purpose.

The mechanics of the tone arm are virtually self-evident. The two primary design considerations are: 1) freedom of movement; and 2) proper tracking. Smooth horizontal and vertical action is obtained by the use of ball-bearing suspension. Perfect tracking is more difficult to come by and precise setups can involve considerable mathematical computation of a high order. Theoretically, the arm should be tangential to the record groove at all times. Obviously, this is impossible since the arm swings radially from a fixed point on the motor board. The best that can be done is to mount the arm in a more or less compromise position. In addition, it has been determined that a slight overhand (over the center of the record) will significantly reduce tracking error.

Syringe Is Handy Service Tool

• A veterinarian's syringe or doctor's hypodermic needle makes an ideal service tool for injecting cleaning fluid into the noisy control of a radio or TV set, since its tiny needle point can reach into the smallest opening with ease and, thus, there's no need to take the control apart. Filled with grease, a hypo needle or syringe makes a handy miniature "grease-gun," too. If your local veterinarian or druggist can't supply you with one of the syringes, perhaps you can obtain one from your dentist or doctor.—JOHN A. COMSTOCK.



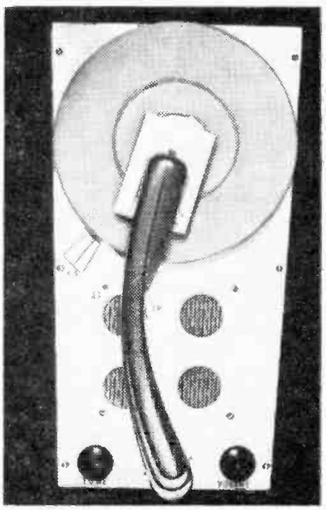


"Put on a record, Joe—but let me warn you—our new five-way player is a little tricky to handle—"

A Really Portable Portable Phonograph

By HOMER L. DAVIDSON

Pick it up and walk right out of the house with it, you'll still hear music with this portable phonograph that's *really* portable. Inset shows arm resting on keeper block.

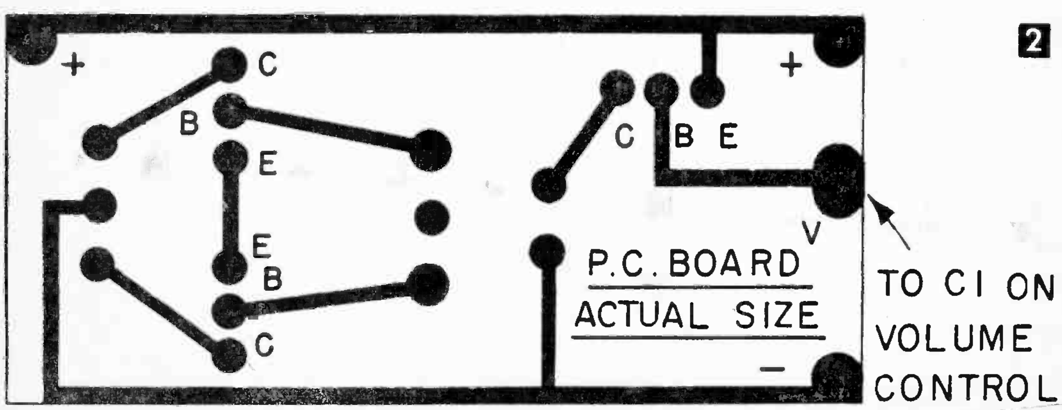


ANYTIME you find yourself far from an *ac* outlet, this little portable phonograph will solve your music problems. Small, thin, light and rugged, it operates on battery power (two of them, wired in parallel for harder and longer service). The small transistorized amplifier is constructed upon a flat, printed circuit board.

Begin construction by taking the printed circuit diagram (Fig. 2) and tracing it directly upon the copper side of the printed circuit board (see Materials List). Use carbon paper. Then apply resist tape to the lines, pressing it snugly to the copper side with a knife. Draw in the small dot circles with liquid resist or use resist tape circles for them.

When the circuit has been completely laid out on the board, pour enough liquid etchant into a flat dish or tray to completely cover the board when it is immersed. Agitate the etching solution by rocking it back and forth to quicken the etching process. It will take approximately 45 minutes to completely etch the board. When etching has been completed, wash the board off with tap water and wash the tray. (Pour the solution back into its container; it can be used again.) Remove tape and resist with a penknife or other sharp blade and drill through circles with a small bit ($\frac{1}{32}$ in. for resistor and capacitor leads, $\frac{3}{32}$ in. for others).

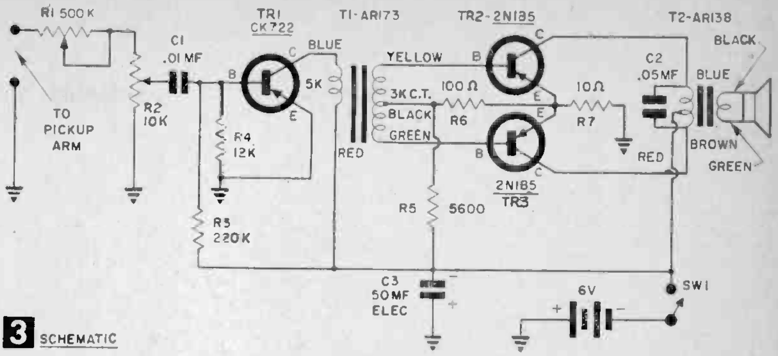
The amplifier has two matched transistors in its output circuit, one transistor as a driver. A 500K-potentiometer (R1) is used in the input circuit as a tone control and to cut down needle



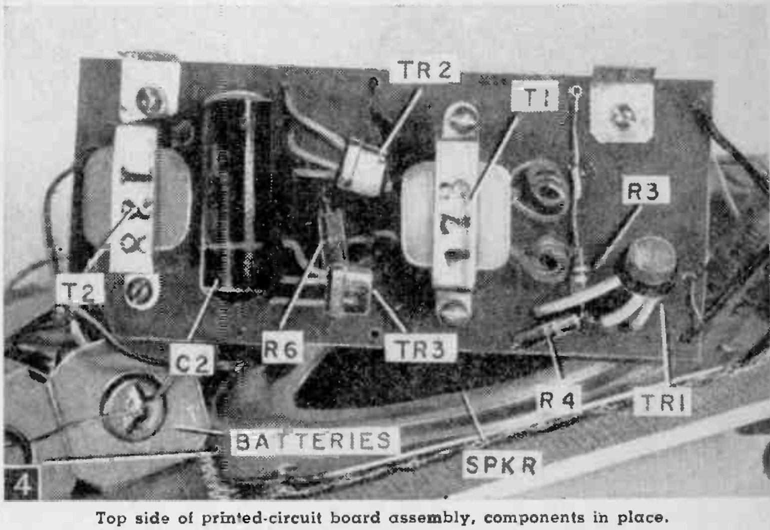
scratch on worn or dirty records (see Fig. 3). A volume control (R2) varies the output from the crystal cartridge to the base circuit of the first transistor. A push-pull interstage transformer couples the driver to the input of the two matched output transistors. The first transistor can be any transistor of audio quality (such as the CK722 or 2N107). A pair of matched transistors drives the small 4-in. PM speaker for plenty of volume, and the amplifier itself pulls only about 5 *ma* of current under normal operating conditions.

Mount all components except the transistors and solder them into place; mount the transistors last (see Fig. 4). Test board and install in cabinet when that unit is completed (see Fig. 5). Be sure when wiring in the phono motor that it runs clockwise. If it doesn't, reverse the connections at the motor.

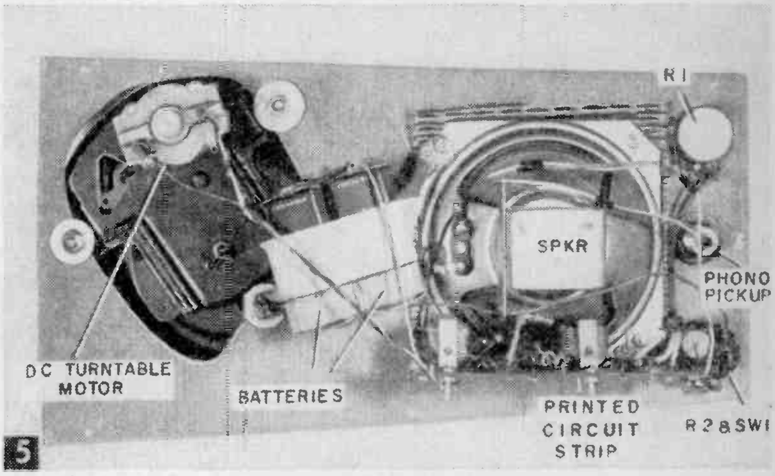
Cabinet. The top panel mounting board is made from Masonite (see Materials List) finished with two coats of enamel. Cut and drill all holes before painting (see Figs. 5 and 6). Plastic grille cloth covers the speaker opening and due to its supporting strength no hardware cloth or screen is needed behind it. The small phonograph is mounted on the top panel. The cabinet is narrower at one end than the other, making it appear much thinner and more compact. After pieces have been nailed and glued together, apply two finish coats of paint, your choice of color. If you spray-paint and use sand-blasted plywood, apply a coat of red. Since the red paint hits only the high spots on the sand-blasted plywood, the aluminum paint lies deep in the grooves, giving a leathery looking finish.



3 SCHEMATIC



4 Top side of printed-circuit board assembly, components in place.



5 Bottom view of completed assembly.

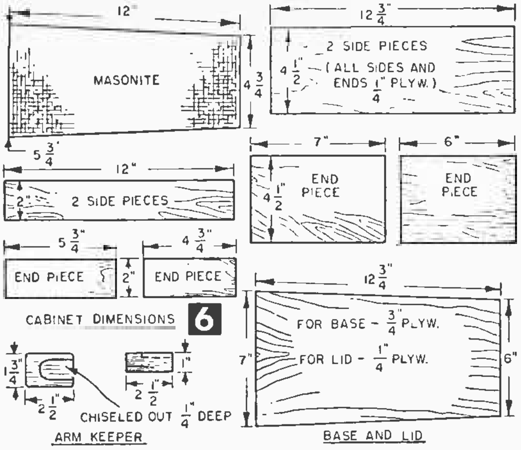
Finally, shape a small block of wood for the arm keeper as shown in Fig. 6. The pickup arm lies in the groove of this block, the top lid fastens down on it. Glue a piece of sponge rubber in the top of the lid so that the arm will rest firmly when the unit is carried. A small hole the size of the phono turntable rod support will

MATERIALS LIST—PORTABLE PHONOGRAPH

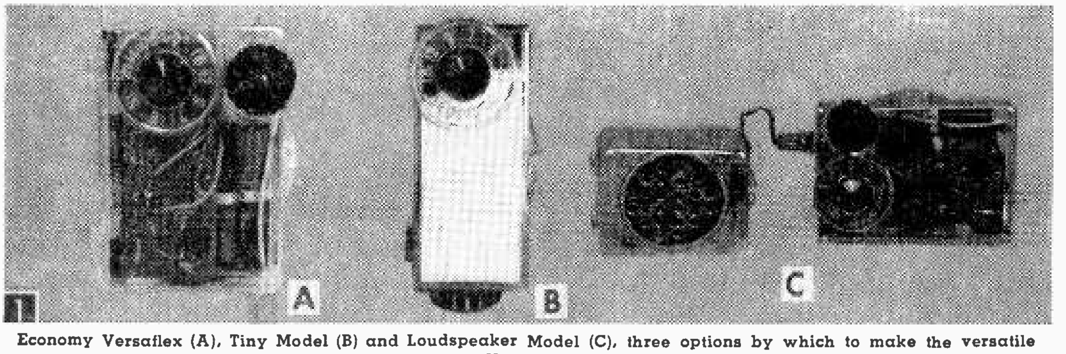
Desig.	Description
R1	500K potentiometer
R2	10K potentiometer with switch
R3	220K fixed resistor
R4	12K fixed resistor
R5	5600-ohm fixed resistor
R6	100-ohm fixed resistor
R7	10-ohm fixed resistor
C1	.01 capacitor, paper, 200v
C2	.05 capacitor, paper, 200v
C3	50 mfd. electrolytic capacitor, 25v
T1	Interstage transformer 5000-ohm primary, 2000-ohm secondary; Argonne AR173
T2	Output transformer, 1000-ohm impedance, 3.2-ohm secondary; Argonne AR138
TR1	CK722 (see text)
TR2, TR3	2N185 (Texas Instrument)
	Pickup arm (Lafayette PK-89)
	Turntable motor 6 volt 16, 33⅓, 45 RPM (Lafayette ML-9)
	2 Batteries (Eveready 724 or equivalent)

Printed Circuit Materials

No. Req.	Description
1 pt	PE-5 liquid etchant
1	2 x 4½" XXXP copper laminated board
1	PRLT ball point pen
1	roll tape resist
	All material available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.



prevent the keeper from side travel. Two small clip-on hinges, like those on a suitcase, hold the lid to the bottom of the cabinet. These can be purchased at the local hardware store.



Economy Versaflex (A), Tiny Model (B) and Loudspeaker Model (C), three options by which to make the versatile Versaflex.

The Versaflex

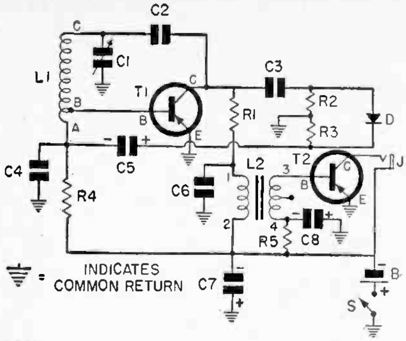
Take your choice of battery economy model, extra tiny model, or loudspeaker drive economy model, this is still a *sensitive* reflex receiver

By FORREST H. FRANTZ, SR.

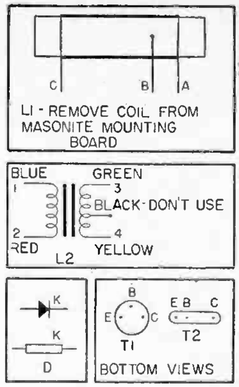
WANT a small radio, say 1 x 1³⁄₁₆ x 2⅞ inches? Or can you tolerate a radio as large as 1 x 2 x 2⅞ inches? Okay, either way, try the *Versaflex*. This little two-transistor receiver will pick up stations without an external antenna lead of any kind within 10 miles of a station. You can build it for roughly $10, including batteries and headphone, and with a slight change in the Economy Model—which uses ordinary penlite cells—you can drive a loudspeaker on local radio stations.

How It Works. The Versaflex is a reflex receiver. That is, one of its transistors (T1 in Fig. 2) does double duty as an RF and AF amplifier. The feedback arrangement through gimmick capacitor C2 (see Materials List) makes the set operate reasonably close to the oscillation level, and it also contributes to increased sensitivity. Other features which contribute to the sensitivity of the Versaflex are transformer coupling to the output transistor stage (T2), the use of entertainment- rather than experimenter-grade transistors, a high-Q antenna coil (L1), and a reasonably high battery voltage.

The antenna coil (L1), which is matched to transistor T1, picks up the incoming RF signal; L1-C1 form the tuning combination. Transistor T1 amplifies the RF signal and feeds it through



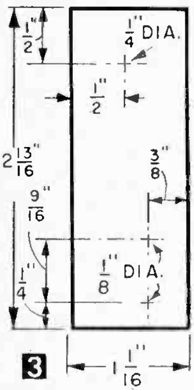
2 VERSAFLEX SCHEMATIC



is transferred to the secondary of L2. T2 amplifies this signal and it is transferred to the output jack.

The power consumption of the Versaflex is very small. Your set will draw between one and three milliamperes. The power consumption is therefore between 6 and 18 milliwatts when you're using a 6-volt battery.

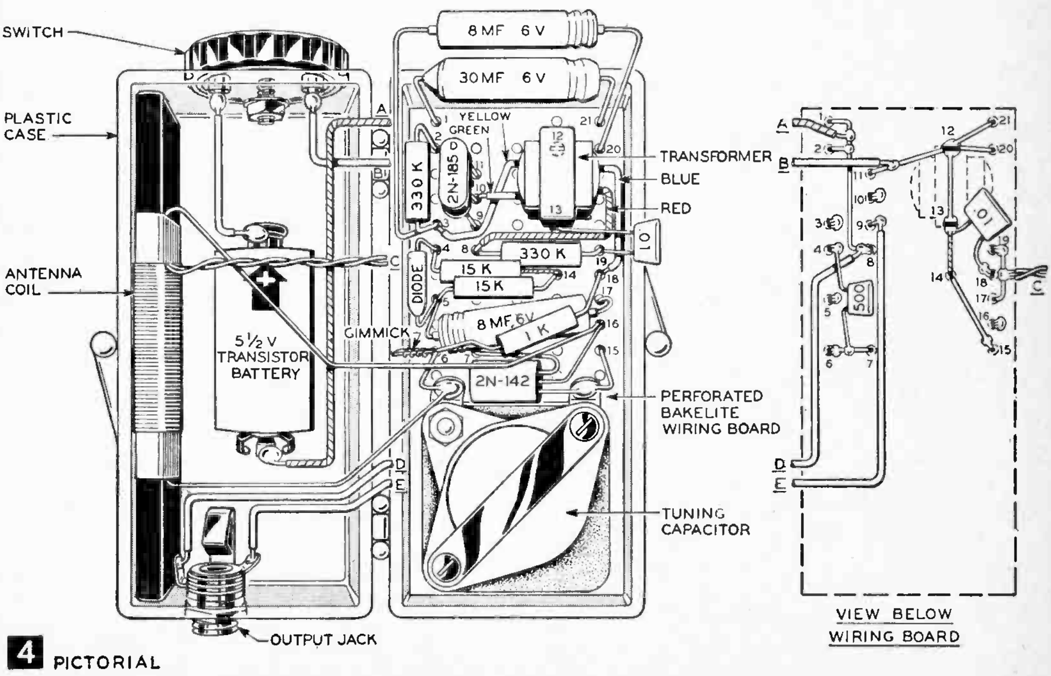
Construction. The Versaflex circuit is the same for all three options: (1) Economy Model; (2) Tiny Model; (3) Loudspeaker Model. The parts values are the same for all three options with these exceptions: Options 1 and 3 use penlite cells, option 2 uses a miniature transistor battery; the value of R5 is 330K in options 1 and 2, but R5 is 220K for option 3. This increases the power consumption of the set slightly for loudspeaker operation.



3 PERFORATED BAKELITE CHASSIS BOARD (FRONT VIEW)

capacitor C3 to diode D. Capacitor C3 blocks the collector operating voltage of T1 from diode D, which rectifies the signal and feeds the audio portion through C5 to the junction of R4, C4 and L1; C4 provides an RF return to ground. The signal at this junction is therefore pure audio, and it flows through L1 to the base of T1 without disturbing the RF amplifier operation of T1. Amplified, it appears across R1 and the primary of L2. Since the primary impedance of L2 is about 10 times the resistance of R1, most of the audio signal

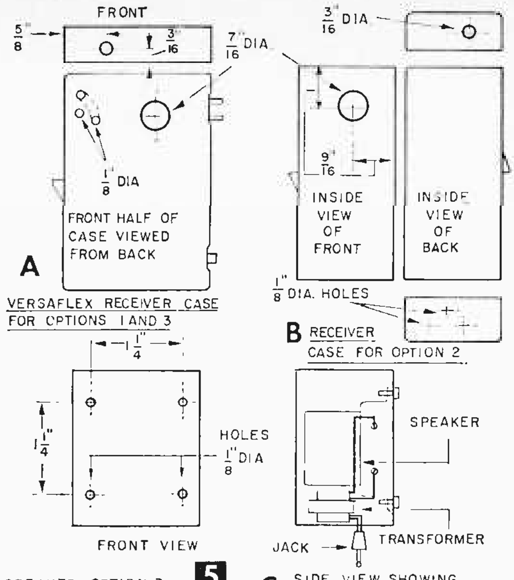
Begin construction by cutting and drilling the chassis board as shown in Fig. 3. Cut off the black lead on transformer L2; cut the other leads to a length of 1½ in. and strip the ends. (Be careful not to pull the leads out when you do this.) Mount tuning capacitor C1 and transformer L2 on the chassis board, bending the mounting lugs of L2 on the bottom side of the chassis board. Next, mount transistor T1 by soldering the emitter lead to the ground lug on C1. This lead must be very short and T1 must be placed close to the frame of C1. You'll have to be very careful not to get the transistor too hot. As a precaution, grasp the emitter lead with a pair of needle-nose pliers between the body of the transistor and the lug of C1 while soldering.



4 PICTORIAL

Next, mount C7, R5, R4, R3, R2, D, C5, R1, C8, and T2 in the order listed. The parts are mounted by pushing the pigtail leads through the perforations in the chassis board. Be sure to get all capacitors and resistors as close to the board as possible or you may have trouble getting them all in the set or in closing the case of the completed radio. The connections are made by soldering leads together on the bottom (front) of the chassis board and clipping them close to the board. Again, be careful not to damage the transistors while you're soldering. When you've finished making these connections, recheck to be sure that you haven't made any wiring mistakes. Check capacitor and diode polarities; be sure your connections to the transistors are correct. If you have any shorts between leads that shouldn't be connected, bend leads till they don't touch.

Mount and connect C3, C4, and C6. Make gimmick capacitor C2 by loosely twisting two 2-in. pieces of #28 insulated (enameled or cloth-covered) wire together. Use one set of ends to connect into the circuit; be sure the other set of ends do not touch. Leave the gimmick sticking out where you can get to it to adjust it according to instructions which will be given later. Connect 3½-in. long leads for the switch, battery, and phone jack. You can cut these to length when you put the set in the case. Figure 4 shows front and back of the wired chassis board with the switch, battery and phone jack leads.



5

Next, make pilot holes in the plastic case with a heated ice pick. Ream the holes to size with a taper reamer. The hole layout for the radio case of option 1 and 3 is shown in Fig. 5A. The case for option 2 is shown in Fig. 5B. The speaker case for option 3 is shown in Fig. 5C.

"It hasn't uttered a sound for three days—and neither has he."

Now cut off the two middle lugs on switch S. Two of the switch's three On positions are not used. Mount the switch and the phone jack J in the case. Place the assembled chassis board, antenna coil L, and battery B in the case. Cut leads to switch, battery, and jack to length. Push L1 leads out of the way and close the case. It if won't close, it may be necessary to slightly gouge out the inside of the case with a hot soldering iron. I was a little reckless with space on the original model. Although the Economy Model (option 1) fitted nicely, I had to gouge out the inside of the case for the Tiny Model. If you have to resort to this, cut out a piece of a filing card and fasten it to the front of case with Carter's rubber cement as I did to improve the set's appearance. The edge of the card serves as a tuning index.

When you're sure everything fits, connect the battery, switch, phone jack, and antenna coil to the batteries. Dress the antenna coil leads so they won't be damaged or shorted to other components when the case is closed. Be careful not to get your soldering iron against the plastic case while you're doing this final soldering. Insulate battery connections with transparent tape. Fasten the dial to the tuning capacitor with the knurled screw, and you're ready to try out your Versaflex.

Final Tune-Up. Turn the set on and tune C1 till you get a station or a squeal. If you can get either of these results, you're in business. If you get a squeal, untwist part of the gimmick C2 till the squeal just disappears. Remove your hand from the gimmick to check for absence of the squeal. When the squeal no longer exists at this point, try the rest of the tuning dial. If you don't hear any squeals, close the case and enjoy the set. To control volume, rotate the set away

MATERIALS LIST—VERSAFLEX

Desig.	Description
R1	1K, ½ watt, 10%
R2, R3	15K, ½ watt, 10%
R4, R5	330K, ½ watt, 10%
C1	365 mmfd tuning capacitor & knob (Lafayette MS-445)
C3	500 mmfd, 75 v, capacitor (Lafayette C-608)
C4, C6	.01 mfd, 75 v capacitor (Lafayette C-612)
C5, C8	8 mfd, 6 v electrolytic capacitor (Lafayette P6-8)
C7	30 mfd. 6 v electrolytic capacitor (Lafayette CF-104)
C2	Gimmick—2 pieces of insulated #28 wire about 1" long twisted together
L1	antenna coil (Miller 2004)
L2	subminiature driver transformer 10K to 2K (Lafayette TR 98)
T1	RF-1st audio transistor (RCA 2N412)
T2	audio output transistor (Texas Instruments 2N185)
D	diode detector (Raytheon 1N66)
J	output jack and earphone (Lafayette MS-368)
S	Switch (Lafayette SP-88)
	Perforated Bakelite Board (Lafayette MS-304)
Option 1, Economy Model	
B	4 penlite cells connected in series (RCA VS0-74, Burgess #7, or Eveready 912)
1	plastic case (Lafayette MS-158)
Option 2, Tiny Model	
B	5.5 volt Battery (RCA VS310)
1	plastic case (Lafayette MS-157)
Option 3, Loudspeaker Model	
SK, L3	loudspeaker and output transformer (Lafayette SK-62)
1	plastic loudspeaker case (Lafayette MS-156)
	All components for the Versaflex are available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, New York

from the direction of maximum pick-up or detune C1 slightly.

If the set doesn't squeal initially, but picks up stations, twist gimmick C2 tighter. This will increase the sensitivity since the RF feedback capacity of transistor T1 is being increased. When you hit the squeal point, you'll have to decrease the gimmick capacity slightly to eliminate it.

If you don't pick up a station when you turn the set on, move the phone plug in and out of the jack. You should hear clicks when you do this. The absence of clicks may mean a dead battery or a bad connection.

The antenna axis must be horizontal for best pick-up, the set is very directional. Assuming you're OK on this score, hold a metal object such as a screwdriver or pen knife in contact with your fingers and touch the junction of C4, R4, C5, and L1 with the tip. If you hear a hum, the entire audio portion of the radio is okay. Look for trouble in the L1-C1 combination or in the connection of C6. A transistor with low frequency cut-off could also be the cause. On the other hand, if you don't hear a hum, look for trouble in the audio amplifier portion of the set. This includes both transistors.

You'll usually find that any difficulties you may have are due to errors in wiring, short circuits, or poor connections.

If you're some distance from radio stations, you can make the Versaflex pick up stations for you by connecting a 2- or 3-foot lead to the side of the tuning capacitor which isn't grounded. But till you're very sure you need this assist, don't add it. I've picked up stations about 15 miles away without resorting to it.

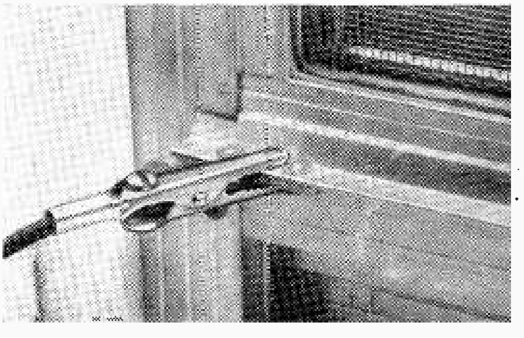
Because the Versaflex is small, it would make an ideal wrist watch radio. A wrist watch band may be attached to the Tiny Model case (option 2) by passing the band through slits provided in the side of the case near the back. The slits can be made with a heated ice pick. Use a cloth band. There is no noticeable decrease in Versaflex sensitivity when the receiver is held near the body. The sensitivity, of course, decreases if the antenna is tilted out of the horizontal plane. Since the receiver has a phone jack, the cord may be left connected and tucked inside your coat sleeve with the headphone in your inside coat pocket when it's not in use. Or the headphone and cord may be carried in your pocket when the receiver isn't in use and plugged in with the cord passing outside your clothes for use.

Either the Tiny or the Economy Versaflex will fit nicely into milady's purse. The Versaflex could be built into a case which doubles as a compact or coin purse. There's plenty of room for originality here.

The Loudspeaker Model (option 3) can be built with speaker and receiver in a single case. Provide any of the Versaflex options with a clip to fasten on the handle bars, and you've got a bicycle radio. Does anyone wonder why I named this set the "Versaflex"?

Aluminum Windows Serve as Antennas

• An aluminum combination window makes a good antenna for boosting the range of broadcast receivers, table-top radios and short-wave receivers, since the metal covers a fairly large area. Just clip a length of wire to the aluminum frame (see photo) and connect the other end to the antenna terminal on the radio, using alligator clips. If you prefer a permanent connec-



tion, fasten the end of the wire lead under one of the screwheads on the window frame. If your radio is an *ac-dc* table model, or any other type which works off the power lines but uses no power transformer or isolation transformer, connect a .01 *mfd* 600-volt fixed capacitor between the antenna terminal and the aluminum window frame to isolate the frame from the radio and prevent shocks.—Arthur Trauffer.

Headphone-Handset Receiver

By HOMER L. DAVIDSON

A handful of circuit components, but an earful of fun, this handset receiver can be constructed in one hour.

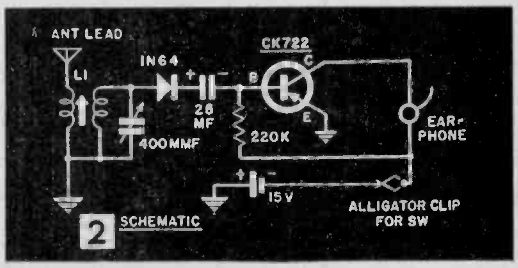
A ONE-EVENING project, this headphone-handset (Fig. 1) employs only a handful of parts, but obtains surprising results in pulling in local stations. A modified, high-gain antenna coil is used as the tuning circuit, the modification consisting of 35 turns of No. 28 enameled wire wound and taped in place over the coil's original winding.

The antenna coil (and thus the receiver itself) is tuned by varying the inductance of the high-gain coil by moving its ferrite slug up and down within it. A 400 *mmf* padder capacitor is adjusted to separate strong local stations.

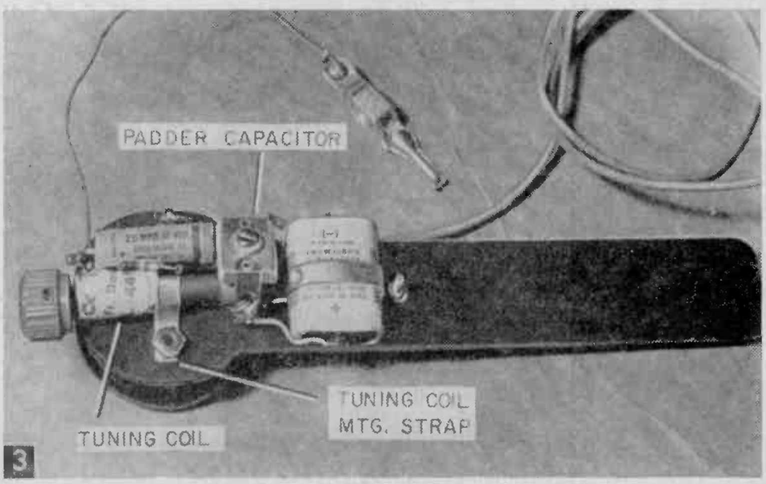
The broadcast signal is then rectified by an 1N64 crystal (see the schematic, Fig. 2), coupled through a 25 *mfd* electrolytic capacitor to the base of a CK722 transistor (the base return resistor is 220,000 ohms), and then fed directly from the transistor's collector to the winding of the earphone.

To construct, first cut a piece of Masonite (or plywood) to the same circle size as the phone. Cut it with an extended piece (see Fig. 3) for a handle and drill three small holes into the back of the phone and the Masonite, securing the phone in place with two 8/32 bolts and nuts (see Fig. 4), and fastening the tuning coil's mounting strap in place with one of these mounting bolts (see Fig. 3). The 15-*v* cell that provides power for this unit is strapped in place on the handle by means of a scrap piece of light-weight metal bolted through the Masonite.

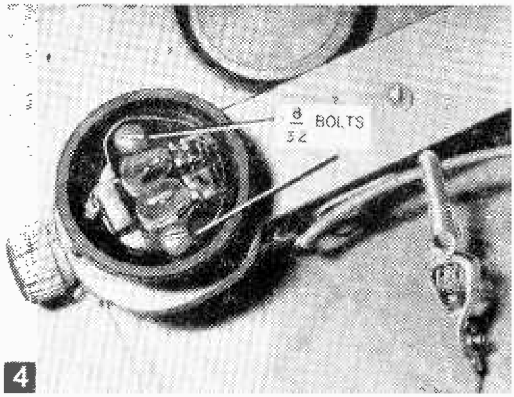
Mount the transistor inside the earphone, and solder leads directly into the circuit, keeping them as short as possible. Mount the 400



2 SCHEMATIC



Pictorial view of handset circuit, inside of phone.



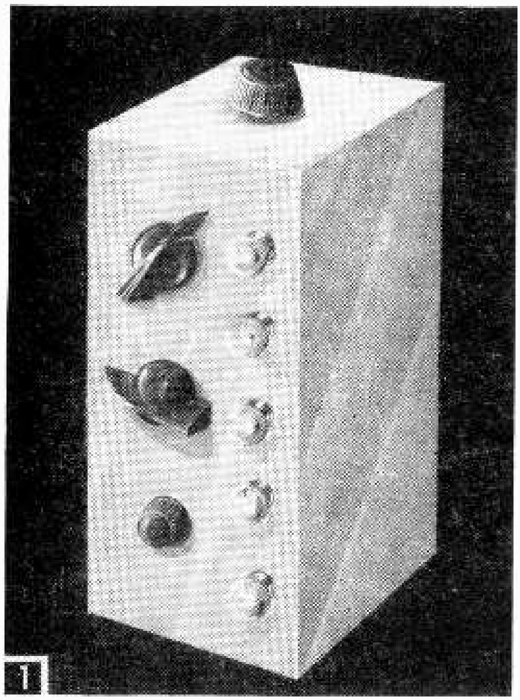
4 Pictorial view of handset circuit, outside.

MATERIALS LIST—HEADPHONE-HANDSET RECEIVER

No. Req'd.	Description
1	ferrite antenna coil (L1; see text for modification)
1	400 mmf capacitor, padder type
1	25 mfd. 50v capacitor
1	1N64 fixed crystal
1	220,000 ohm, 1/2-watt resistor
1	15 v Burgess hearing aid battery
1	CK722 Raytheon transistor
1	single unit earphone (from scrap box)
1	miniature alligator clip

mmf padder capacitor on the antenna coil lugs as shown in Fig. 3. Be sure to observe polarity on the small hearing aid battery when connecting it into the circuit or you may damage the transistor. To turn the receiver On, simply clip the alligator clip to the minus side of the battery.

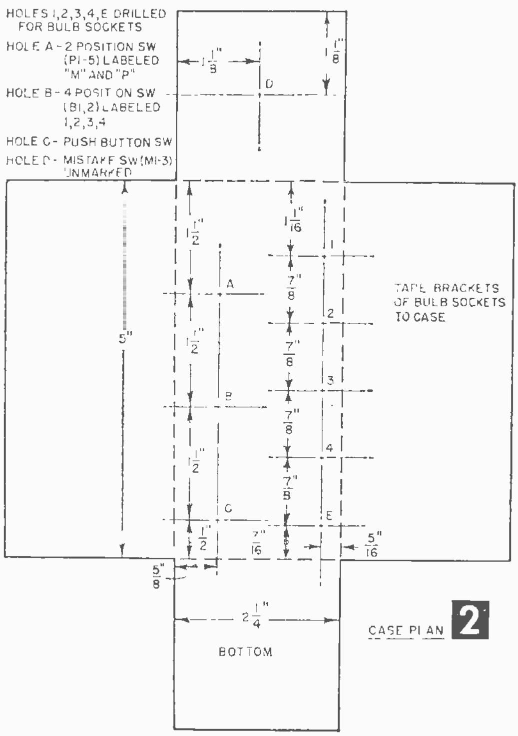
Machine to Play ZIM



1

THIS *Zim* machine is a new version of an old game. In the original game, two players alternately took one to four sticks from a pile of 21 sticks. The player who forced his opponent to take the last stick won the game. The Zim machine takes the place of one of the players, indicating its move by the use of bulbs. For example, if bulb No. 1 lights, the machine has taken one stick; bulb two, two sticks, etc.

Operation. When you want to start the game: 1) Turn the two-position switch to the "P"



CASE PLAN 2

(person), or second position. 2) Turn the four-position switch to the position indicating the number of sticks (1-4) you take from the pile of 21 sticks. 3) Press the push-button switch. 4) A bulb will light indicating the number of sticks the machine wishes to take (take these sticks from the pile). 5) Continue steps 2, 3, and 4 to the end of the game.

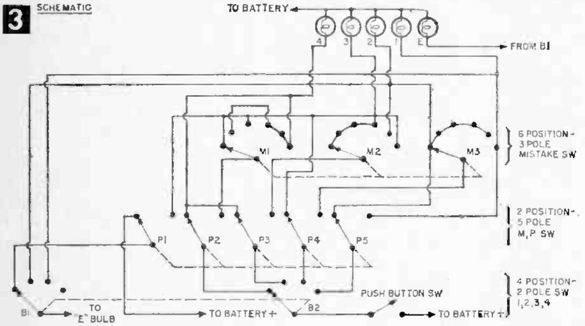
When you want the machine to start the game: 1) Take the four sticks of the machine's first move from the pile. 2) Turn the two-position switch to the "M" (machine), or first position. 3) Follow steps 2, 3, 4, and 5 of preceding instructions.

If the *extra bulb* lights, the two-position switch should be in the "M" position and kept there until the bulb goes off. Turn it to the "P" position the turn *after* the bulb goes off.

So that you may win once in a while, the machine has a Mistake Switch built into it with an unmarked knob. Every so often this knob should be turned to change the mistake the machine will make as a reply to a certain move. However, any errors made by the machine will be corrected unless you immediately take advantage of them. The elimination of the Mistake Switch makes the machine impossible to beat when *you* start the game. (To eliminate the switch, connect position two of P2 directly to bulb four, position two of P3 directly to bulb three, and position two of P4 directly to bulb two.)

Construction. Begin by drilling holes in the front section (containing the two ends and the front) of the chassis (see Fig. 2). Then remove the adjustable stop on the Mistake Switch (6 pos., 3 poles per pos.), and install all switches. Cut brackets on sockets even with the sockets themselves. Next, wire the circuit, leaving ample lengths of wire connected to the bulb sockets. Then, placing them under their respective openings, tape or solder brackets to the rear half of the chassis as indicated in Fig. 2. If you use tape, apply tape to the complete group of sockets as well as to each individually.—B. DICKMAN.

3 SCHEMATIC

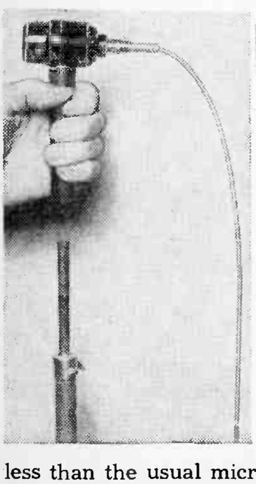


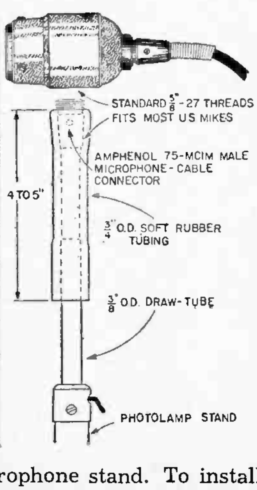
MATERIALS LIST — ZIM MACHINE

No. Req.	Description
5	miniature screw pilot light sockets with socket arms (Allied 34 B 257)
5	miniature screw lamps—GE222 (Allied 52 E 330)
1	chassis—2¼ x 2¼ x 5" (Allied 80 P 346)
1	miniature push-button switch (Allied 34 B 944)
1	non-shorting, 6 pos., 3 pole switch (Allied 34 B 360)
1	non-shorting, 2 pos., 5 pole switch (miniature) (Allied 34 B 928)
1	non-shorting, 4 pos., 3 pole (one not needed) switch (Allied 34 B 355)
1	1½-v. 935C dry cell
	wire, solder, unmarked knob, dial plate

Shock-Absorbing Adapter for Mike

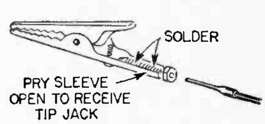
• This simple adapter and stand helps to cushion the microphone from bumps and vibrations that could ruin a perfect transmission or recording or damage the mike, yet total cost of project is less than the usual microphone stand. To install adapter, remove the cord-protecting spring in a male mike-cable connector and press connector into one end of a length of ¾ in. soft rubber tubing, allowing only the threads of the connector to protrude from the end of the tubing. Force the other end of the tube onto the top draw-tube of a standard folding and telescoping photolamp stand, distance depending on the weight of the microphone and the amount of cushioning desired. When you want to hold the mike in your hand, simply pull the rubber tube off the photolamp draw-tube and use it as a handle.—ARTHUR TRAUFFER.





Alligator Clip Receives Phone Tip

• When you need to connect a cord tip to an alligator clip in order to make a special connection, convert the clip to take tip rather than purchase a more expensive clip with tip jack attached. Simply pry open the sleeve of the alligator clip, insert a metal tip jack, pinch the sleeve tightly around the jack with a pair of pliers and solder securely.—A. TRAUFFER.



Combination Strobe-Flash Slave Unit

Strobe-Flash

Flash or strobe, you can use two lighting units synchronized with your camera's shutter with this "slave" as the second unit

By W. F. GEPHART

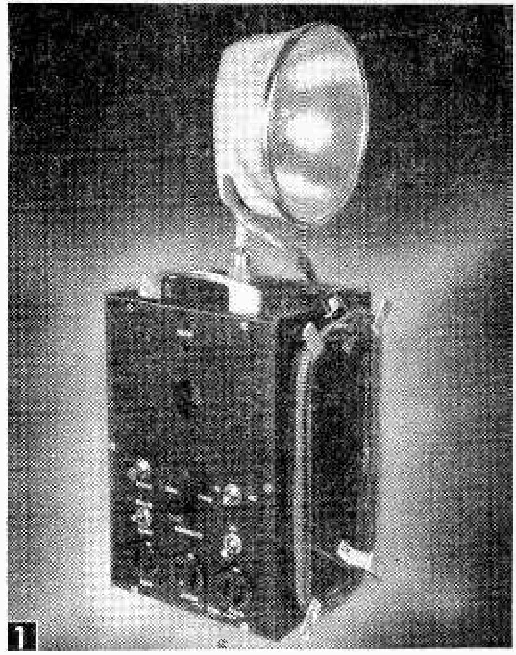
ONLY recently have electronic flash slave units appeared on the market, but due to synchronization difficulties, most of these units cannot be used with flash bulbs when the occasion requires, such as when the coverage exceeds the capacity of the strobe light. And, either for balanced lighting or increased lighting values, there are any number of times when you'll want to use two synchronized units.

The unit shown in Fig. 1 can be used as a flash or strobe "slave" unit or simply as an extension unit, using interconnecting wires. (In some cases, it is not feasible to have a line-of-sight light path between the camera and the unit, and extension wiring is required.) The unit's versatility also includes *ac* operation or self-contained battery operation.

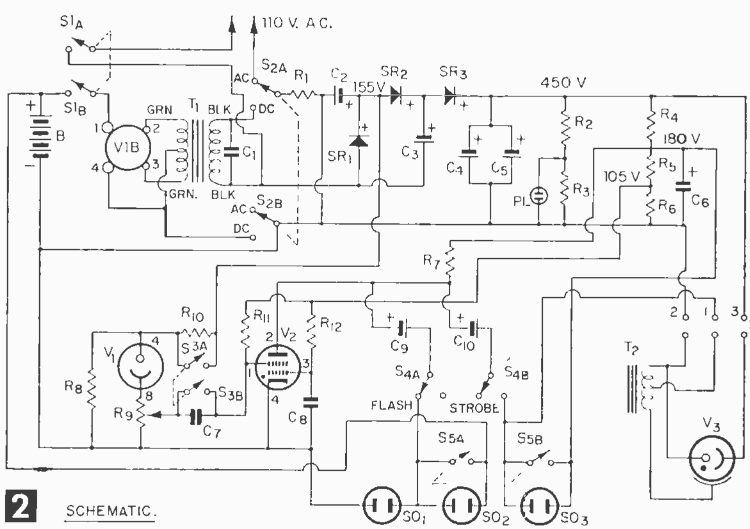
Figure 1 shows a panel view of the unit, the schematic in Fig. 2 shows that the unit consists of two basic circuits: 1) the strobelight circuit; and 2) the photocell triggering circuit. Interconnecting switches control the unit's function and its power source.

The strobelight circuit is a low-voltage, high-capacity type which reduces insulation and shock hazard problems. To reduce costs, the same voltage multiplier circuit is used on both *ac* and *dc* and, when using *dc*, an ordinary filament transformer is used instead of the more expensive vibrator transformer. When S2 is at "AC" and S1 is "On," line voltage is fed to the multiplier circuit, consisting of three selenium rectifiers and two capacitors which provides about 450 *v* to charge main capacitors C4 and C5, providing slightly in excess of 100 watt-seconds light output.

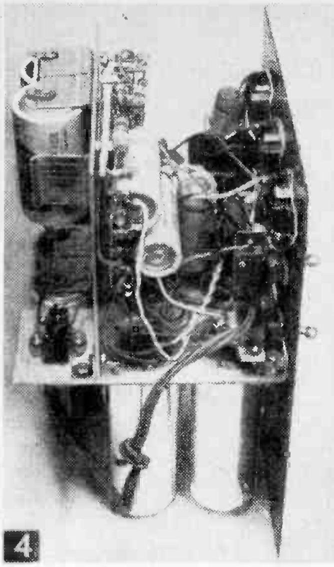
When S2 is on "DC" and S1 is "On," the battery voltage is converted to *ac* in the vibrator (VIB, Fig. 2) and fed into the *secondary* of filament transformer T1. The voltage appearing in the *primary* of the transformer (which is used as a secondary) is approximately the same as normal line voltage and is fed into the same voltage multiplier circuit (through S2), again providing approximately 450 *v*. Exact voltage will depend on battery condition. With fresh batteries, light output will almost equal 100 watt-seconds, but

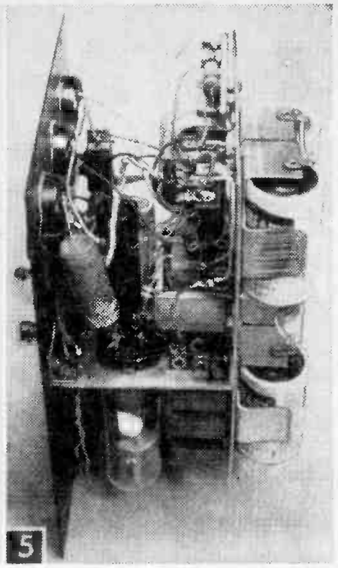


1 View of completed strobe-flash slave unit. Cord on brackets on unit is used only when light from camera unit cannot reach unit's cell.



2 SCHEMATIC.





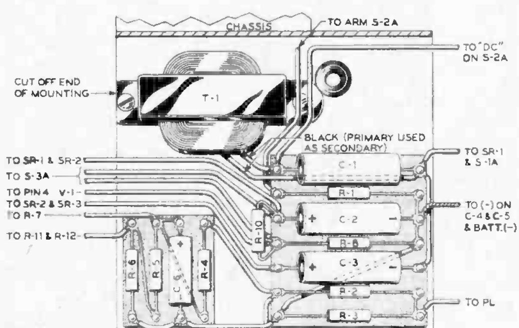
3 4 5

Back view of unit out of case (left) showing battery mounting; under-chassis view, showing three rectifiers stacked (at lower-center); and under-chassis view (right) show need for sub-assembly wiring.

will drop to about 80 watt-seconds as the batteries weaken.

Two voltage dividers are used to provide control and indicator voltages. The first of these, R2 and R3, provides approximately 90 *v* to fire the neon pilot light when the main capacitors are fully charged. Due to variations in neon bulbs, the value of R3 may have to be adjusted in assembling the unit. It should be set at a value that causes the neon bulb to light when the charging voltage reaches about 425 *v*.

The second voltage divider (R4, R5, and R6) provides ignition voltage for the flash tube (V3) and biasing voltage for the trigger tube (V2). These voltages are quite critical, and the values of these resistors may have to be changed slightly to provide the voltages shown in Fig. 2.

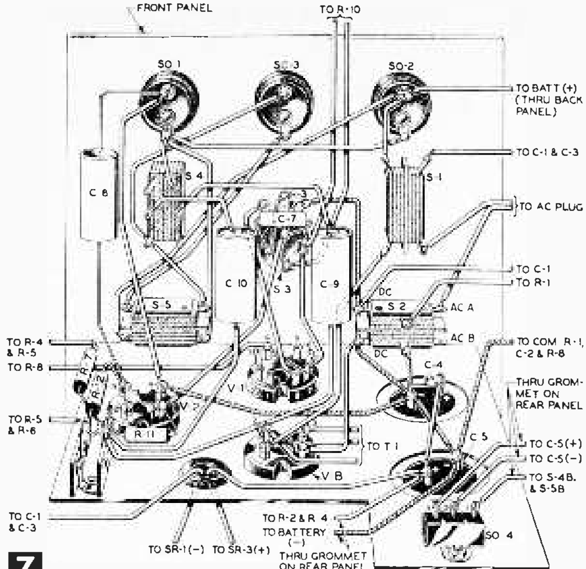


6 PICTORIAL - BACK PANEL

The "slave" circuit consists of a photocell (V1) and a strobotron trigger tube (V2). The trigger tube, a 1D21/SN4, is a grid-controlled gas tube capable of very high peak currents. Like most such tubes, it acts as a relay; the resistance between plate and cathode is almost infinite until "firing," upon which the resistance drops to nearly zero. Firing, or ionization, is controlled by the grids; de-ionization is controlled by the plate voltage. In this circuit, the grid voltages are established just below the ionization point by fixed *dc* bias (through R11 and R12), and a slight additional voltage from the photocell (when light strikes it) causes the tube to ionize, short-circuiting C9 (or C10) through ignition coil T2. The discharge of the capacitor through the coil fires the flash tube, the whole operation occurring within a few *micro*seconds of the time that light strikes the photocell.

As soon as the plate capacitor (C9 or C10) is discharged, the trigger tube de-ionizes since charging current for the capacitors, flowing through R7 causes the plate voltage of the trigger tube to fall below its ionization point. If the output of the photocell maintained sufficient voltage on the grid of the trigger tube, however, the latter would fire again as soon as the plate capacitor was re-charged. To prevent this, the output of the photocell is normally connected to the grid through a capacitor. Thus, the grid voltage of the trigger tube is not increased unless there is a sudden pulse of voltage such as would be created by a flash, or rapid increase of light. Use of this feature avoids the necessity of any sensitivity adjustment of the unit in usage.

In some cases, "pulse" of light operation can be a handicap. In a brightly-lighted room, for instance, movement between the main light source and the cell might trigger the unit. In such cases, closing S3 provides for operation on a "light intensity increase" basis, with adjust-



7 PICTORIAL - FRONT PANEL AND CHASSIS

of the cell and R10 is short-circuited to maintain operating voltage on the photocell plate. Voltage from normal room illumination appears across R9 (and the grid of the trigger tube), and if it is sufficient to fire the tube, the amount of voltage on the grid can be reduced by adjusting R9. In practice, this is done by looking through the cell opening in the case and adjusting R9 until it is seen that the trigger tube stops firing. Since the illumination will be increased by the flash bulb or strobe light on the camera, sufficient additional voltage will appear on the trigger-tube grid to fire it.

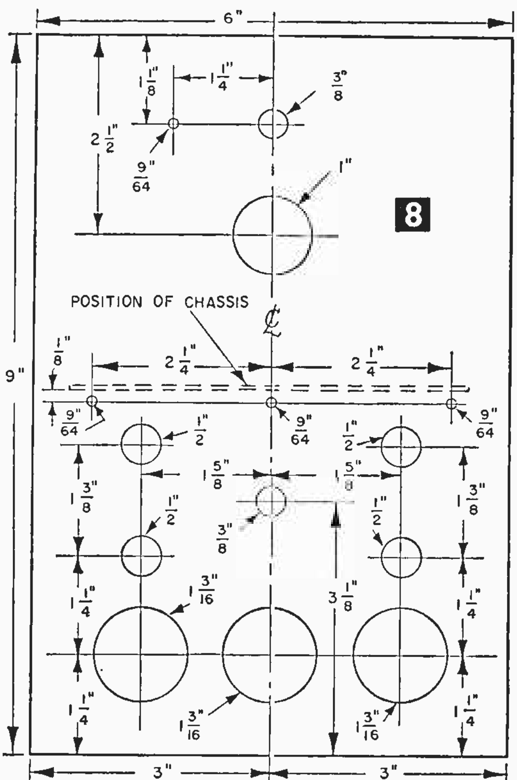
When coverage requires the use of flash bulbs, a flash unit can be plugged in SO1 and, in "slave" operation, C9 will discharge through the flashbulb, igniting it, when S4 is on "Flash."

When the unit must be located where light from the camera unit cannot reach the cell, the strobe light (or flash unit) can be synchronized with the camera by using a cord plugged into SO2 and SO3. In such case, S4 should be set to the function *not* being used, to prevent another source of light from firing the unit. On synchronized flash, the batteries in the unit are used to prevent voltage drop in long leads from the camera-mounted battery case.

Some of the components used in the unit shown were salvaged from a commercial strobe unit, thus reducing cost. In this particular case, the flashtube (V3), reflector and mounting, as well as C4, C5 and T2 were salvaged from an "FR" Model I electronic flash unit, which can be bought (used) for around $20 (the parts by themselves would cost around $40). The flash unit, regardless of source, should be mounted on a swivel bracket, such as a small tripod head or "bounce flash" bracket, since the cell must always face the camera, while the direc-

ment for sensitivity.

With S3 open, the cathode of the photocell is at ground potential, and approximately 90 *v* appears on the plate through voltage divider R8-R10. When S3 is closed, the positive grid voltage from the trigger tube is connected to the cathode



8 FRONT PANEL LAYOUT

MATERIALS—SLAVE UNIT

Desig.	Description
R1	27 ohm, 1/2 watt
R2	2 meg., 1/2 watt
R3	.56 meg, 1/2 watt
R4	.82 meg., 1/2 watt
R5, R6	.2 meg., 1/2 watt
R7	10K, 1 watt
R8	.15 meg., 1/2 watt
R9	5 meg., potentiometer
R10	.1 meg., 1/2 watt
R11	4 meg., 1/2 watt
R12	10 meg., 1/2 watt
C1	.008 mfd., 1600-v buffer
C2	8 mfd., 250-v electrolytic
C3	8 mfd., 450-v electrolytic
*C4, C5	250 mfd., 450-v electrolytic (or one 525 mfd., 450-v electrolytic, Sprague FF-1)
C6, C8	.1 mfd., 200-v
C7	.002 mfd., 200-v
C9	30 mfd., 250-v electrolytic
C10	1 mfd., 200-v
V1	930 photo tube
V2	1D21/SN4
*V3	Flashtube (GE FT-118 or Kemlite-Sprague DW-2)
S1	DPST toggle switch
S2, S4	DPDT toggle switch
S3	DPST rotary switch (ganged with R9)
S5	DPST push button
S01, S02, S03	Female ac receptacle (Amphenol 61-F)
S04	3-contact socket and plug (Jones S-303-AB and P-303-CCT)
T1	6.3-v @ 2 amp. filament transformer (Merit P-2045)
*T2	Ignition coil (Thordarson 22R44, or "OK Senior" model airplane ignition coil)
SR1, SR2, SR3	65 ma. selenium rectifier
PL	NE-51 neon bulb
VIB	6-v non-synchronous vibrator (Mallory Type 4-4)
B	6-v battery (4 "D" cells)

Two 4-prong sockets, one Octal socket, two Dual "D" cell battery mounting clips, one bayonet pilot light socket, one metal utility cabinet 5 x 6 x 9" (Bud CU-1099 or AU-1040)

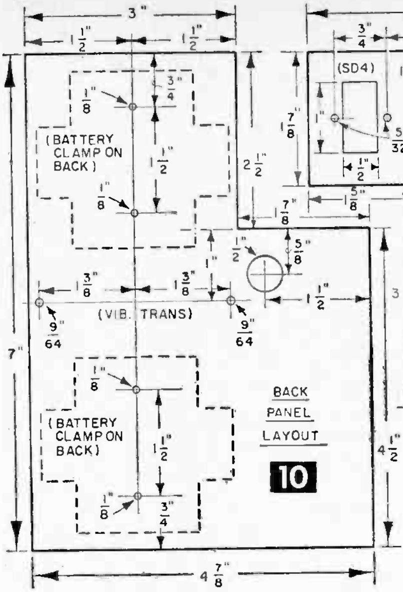
* Salvaged from "FR" Model I electronic flash unit

tion of light from the unit may vary. Convenience in handling is provided by a handle on top and aluminum angles for the *ac* cord.

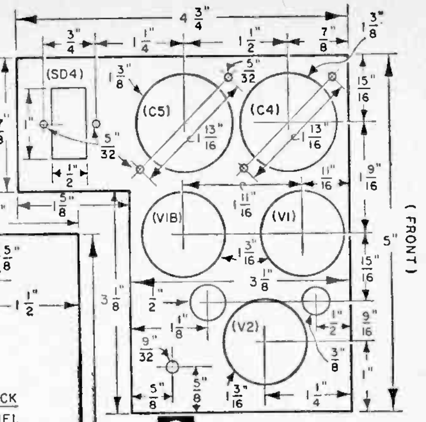
Figure 3 shows a top view of the unit. The batteries are accessible from the back of the case for replacement. Only about 40 or 50 flashes can be secured from a set of "D" cells, and the unit should be used on *ac* whenever possible. If it is to be used on battery, the main capacitors should be charged initially on *ac*, particularly if the unit has been standing for some time.

Figures 4 and 5 show construction details. To get all components into the cabinet, it is necessary to use dual-panel construction, which requires pre-wiring before assembly. In practice, parts are mounted on the front panel and chassis, and these units are fastened together and wired, leaving long leads going to other components which will be mounted on the back panel. Then parts are mounted on the back panel, as shown in Fig. 6, and wired as shown. Capacitors and resistors can be mounted on mounting boards or with terminal strips. The back panel is then attached to the chassis and wiring completed.

Notice that the ignition coil is mounted on the flash head. Extremely high voltages (several thousand) are present in the output of this coil,



10

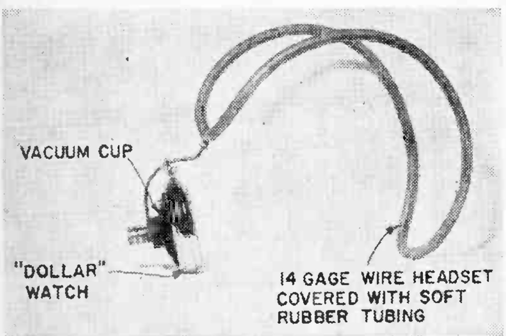


9 CHASSIS LAYOUT

and mounting it on the flash head reduces insulation problems.

Figure 7 shows the wiring arrangements on the front panel and chassis. Miniaturized components should be used, if available to meet specifications, to permit adequate wiring space. Figures 8, 9 and 10 show the layouts of the panels and chassis. The chassis layout shows space for two main capacitors as salvaged from a commercial strobe unit. If a single unit is used (as the alternate mentioned in the Materials List), it can be mounted in the center of the space shown for the two units. Both the chassis and rear panel are made of scrap aluminum and fastened to each other and to the front panel with small sections of aluminum angle.

Ticking Headset for Split-Second Photo Timing

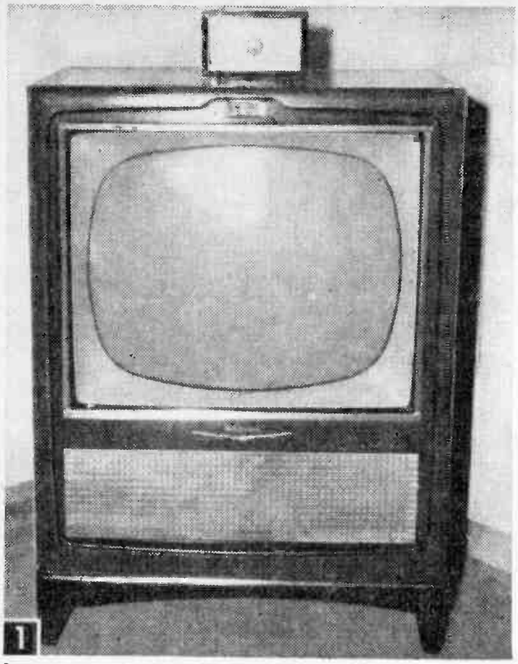


• There's no need to keep your eye on a timer while you are busy at the printer, enlarger, or camera with a ticking headset. Timing is more accurate, because most watches tick four times per second and you simply count the ticks for split-second timing. Also, the inexpensive pocket watch used saves the cost of a special photo timing clock.

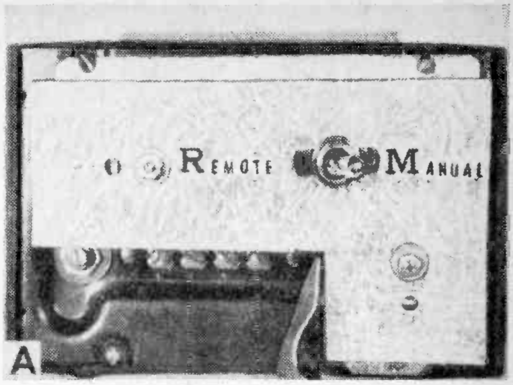
Bend a double headband from 14-gage solid copper wire, or from a wire coat hanger. Slip soft rubber tubing over the wire before you twist the wires together. Form an eye in the free end of the wire and fasten under the thumb-nut of a 1¼ in. diameter vacuum cup which has a screw molded into the rubber. When wetted, the vacuum cup will stick securely to the smooth back of a pocket watch. However, as an added precaution, slip the headband wire through the loop on the winding stem of the watch before sticking the cup to the back of the watch, as shown in photo.

If you use a wrist watch instead of a pocket watch, you can dispense with the vacuum cup. Just staple a small block of wood to the headband so that the wrist watch can be strapped to the block.

Some wrist watches tick faster than pocket watches, so count the number of ticks in a five-second period to determine how many ticks there are in one second.—Arthur Trauffer.



Just about all you do to control your TV antenna rotator from your armchair is to look at it—and flick a switch after having set the switch on the remote unit (see A, above right) to Remote.



ROTATOR Remote Control

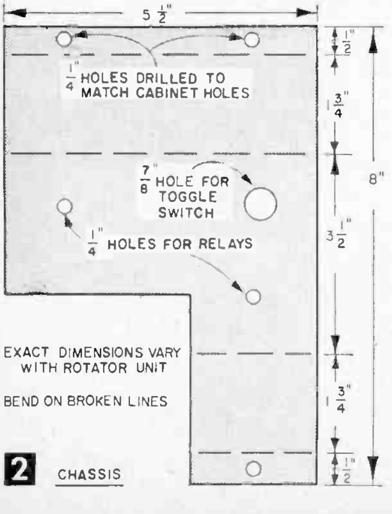
By HOMER L. DAVIDSON

SINCE the TV receiver has become remotely controlled, the owner usually likes to remain in his easy chair and control everything from there. But nothing has been done about the lonely rotator control box that sets on top of the set. Sometimes when the television receiver is moved to another location, the rotator control box remains behind. Then, when a desired distant station is in a different direction you still have to get up and operate the rotator control box. So here's the solution to that problem: a rotator remote control.

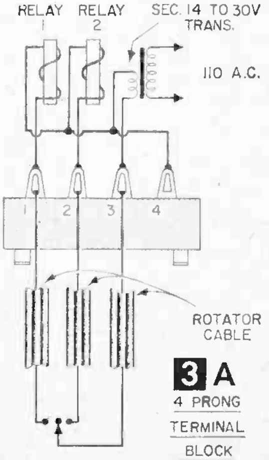
Generally, the indicator on the rotator control box gives a direction of rotation, but does not pin-point it. The operator watches the picture on the screen for indication that he is approaching the direction of the station or passing it. With this in mind, the remote rotator control operator simply pushes the switch to right or left and watches the picture on the screen. The small remote box that he uses is nothing more than a single-pole, three-position rotary switch. A standard 4-conductor rotator cable is used to hook the remote box to the relays on the back of the rotator control box.

Any manually operated rotator, regardless of make, can be wired as described in this article; connections shown in the Figures are those made to an Alliance T-12 control. The chassis will vary in size and dimensions depending upon what manual rotator you have.

Pick up a small sheet of Reynolds aluminum at your local hardware store to form the chassis for the control unit and drill two ¼-in. holes in it (see Fig. 2) and a ⅞-in. hole to mount the toggle switch. After the chassis has been cut and drilled, bend it to house the small relays. Then drill the chassis mounting holes. I bent my unit so that the mounting holes and screws for the rotator unit's plastic case attachment could also be employed to fasten the small



2 CHASSIS

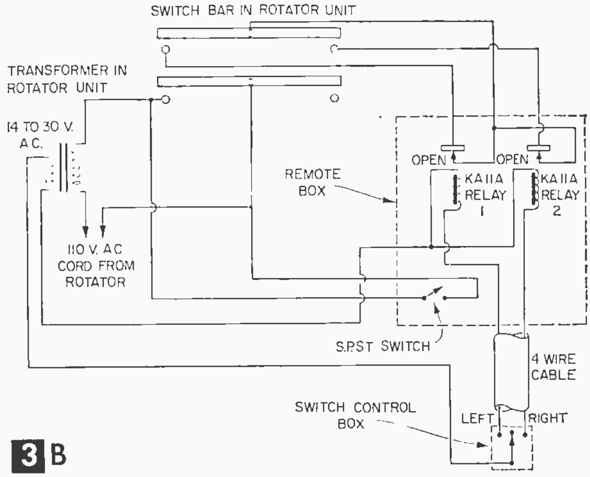


3A 4 PRONG TERMINAL BLOCK CONNECTIONS

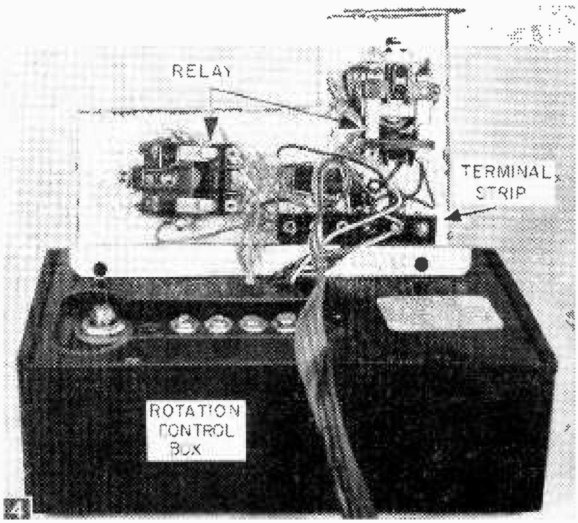
MATERIALS LIST—ROTATOR REMOTE CONTROL

No. Req'd	Description
1	single-pole, 3-position rotary switch (No. 12B579)*
20'	4-conductor antenna rotator cable (No. 2B20, Belden type 8464)
2	Potter and Brumfield KA11AY DPDT relays (No. 19A1424)
1	SPST toggle switch (No. 12A403)
1	Jones solder type terminal strip (No. 12A1584)
1 pc	6 x 8" aluminum 1/16" thickness, or to suit antenna rotator unit

* (all catalog numbers are those of Burstein-Applebee Co., Dept. SM-8, 1012-14 McGee St., Kansas City 6, Mo. The antenna rotator adapted in this article is the Alliance Tenna-Rotor T-12, No. 4W172)



3B



4

chassis of the remote unit to the control case.

After the two relays and the toggle switch have been mounted, solder a lead to one side of each coil of the relays and run this directly to the terminal block (see Fig. 3A and 4). Tie the remaining two leads of the coil connections together and tie to one of the remaining outside lugs on the 4-lug terminal block (see Fig. 3A). Next, solder the first three terminal lugs to the flat rotator wire.

The small toggle switch actually switches the *ac* current into the primary circuit of the rotator transformer. These two wires are soldered in parallel with the strip switch of the original control box. The relay point-contact connections are soldered across (in parallel) with the strip switch that, when pressed down, activates the direction of the small rotator motor (see Fig. 3B). It is best to just parallel these wires and when hooking them to the remote control switch they can be switched so that the rotator turns in the right or left direction.

In most rotators when the switch is turned right or left, the 110-*v ac* is applied to the transformer and the rotator motor connections are wired so the motor will go to right or left when so pressed. With this remote control, you simply turn the switch to Remote (see Fig. 1A), then remain seated the rest of the evening. When through using the remote control, switch the unit back to Manual.

After the wiring has been completed, the unit is ready to be checked out. Do not screw the chassis to the rotator control box until the unit has been completely tested. First check over the wiring, then throw the toggle switch to the Remote position. Press the remote control switch to the "right" position. The needle on the control box should move in this direction. If not, simply reverse the two wires in the control box. Now try the unit to the "left" position. (The relays used are very quiet and do not chatter when in operation.) Finally, turn the rotator a complete rotation in both directions.

This Makes Used Volume Controls as Good as New

When a radio set needs a new volume control and it cannot be obtained, the old one can be made to give service as well and as long as a new one. All that is needed is to apply a thin coating of carbon in liquid form and allow it to dry thoroughly, after which one drop of some good machine oil is put on the control and the control rotated for a short time until the oil has been distributed in the form of a thin film over the carbon coat. A drop of oil will also give longer life to new controls.—HAROLD H. PEER

• According to a recent survey taken of U. S. married couples, TV viewing has virtually eliminated family quarrels. Reason: 50% of those surveyed stated they no longer spoke to their wives in the evening; the other 50% no longer spoke to their husbands.

Two Tin-Can Megaphones

"Calling all cars, calling all cars, go to Vine and Cherry and pick up two young men riding on a bicycle." This could be the voice of any youngster, perhaps one of your children, using these small megaphones

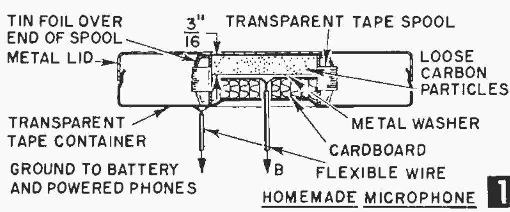
By
HOMER L. DAVIDSON

Experimental jobs, the two tin-can megaphones for which plans are given in this article will afford children a lot of fun.

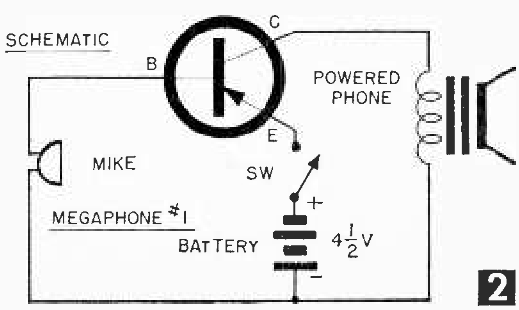
THESE experimenter's projects, from which surprising results have been obtained, can be used as megaphones or as portable microphones. Voice clarity is quite good and volume is good enough for the purpose intended.

The first megaphone (Fig. 2) uses only four major components: a small homemade mike, a 2N255 power transistor, 4½ *v* batteries, and a surplus, powered phone. The microphone requires the most work, but by building it yourself, you'll save roughly the $5 a commercial button would cost. First, secure a small, thin, metal container such as those used for transparent tape. The spool on which the tape was rolled will serve as the heart of the microphone. Glue it to the bottom of the metal container and fill the core of the spool with corrugated cardboard spacers. Place a metal washer over this assembly and drill a small hole through the center of the metal container. Solder a length of flexible wire to the washer and push it through this hole. Glue washer and cardboard spacer in place, leaving about 3/16 in. space at the top of the spool. Solder another short length of flexible wire to the container. (Be sure to scrape off paint so a good contact can be made.)

Now remove the core from a small discarded flashlight battery and crush the carbon into very small particles. Scoop these up and place them in the depression above the washer in the tape container (see Fig. 1). Do not pack them tightly, but fill the space. Place a piece of tin foil over the assembly, put lid in place, and test the unit. Some granules may have to be removed for best results.

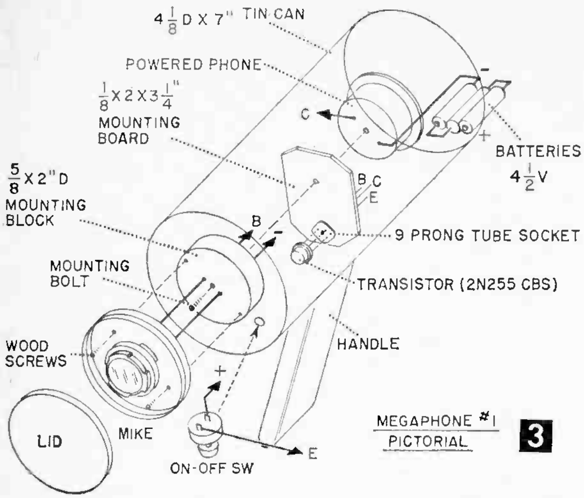


HOMEMADE MICROPHONE **1**



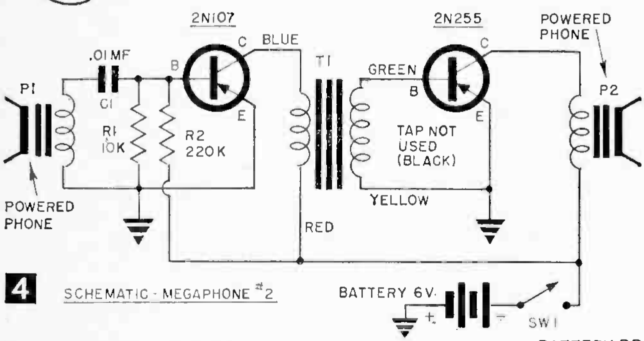
2

Mount the transistor and powered phone on the fiber board as detailed in Fig. 3. Remove the bolt that holds the powered phone together and substitute a larger one that will clear the small wood block, fiber board, and powered phone. (The small wood block prevents the transistor from shorting against the metal container.) Mount a 9-prong wafer tube socket on the other side of the power transistor to plug the power transistor into, and insert the three penlite batteries



MEGAPHONE #1 PICTORIAL **3**

MATERIALS LIST—TIN-CAN MEGAPHONES	
Megaphone No. 1	
Desig.	Description
Microphone	homemade (see text and Fig. 1)
Speaker	powered phone (surplus)
Transistor	2N255 CBS power transistor
Battery	3 penlite cells & holder
Switch	SPST rotary
Megaphone No. 2	
P1 & P2	powered phones (surplus)
C1	.01 mfd paper capacitor, 200 v
R1	10K fixed resistor, 1/4 watt
R2	220K fixed resistor, 1/4 watt
T1	Argonne AR173 interstage transformer
TR1	2N107 GE transistor
TR2	2N255 CBS power transistor
Battery	6-v Eveready
Switch	Rotary SPST switch



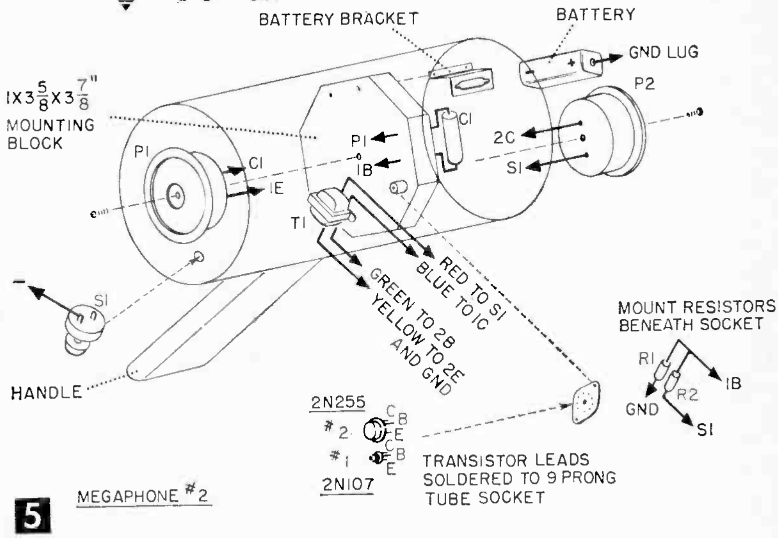
4 SCHEMATIC - MEGAPHONE #2

bolts that hold the plastic cases to the power phones and substitute larger ones. Countersink bolt heads so that other components mount flat against the pine board. A small rotary switch taken from a volume control turns the unit Off and On. If feedback occurs on this model, reduce the value of R1 until the howl disappears.

On both megaphone mikes you must talk directly into the microphone. If the carbon granules of the homemade mike (Megaphone No. One) pack, hold the unit down and talk into it or give the case a tap to jar them loose again.

into standard holders mounted near the end of the large, juice-type tin can (4 1/8-in. dia., 7 in. long) so that they are easily accessible.

Megaphone No. Two. This megaphone has more volume and slightly greater voice clarity than the first. A second transistor is used for amplification and a surplus, powered phone is employed as the mike. This mike is capacity coupled to the base circuit of TR1 (see Fig. 4). An interstage coupling transformer couples the two transistors together, the output signal is fed directly from the power output transformer into the surplus phone. No output transformer is needed. This megaphone is also mounted inside a large size juice can.



MEGAPHONE #2 **5**

First mount all components on a piece of white pine (see Fig. 5). Mount the power transistor and one surplus phone on one side of the pine board, the other phone and the small battery on the other side. Remove the small

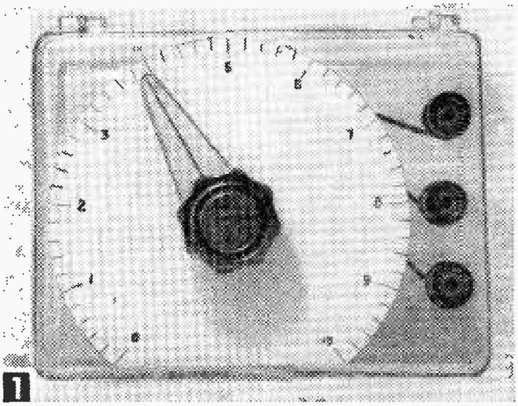
Hot Tip for Soldered Joints

• When soldering wires and cables in a radio receiver, immediately after the iron is removed from the soldered joint, paint the joint with lacquer-thinner, using a small brush. The rosin flux will evaporate immediately, leaving a clean joint and cold-soldered joints will show up immediately, preventing future trouble.

Calibrated Potentiometer

Precisely calibrated, an 82¢ pot is worth 10 times its purchase price

By FORREST H. FRANTZ, SR.



This precise calibrated potentiometer has many practical and time-saving applications. It can be built for less than $2.

THOUGH inexpensive, simple, and versatile, this calibrated potentiometer can be used to do precise measuring jobs, as a calibrated voltage divider, as a Wheatstone bridge element, as a precise circuit control, as part of a reactance measurement circuit, as a circuit substitution element, and in numerous other applications.

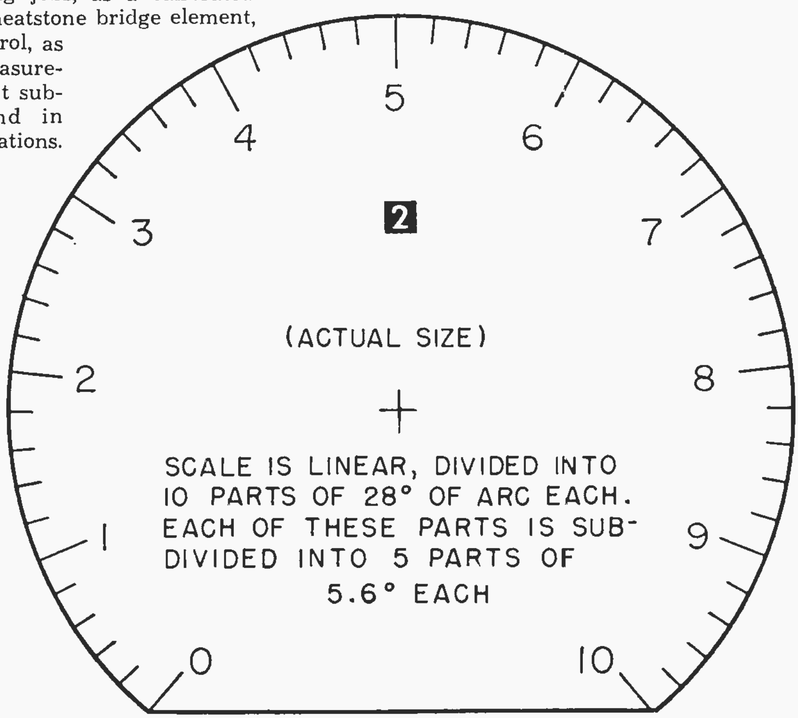
The potentiometer adapted is a Clarostat type 58C1. It has an electrical rotation of 280° and a mechanical rotation of approximately 300° due to the metal wire retainers at the ends. Type 58C1 was chosen because it has an independent linearity of plus or minus 1%. Since most potentiometer applications involve a voltage divider scheme, 1% is usually the maximum overall error. The total (end-to-end) resistance, however, is only within plus or minus 5% of the stated value.

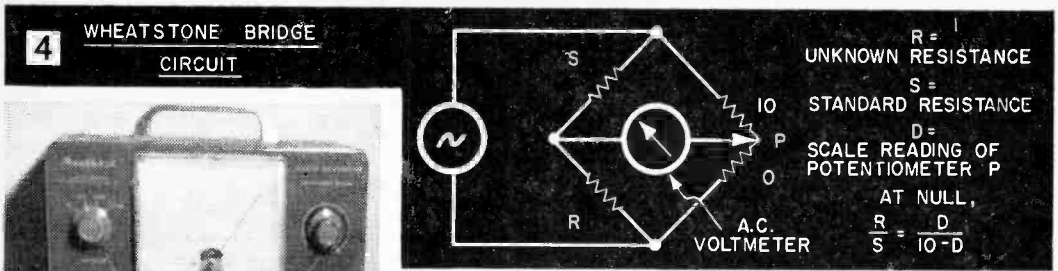
If you're going to use your calibrated potentiometer in rheostat fashion as a variable resistor, measure its total resistance with a Wheatstone bridge and record this value on the dial scale (Fig. 2). The actual resistance for any setting of the dial—when the zero and center terminals of the potentiometer are used—will then be the dial setting times the total resistance divided by 10. If you don't have access to a Wheatstone bridge (your parts distributor, the local high school, or your phone or power company in smaller communities may have them), you can determine the total potentiometer resistance by comparison with reasonably accurate resistances on the ohm scale of a vacuum tube voltmeter.

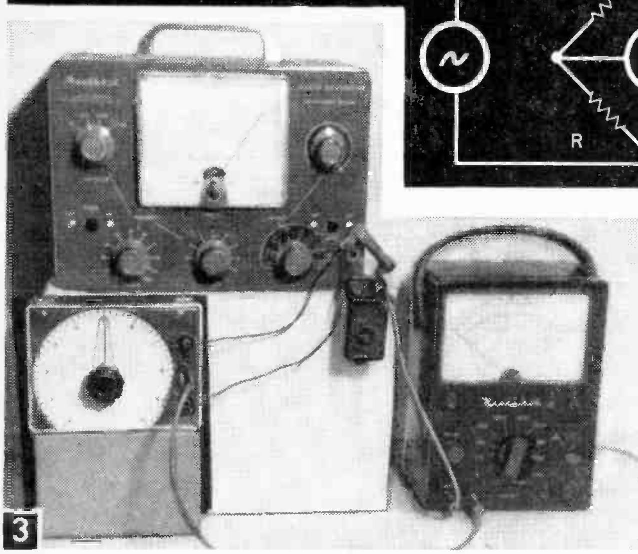
Begin construction by mounting the potentiometer in any box you have available with a front panel 3¾x5 in. or larger. I used a plastic box (see Materials List). The potentiometer mounting hole is ⅜ in. Copy, cut out and paste down the scale given in Fig. 2 on the case. Use Carter's Rubber Cement and be sure to force out all air pockets between the scale and box. Also be sure to align the scale center hole and the potentiometer mounting hole on the panel accurately.

Now place the potentiometer shaft in a vise (to avoid damaging the control), saw the shaft to a length of ½ in. and mount potentiometer and binding posts on the panel. The wiring is simply a connection from each potentiometer terminal to a binding post (see Fig. 1).

Make the hairline on the plastic piece used as a pointer by scratching a straight line through the knob center line with an ice pick or other







The calibrated potentiometer can be used as a Wheatstone bridge element for precise resistance measurements (see Fig. 4).

sharp instrument and filling the scratch with India ink. Attach this pointer to the knob with Duco cement, being careful to align the hairline accurately with the knob's center hole.

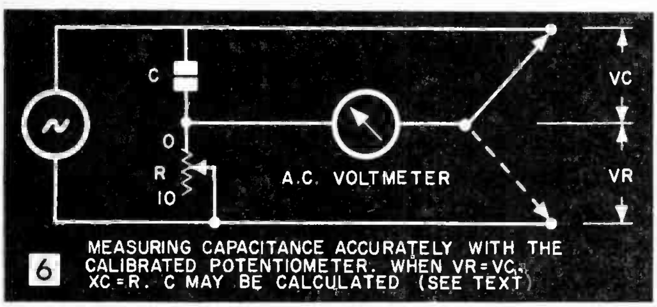
Place the knob-pointer assembly on the potentiometer shaft and fasten it so that it overrides the 0 and 10 marks by equal amounts. The knob set screw may have to be loosened and the knob reset several times before this is realized. It is, however, the only calibration required.

You'll find it convenient to build several calibrated potentiometers. Suggested values are 10, 100, 1K (1000), 10K, and 50K ohms. (The 50K pot will cost you $1.44; the rest, 82¢ each.) They will extend the utility of all of your other instruments considerably. Figures 3 and 4, for example, show the potentiometer in a Wheatstone bridge circuit for measuring resistance accurately. The unknown resistance R is found with this formula for the null (zero) condition on the voltmeter:

$$\frac{R}{S} = \frac{D}{10\text{-}D}$$

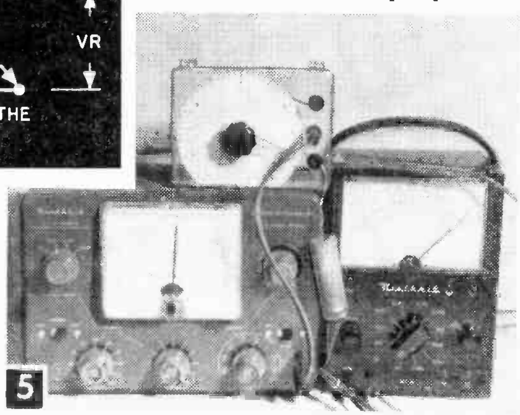
This formula for a null on the voltmeter reading holds true for readings where S is the standard resistance and D is the potentiometer (P) dial reading. Greatest accuracy is realized when R is nearly equal to S. You can get a rough idea of the value of R with your ohmmeter. If you have several calibrated potentiometers and if you know the total resistances accurately, you can readily use one of these to obtain the desired value of S. This should immediately suggest the alternate scheme of setting potentiometer P at 5 and adjusting S for null. Then R equals S. I've shown an audio signal generator as an energy source for the bridge because this is the handiest source if you have one. A battery may just as well be used with the meter switched to a *dc* current scale.

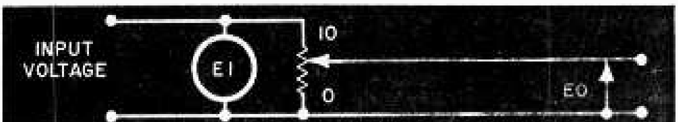
Figure 6 shows the circuit for determining capacitance with the calibrated potentiometer. Several methods are possible. The fastest is to use an audio generator set to 15,900 cycles. Adjust R till the voltage drop measured across R equals the voltage drop measured across the unknown capacitor. The capacitance C in microfarads is then 10, divided by R in ohms. The mea-



MEASURING CAPACITANCE ACCURATELY WITH THE CALIBRATED POTENTIOMETER. WHEN VR = VC, XC = R. C MAY BE CALCULATED (SEE TEXT)

The calibrated potentiometer, a source of *ac* voltage, and a multimeter are used to measure capacity.





7 THE POTENTIOMETER WITH ITS ACCURATELY CALIBRATED SCALE IS A PRECISION VOLTAGE DIVIDER

MATERIALS LIST—CALIBRATED POTENTIOMETER	
No. Req'd	Description
1	potentiometer (Clarostat type 58C1—specify resistance value desired)
1	plastic box (Lafayette MS-162)
3	binding posts (ICA 623)
1	knob (ICA 244 or equivalent)

sured capacitance may be in error by about 10%, although with an accurately calibrated signal generator and a high-impedance, ungrounded meter you can realize more precise results.

The most accurate method is to use a 25- or 30-*v* filament transformer for your signal source. Adjust R for equal voltage drops across R and C as before. Then C can be calculated from

$$X_c=\frac{1}{2\pi fC}$$

since resistance $R=X_c$ for this condition. Therefore C in farads equals 1/377R where R is the resistance and the *ac* line frequency is 60 cycles.

Another use for the calibrated potentiometer is as a precise voltage divider. The circuit is shown in Fig. 7. The output voltage Eo in terms of the input voltage Ei is Eo=(D/10)Ei where D signifies the dial reading. This arrangement is equally satisfactory with *ac* or *dc*.

There are two points to remember in connection with the voltage divider application:

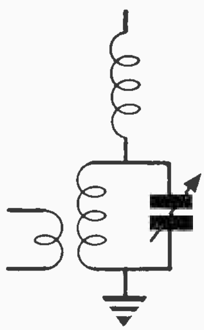
1) The formula given will hold to within approximately 1% if the load resistance connected across the output terminals is 20 or more times greater than the total resistance of the potentiometer used. If the load is resistance and is only 10 times the total potentiometer resistance, the error becomes approximately 2% if the potentiometer is set between 6 and 7 (where maximum loading error occurs). If the load-to-total-potentiometer-resistance ratio decreases further, the accuracy of the formula also decreases.

2) The 58C1 potentiometers are rated at three watts dissipation. Be careful not to exceed this. You may not burn out the potentiometer if you do, but it may damage the unit sufficiently to corrupt the accuracy of your calibrated potentiometer. The maximum voltage that can be applied across the potentiometer total resistance without exceeding the three-watt limit is $1.7\sqrt{R}$ where R is the total potentiometer resistance. This assumes a negligible load (20 times R).

DECCA

160's Last Chance?

By C. M. STANBURY II



THERE was a time when the radio amateur and the SWL who tuned the amateur bands, could take advantage of every DX challenge, medium wave, short wave and VHF (such as it was before World War II). But during WW2 all amateur radio operations were suspended and when they were resumed, MW operators were forced to share 160 meters with a new, noisy and fast growing radio service, LORAN. From that day until this, the band has steadily declined. It almost reached rock bottom when, about six months ago, the frequencies assigned for amateur use were cut from 100 kc to only 50 kc—because of another LORAN chain. It is fortunate coincidence that at that same time a new radio-navigation system was being introduced in North America: DECCA. This is a widely used system in Europe and has kept the ear-splitting LORAN buzz off 160 in that part of the world. It could do the same over here. A chain is already in operation along Canada's East coast.

Fourteen Years of Neglect. Although Decca was invented by two Americans, it was developed in England and up until now has never been used here. The system literally had a baptism of fire. It was first used on June 6, 1944, D-day, and was instrumental in the success of the Allied invasion of Europe, guiding the vast invasion armada through the few channels swept clear of enemy mines.

The first permanent chain was put into operation in 1946. And it is at this point that we can start raising our eyebrows. The U.S. Navy publishes a complete listing of radio navigational aids. The last edition was published in 1955, eight supplements have been issued since to keep it up-to-date. The publication contains all LORAN stations. It even goes so far as to list stations of a European system called CONSOL. (From the standpoint of accuracy, CONSOL is inferior to both LORAN and DECCA.) But for the U.S. Navy, if we are to judge from this publication, DECCA does *not exist*.

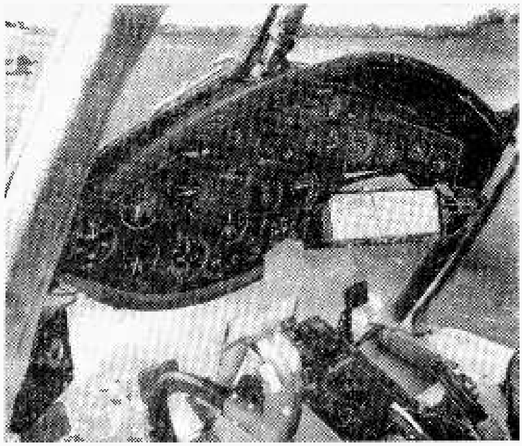
Decca vs. Loran. Each DECCA system consists of four stations, a "master" and three "slave" stations designated red, green and purple. By measuring the phase difference between the master and any two slave stations, a navigation fix is obtained and position automatically plotted on a gridded chart. Its operation sounds simple and it is, much simpler than that of LORAN.

For navigational purposes, DECCA is as good, if not better than LORAN. While LORAN may have an edge in range, the accuracy of DECCA is unbeatable—it is measured in yards! DECCA is so far advanced as a medium-range aid that LORAN is not considered as competition.

From the point of view of the amateur or DX listener, DECCA is ahead all the way. First it does not now use the 160-meter band, operating instead between 70 and 130 kc. Second, each LORAN chain has a band width of 100 kc, while DECCA stations use unmodulated carriers. Thus, if these stations were to use 160 meters, which is unlikely, the interference would still be less.

The Future. There is, of course, no assurance that DECCA will ever replace LORAN in the U.S. This is true despite the fact that an experimental chain has been set up at New York, because millions of dollars have been spent on LORAN transmitting and receiving equipment. On the other hand, DECCA is somewhat cheaper and it is conceivable that a gradual changeover would save money for everybody concerned over the long run. This possibility becomes a probability when you realize that LORAN costs are going to increase for the user. Much of the present receiving equipment is war surplus and, when it wears out, replacements will be new, full-price sets.

Then there is the distance edge held by LORAN. Balancing this off is DECTRA, a new long range



Decca Navigator and Flight Log installed in a Bristol 171 helicopter of British European Airways. The map moves vertically on rollers, in scale with plane's forward speed. Lateral movements are traced electronically by a pen that gives the plane's second-by-second position with faultless precision.

version of DECCA. This system is being used experimentally by Pan American and a number of other airlines on their North Atlantic flights. Should DECTRA work out, and the odds are good that it will, there is little doubt that the DECCA systems will *eventually* replace the present aeronautical systems. The public will only stand for so many Grand Canyon disasters before it demands—and gets—action. From there it is only a short step to the complete deletion of LORAN.

But the biggest question mark of all is the amateur himself. At the moment his interest in the band is almost nil. In order to hold any amateur band it must be used. If this indifference continues, the amateur will not only fail to regain what he has lost on 160, he will undoubtedly lose what he has left on Medium Wave.

THE DECCA BAND IN NORTH AMERICA

K C	Exact Frequency	Chain	Station	Location
70	70.384	Newfoundland East	Purple Slave	Comfort Cove
	70.98	Newfoundland West	Purple Slave	St. Lawrence
	71.142	Nova Scotia	Purple Slave	Ecum Secum
	71.4375	Quebec	Purple Slave	St. Felix-de-Valois
80	84.461	Newfoundland East	Master	Port Blandford
	85.18	Newfoundland West	Master	Ramea Island
	85.370	Nova Scotia	Master	Chester Basin
	85.725	Quebec	Master	St. Raymond
110	112.615	Newfoundland East	Red Slave	Shore Cove
	113.57	Newfoundland West	Red Slave	Cape Ray
	113.827	Nova Scotia	Red Slave	Alma
	114.3	Quebec	Red Slave	Lac Bouchette
	117.1575	Quebec	Purple Slave(extra/ID frequency)	St. Felix-de-Valois
120	126.691	Newfoundland East	Green Slave	St. Lawrence
	128.055	Nova Scotia	Green Slave	Jordan Bay
	128.5875	Quebec	Green Slave	St. Camille

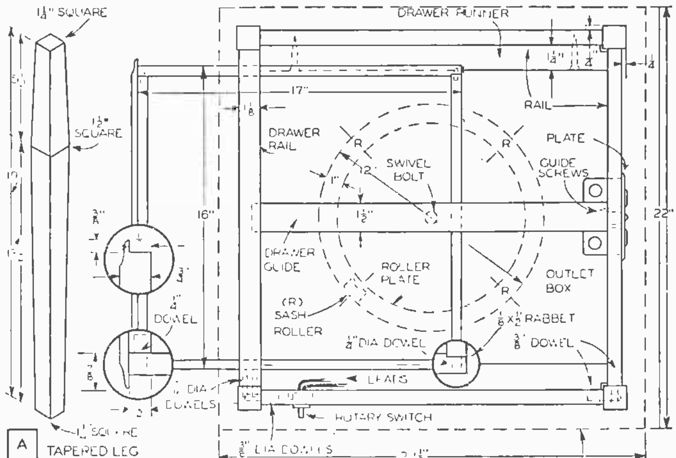
Versatile TV Stand

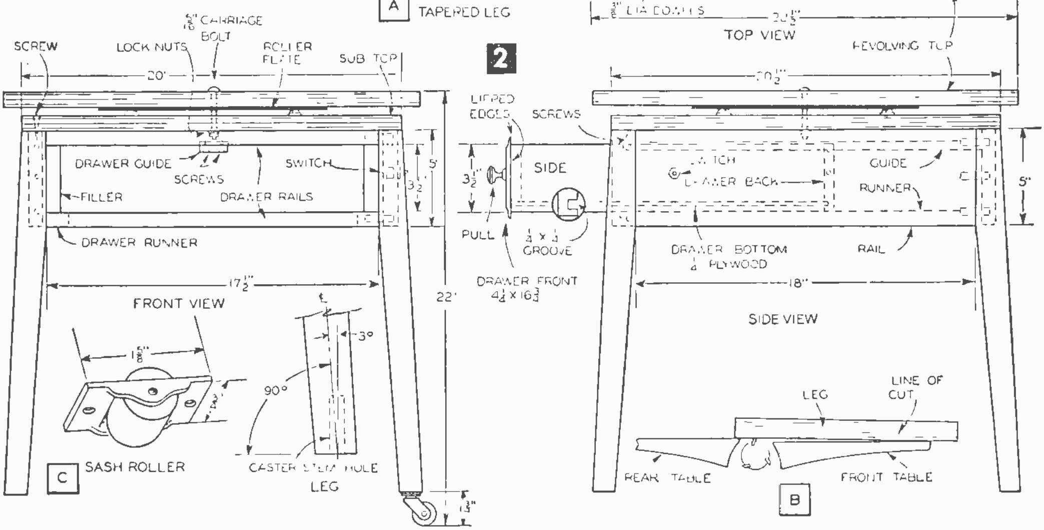
Portability, indirect lighting and a storage drawer make this stand a valuable companion for your TV set

By FRANK HEGEMEYER

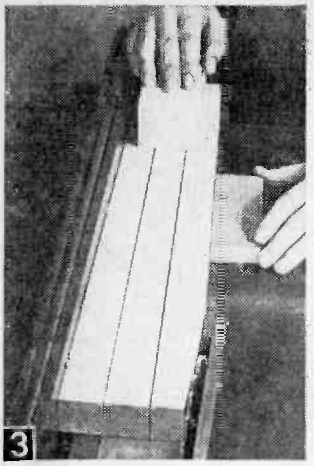
THIS television stand has a revolving top, a drawer for TV programs, indirect lighting for balancing room illumination with the screen brightness plus casters for easy wheeling to other room locations. The stand, patterned after furniture of the Hepplewhite period, was designed primarily for a 17 in. television set having a case measurement of 20 wide by 20½ in. deep. You can easily adapt it for the larger 20 or 21 in. sets by simply increasing the size of the revolving top in which it is cut, to extend 1 in. beyond all four sides of the case. Use a close-grained hardwood finished to match the television case, or to blend with cabinets finished in a solid tone.

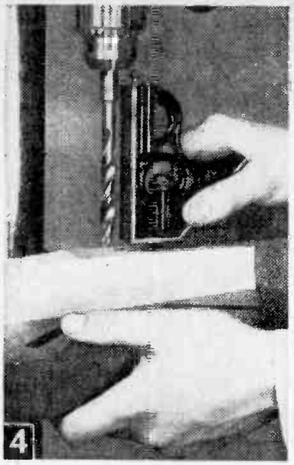
Note that the legs have a double taper (Fig. 2A). First make full-length tapers on a jointer with the setup shown in Fig. 2B. Tapering is done by simply lowering one end of the leg onto the rear table when starting the cut. To prevent tearing the work, form the tapers in a series of cuts until the 1¼ in. square





2



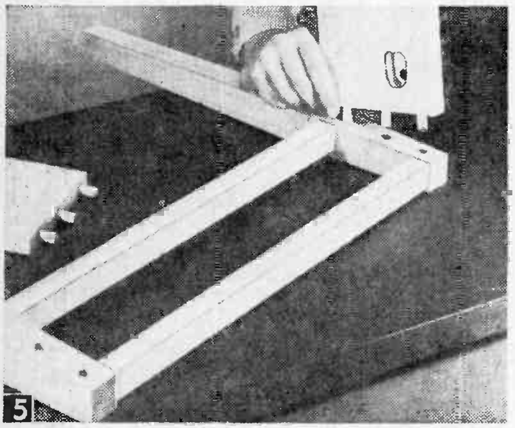


Left, when cutting the short tapers, the narrow parts of the legs face towards the operator. Note push block used to advance all three legs forward simultaneously.

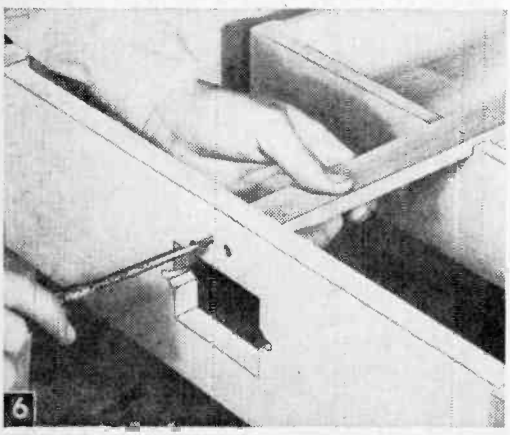
Right, dowel holes in the legs should be bored at true right angles to the face side of the short tapers, using a spur bit for making the holes.

dimensions are reached on the lower end of the legs. The short tapers (at the upper end of the legs) are made on two adjacent sides only, which in this instance are best cut on a circular saw (Fig. 3). Position your fence 4½ in. from an inside tooth and sandwich two of the previously tapered legs between the fence and the leg to be short-tapered. After this taper is cut, turn the leg over to make a similar taper on an adjacent side. Then repeat the process with the other three legs.

Next, form the sides, back and drawer rails, and then cut a rectangular opening in the back rail for an outlet box, and an inside mortise in the right rail towards the front for insertion of the light-control switch (Fig. 2). Dowel holes are bored in the rails first and then spotted (preferably with dowel centers) on the short tapered sections of the legs. If these matching holes in the legs are made on a drill press, tilt the table slightly to the left, to square up the tapered surface with the bit (Fig. 4). To assemble these parts, first join the drawer rails and front legs together with dowels and a liquid hide glue to form a unit, then join the rear legs to the back rail. Then dowel and glue these two



Assembling right rail to front leg unit. Note mortise and thru-hole for mounting lamp control switch.



Drawer guide is attached with screws to the rear and top front drawer rail. Note notch cut in the drawer back for the guide.

MATERIALS LIST—TELEVISION STAND

No. Pcs.	Description	T (in inches)	W (in inches)	L (in inches)
4	Legs	1⅝	1⅝	19
2	Drawer rails	¾	1⅛	17½
2	Fillers	¾	1⅛	3½
2	Side rails	¾	5	18
1	Rear rail	¾	5	17½
1	Drawer front	¾	4¼	16¾
2	Drawer sides	½	3½	17
1	Drawer back	½	3½	15¼
1	Drawer bottom (plywood)	¼	15½	16½
2	Drawer slides	¾	1¼	18¼
1	Drawer guide	½	1½	18¾
1	Sub top (plywood)	¾	20	20½
1	Swivel top (plywood)	¾	22	22½
1	Roller plate (Presdwood)	⅛	12⅛	12⅛

MISCELLANEOUS ITEMS

No. Pcs.	Description	Size	L
4	Sash rollers (see drawing)		
1	Carriage bolt	5/16 dia.	2½
2	Lock nuts and 1 washer		
8	Dowels (for drawer rails)	5/16 dia.	1½
18	Dowels (for side and back rails)	⅜ dia.	1¾
12	Dowels (for drawer assembly)	¼ dia.	1
2	Drawer pulls		
4	Casters (swivel type)		
12	Misc. flathead screws (see drawing)		

ELECTRICAL PARTS

No. Pcs.	Description
1	Outlet box
2	Outlet box connectors
2	Convenience outlets
1	Convenience outlet plate (duplex)
1	12 ft. Appliance cord (14 gage)
1	Appliance plug (male)
1	Socket (keyless)
1	Tubular half shade
1	Mounting bracket (metal) see drawing
1	Tubular lamp (40 watt, T 10)
1	Rotary switch

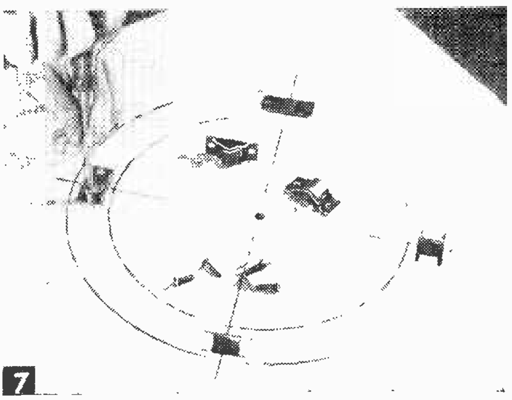
Note: Dimensions given are finished sizes. Parts are cut from solid stock unless otherwise specified.

units to the side rails (Fig. 5). Anchor the fillers in the drawer opening to the front legs with nails.

For the drawer, make the necessary rabbeting cuts for the corners, grooves for the bottom, and then fashion the lip on the drawer front (Fig. 2). Then assemble the parts by first joining the front and back to one of the sides, and then inserting the bottom in the grooves and adding the remaining side. Next, fit the runners and install the guide as in Fig. 6.

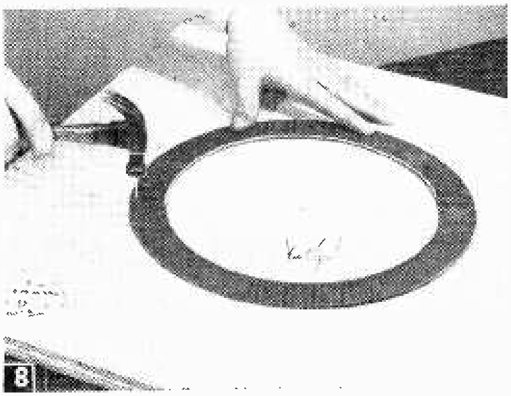
Fig. 2C shows the type of sash roller on which the revolving top rides. These rollers are installed in mortises cut in the sub top (Fig. 7), and the sub top is screwed to the legs. Next in order is the revolving top to which the roller plate (Fig. 8) is attached with brads. You mount this top on the sub top with a carriage bolt inserted through the pivot holes of these two members (Fig. 2C). Remember to oil the rollers and apply a thin coating of lubricating grease to the roller plate before using. When installing the casters, make certain the stem holes in the legs are bored on a true vertical (see front view in Fig. 2) or on a 3° angle from the leg center line. Boring them parallel with the center line interferes with the swiveling action of the casters. You can do this boring most easily after you have assembled the parts (minus the revolving top), if it is done on a drill press with the table set at the level position.

After sanding and finishing the wood, you can install the electrical units. The wiring hook-up (Fig. 10A) permits the television set to be operated as usual with its *On-Off* switch, while the lamp is controlled by a small rotary switch. To minimize eye strain, have the reflected light from the wall match the incident brightness of the picture screen. You can do this by using a 40 watt lamp and half shade (see Fig. 10B) for light walls, 60 watt for medium tones and 75 watt for dark-colored walls. A larger shade or reflector can be substituted for the half shade shown in Fig. 9 to fit the higher wattage lamps.



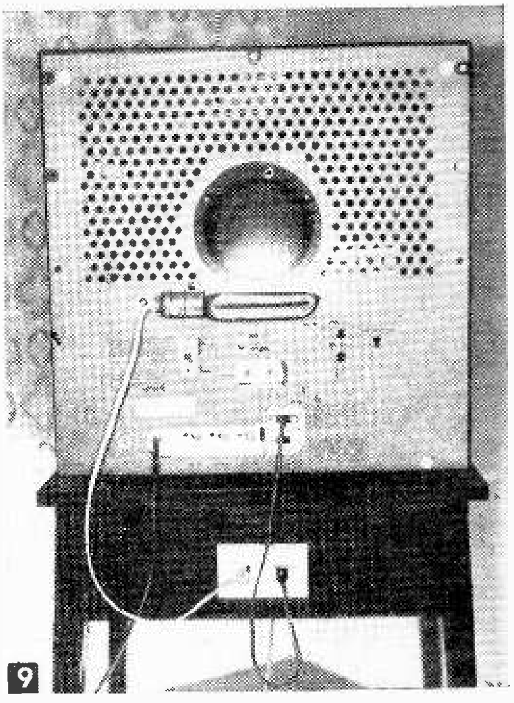
7

Attaching sash rollers diagonally to the sub top.



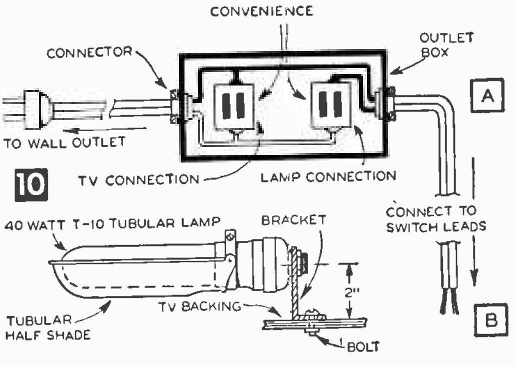
8

When bradding roller plate to the revolving top make certain it is positioned to coincide with the scribed circles shown in Fig. 7.

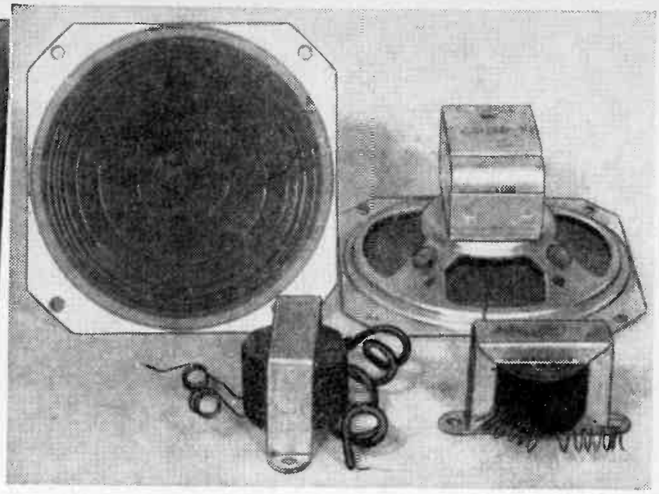


9

Keep wires connecting the lamp and TV set to the receptacles fairly short if you can. With this wiring hook-up it is necessary that only one cord be connected to a wall outlet.



10



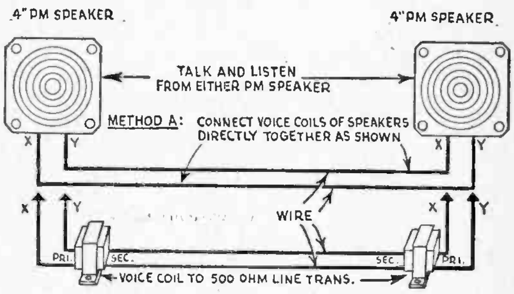
Left, cigar box with 4½ in. hole cut in bottom, then covered with leatherette, makes neat cabinet. Above, pair of 4 in. PM speakers and two line transformers make up this interphone.

Sound-Powered INTERPHONE

THIS simple interphone system requires no electrical source of any kind to operate. The voice itself generates the necessary power to operate the two-way communicating system. Operation of the interphone is based on the fact that any moving coil, placed in a magnetic field, generates a small voltage which varies with the vibration or movement of the copper coil. A PM type radio loudspeaker is just such a moving coil device. And while intended to reproduce sound impulses, it will, by the same token, transmit them. Of course, the volume of this system is not to be compared with an interphone outfit operating through several stages of amplification and it is not advised for use in a factory or other noisy location. But it serves well otherwise.

The only materials needed for construction are a pair of 4 in. PM speakers, a suitable length of lamp cord or two conductor bell wire, and two *voice coil to 500 ohm line* speaker transformers. However, before even buying the line transformers, try the speakers connected *direct* to the line. You may not need the transformers. Since this system depends upon speakers with strong magnetic fields, use a pair of PM units with the largest size magnets you can buy. Standard PM speakers are available with a choice of magnet power ranging from 0.68 to 1.47 ounces or more. The heavier the speaker magnet, the more volume you can expect from this interphone. Buy the *best!*

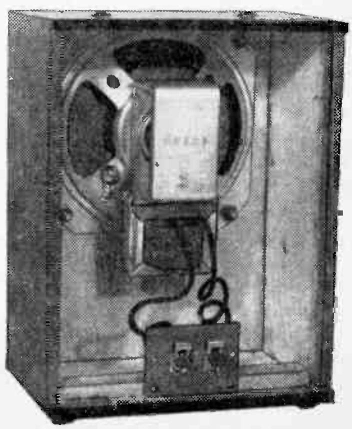
Each speaker is mounted in a small cabinet which may be a metal speaker box such as those sold by radio supply houses. Or this box can be home made (see photo). A pair of terminals at the bottom allow for easy connection to the line.—T. A. BLANCHARD.



METHOD B: INSTALL LINE TRANSFORMERS BETWEEN SPEAKERS

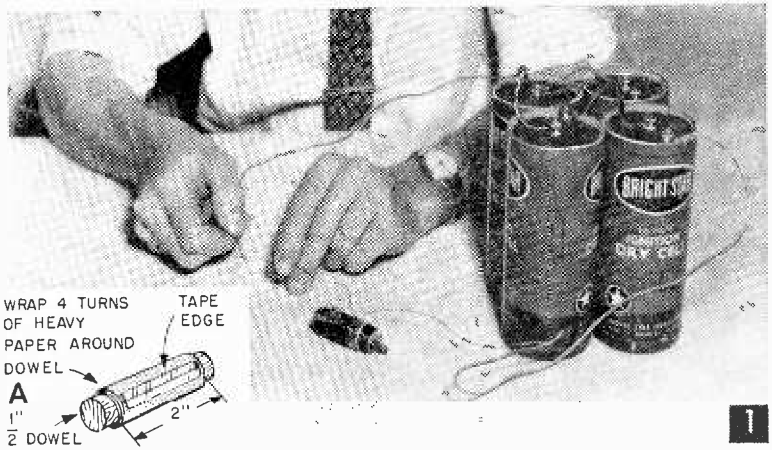
MATERIALS LIST
SOUND-POWERED INTERPHONE

2 PM Radio Loudspeakers, 4 in. dia. Quam type 4A15, with 1.47 oz., #5 Alnico, 3-4 ohm voice coil
2 Line Transformers; Thordarson type 22S80 universal line-to-voice coil. 500 ohm primary and 3.2 to 4 ohm secondary connections
2 Commercial or homemade speaker cabinets
4 Terminal clips, or binding posts
8 Speaker mtg. screws (6-32 x ½ in.)
1 Suitable length of transmission line (#18POSJ lamp cord)



Note in rear view (right) that cabinet contains nothing but speaker, transformer, and line terminals or clips.

The Making and Testing of Magnets

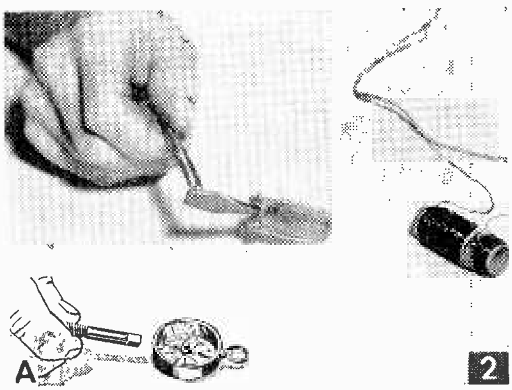


1

WHILE a simple magnet can be made by stroking a permanent magnet along a piece of hardened steel (as is demonstrated whenever someone makes a simple magnetic compass), stronger magnets are made by other methods. One often used method is to provide a coil into which the piece of hardened steel to be magnetized is placed. Then a source of d-c current is applied to the coil. The magnetic field surrounding the coil induces a strong magnetism in the piece, with a North pole at one end and a South pole at the other. Soft iron or steel will retain but very little permanent magnetism so hardened steel must be used.

To demonstrate this, make a paper cylinder by wrapping a piece of heavy paper about 2 in. wide over a ½-in. hardwood dowel, making about four or more turns around the dowel (Fig. 1A), and then fasten the edge down with transparent tape. Over this tube (with the dowel in place to keep it in shape), wind 200 turns of #24 enameled magnet wire, carrying it back and forth across the tube to make a uniform winding. Then remove the dowel after you have secured the end of the wire with some tape.

We now have a coil that will magnetize small hardened steel pieces or tools which will fit in the tube diameter. The source of power can be four dry cells connected in series to get 6 volts. Clean the ends of the wire down to the copper with fine sandpaper or by scraping. Then connect a wire from one side of the battery to one end of the coil. Provide a wire from the other side of the battery to go to the other end of the coil as a momentary contact switch. For a test piece, use a tap or a twist drill, which are always hardened steel. Place the tap in the coil and make two or three short contacts from the battery to the coil. Now remove the tap and you will find it so strongly magnetized it will pick up a screwdriver blade or other small tool from the bench as illustrated in Fig. 2. If you hold each end of the magnetized piece near a pocket compass, (Fig. 2A), you will find that one end is North and the other South.

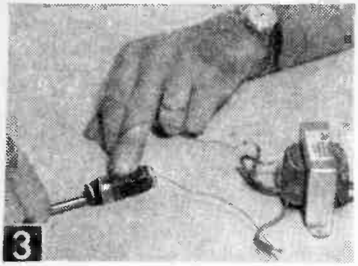


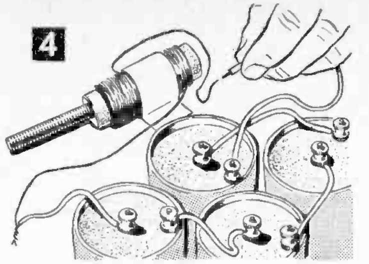
2

Now suppose that you want to demagnetize this tool, which you would want to do before using it again for tapping threads. Connect a 6.3 volt filament transformer to the line with clip leads and from its secondary, connect two leads to go to the coil. Place the magnetized piece within the coil and, during a few seconds, make two or three short applications of this a-c power. Then, while the coil is *still connected* to the transformer, slowly withdraw the tool (Fig. 3). A test will show that the magnetism is gone. The alternating current by its constant and rapid reversals tends to knock out magnetism. This is the principle used with demagnetizers.

Alternating current can also be used for magnetizing, but not so satisfactorily as d-c from a battery or other power supply. To prove this, place the tap back in the coil and then make two or more short applications of power from the transformer to the coil. Then, with the power *off*, remove the piece. Unless you happened to interrupt the current at the zero point of its a-c cycle, some magnetism will be induced in the piece. If the point of cutoff happened to be at the maximum point or peak of the cycle, the induced magnetism will probably be as strong as that from the battery power.

Demonstrating a Solenoid. The principles of a solenoid can be demonstrated with this same coil. Solenoids are used in many types of control equipment for operating valves, plungers and



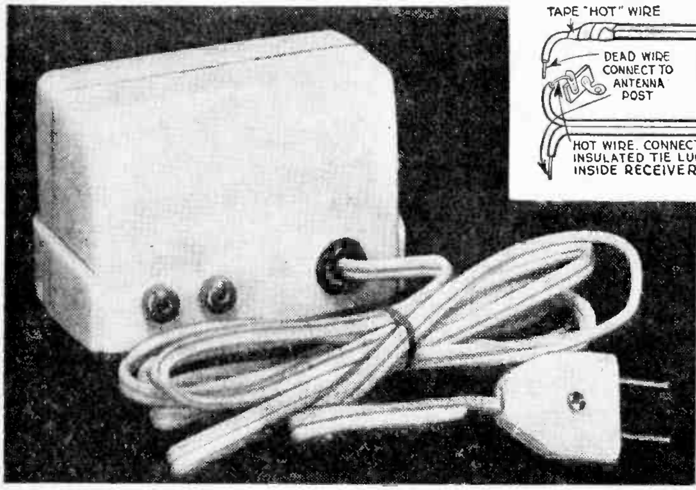


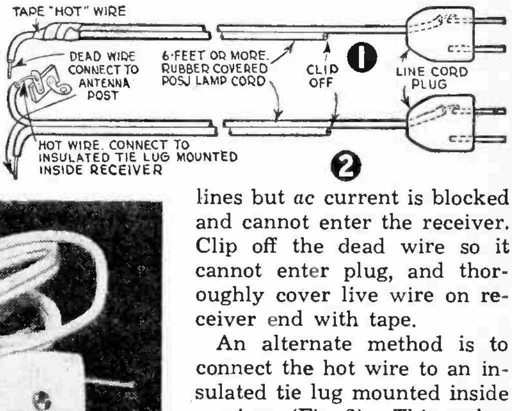
Now you can make the battery contact (Fig. 4) and the piece will snap in to a point beyond the other end and then will come to rest centered in the coil.

This shows the principles of a d-c solenoid. Parts to be operated, like opening or closing a valve, are connected to the plunger and can thus be operated by remote control. Alternating current can also be used for a solenoid as you can demonstrate by connecting the filament transformer to the coil and repeating the experiment. However, a-c solenoids usually employ laminated cores if they are to be used to any extent. This is because the a-c develops eddy currents in the core and this causes excessive heating. Laminating breaks up these eddy currents which results in the core running cooler.—H.P.S.

others too numerous to mention. When a source of either a-c or d-c is applied to a coil such as we have made, the tendency is to cause a piece of iron or steel to be suddenly drawn into the coil, until it is magnetically centered. Try connecting the battery to the coil with one lead open for a switch and place a short piece of iron, such as that cut off from a ¼-in. bolt, so it just enters one end of the coil. Tape coil to the bench so that maximum pull can be observed.

Power-Line Antenna for Crystal Set





HERE'S a simple and efficient power-line antenna for use with a crystal set that will bring in stations from near and far and requires no conventional blocking capacitor. It does away with the antenna nuisance, allows the set to be used in any room of the house, and makes it look like a real midget *ac* table model but draws no current.

A 6 ft. length of POSJ lamp cord and a plug are all you need. Connect one side of lamp cord to one prong of plug (Fig. 1), but allow other side of cord to remain free. Thus the dead wire is capacitively coupled to the "hot" wire and no conventional capacitor is needed. When the dead wire is connected to the antenna post on a receiver, it picks up r.f. energy from the power-lines but *ac* current is blocked and cannot enter the receiver. Clip off the dead wire so it cannot enter plug, and thoroughly cover live wire on receiver end with tape.

An alternate method is to connect the hot wire to an insulated tie lug mounted inside receiver (Fig. 2). This makes an efficient antenna for crystal sets and allows the set to be used in any room of the house simply by "plugging in." This antenna will work on other sets but the noise picked up from the power-lines will be annoying. The longer the cord, the greater the amount of r.f. picked up from the power-lines. On the crystal set, a 6 ft. length of cord brings in local stations with good volume without a ground connection. When using a bed spring as a counterpoise in addition to the 6 ft. line cord, local stations have worked a magnetic speaker and distant stations have been received in the earphones after the local transmitters have signed off for the night. For the best results, reverse the line cord plug in the wall socket for maximum signal pick-up. In some cases this results in a decided change in volume.—ARTHUR TRAUFFER.

Electronics consultant Tannenbaum working with the set-up he used to monitor signals from both of the first two Russian Sputnik satellites. Fig. 5 lists the instruments used.

Reading the First Sputniks

An Historical Report

By JEROME TANNENBAUM
Electronics Consultant

as told to DON DINWIDDIE

I HAD BEEN at the lab for more than an hour, the Hammarlund Super-Pro tuned carefully to 20.005 megacycles.

Earlier in the evening, Moscow radio had announced that the first man-made earth satellite had been successfully launched. Many remained skeptical. It was not until 11 *pm* (C.D.T.) that the Chicago papers published the frequencies on which the first Sputnik was transmitting.

Of course, I had returned to the lab immediately and warmed up my equipment.

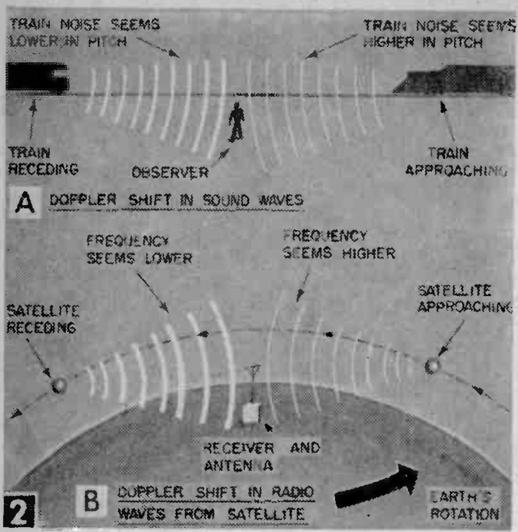
During that hour of waiting, only the usual crackling of cosmic, atmospheric and man-made line noises came from the speaker, slight overtones above the slam of a distant door and the occasional creaking noises one hears in a silent office building at night. I was tempted to go home.

But then, at exactly 12:03, Saturday, Oct. 5, 1957, it was there—something was coming through.

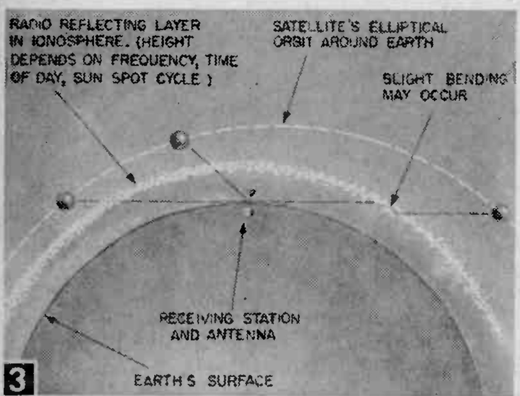
I dove across the lab, turned all gains up full and there it was, sounding clearly—the now familiar da-da-da-da sound from outer space.

The signal stayed in that time for 13 minutes, driving the "S" (signal strength) meter on the receiver up to S9, indicating extremely strong signals. I carefully logged the exact starting and ending times of the reception and other observations. In this brief 13-minute period, Sputnik I had traveled about 2,200 miles.

Again, at 1:45 *am*, it came 'round again. This time it was in for only 5 minutes and its received strength was only S7 (moderately strong signals). In the next three days, Sputnik I was logged in my lab 24 times. Its strength varied from S3 to S9 and the duration of the observations varied from those as short as 1½ minutes



Doppler shift occurs when a source of radiation is in motion with respect to an observer. It shows up as a shift in frequency.



Line-of-Sight Reception. Satellite is near or above the horizon of receiving antenna. Signals come in sharply and go out sharply and are much stronger when in. No echoes or fading.

to one which was 45 minutes long.

What Sputnik I Sounded Like. For the first four days the keying of the transmitter in Sputnik I was fairly consistent. When the satellite radio was in, you could hear a succession of long dots giving a da-da-da-da sound. Each dot was about one-third of a second long and the intervals between dots was about one-third of a second. There were also small but distinct frequency changes, detected as small shifts in the tone of the audio signal.

After the first few days, the keying motor or keying relay in Sputnik I failed. From then on, its signals were received as a continuous tone, no dots but still with the frequency shifts mentioned above. After Sputnik I had been up for three weeks, its radio transmissions failed completely.

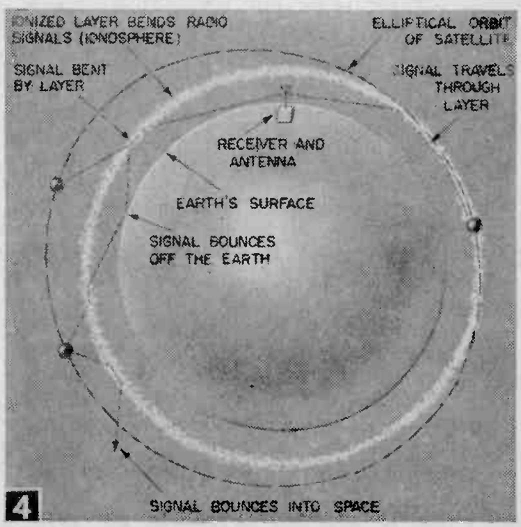
Sputnik II Signals Similar. In the wee hours of Sunday morning, November 4, a local reporter called to say that Sputnik II had been launched. Fifteen minutes later, we were at our lab, eagerly listening. At 5:08 *am.* C.S.T., Sputnik II announced itself on 20.005 megacycles. Here were the same da-da-da-da sounds, very similar to Sputnik I. By 9 *am* of that exciting morning, it had been heard distinctly four times.

Sputnik II's signals on 20 *mc* started as a keyed signal. There seemed to be times, however, when the transmitter gave out a continuous tone. There were other times when the signal shut off for long periods, perhaps to conserve battery life. Or Sputnik II, as it passed Russia, may have received a signal from the ground instructing the satellite to play its tape recorded information on the physical condition of the dog, Laika, within it, and the readings of other instruments.

The Sputnik II's 40-megacycle signals seemed to be more consistent, being heard only as a continuous tone without any keying.

Doppler Shift. A clear Doppler shift was also heard at various times on both Sputniks' signals. Doppler shift occurs when either a source of radiation or an observer is moving with respect to the other (Fig. 2). For example, if you are standing still by a railroad track, as a train moves toward you the noise it radiates will seem to become higher in pitch; as the train moves away from you the sound will seem to become lower in pitch, even though the train is moving at constant speed and emitting a constant noise. This happens because the speed of the train, as it approaches the hearer, imparts additional "compression" between successive sound waves, giving the effect of raising the frequency. The opposite effect obtains when a train is moving away.

Doppler shift on light waves is used in astronomy to measure whether distant stars are moving nearer or farther away from our Solar System. It has rarely been observed on radio waves.



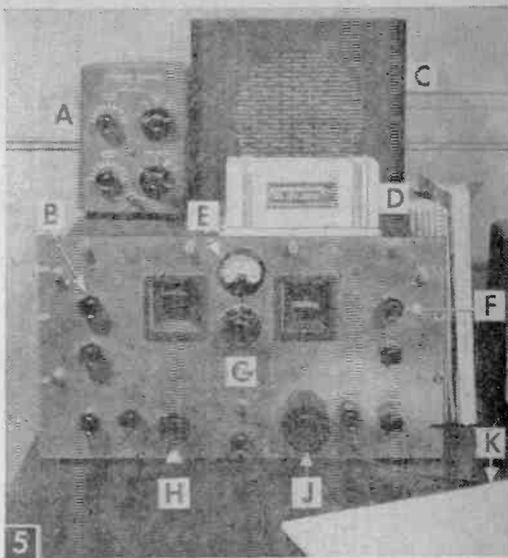
Sky-Wave Reception. Satellite is below the horizon. Signals are bent by ionized layer in upper atmosphere. Signals are weaker, have echoes, fading and flutter. Transmitter may be great distance away.

A Sputnik's speed of about 5 miles per second (*mps*) is a measurable part of the speed of radio waves, 186,000 *mps*. Doppler shift was heard as a higher average frequency as the satellite approached and a lower average frequency as it moved away from the antenna. The maximum shift observed here due to this effect, was about 800 cycles per second.

Radio Propagation. Not only were these satellites describing their positions, orbits and speeds, their radio transmissions were a mine of information on radio conditions. An earth satellite presents an extraordinary vantage point. If it is more than about 150 miles up, it is actually on the outside of the layers in the upper atmosphere which usually reflect and bend radio signals from the earth's surface. Radio propagation, the manner in which radio waves travel through the atmosphere, is normally studied by earth-bound transmitters and receivers. Here we had a speeding probe, high above the radio reflecting layers, whose position could be accurately plotted.

On the 20 megacycle signals from both Sputniks, two types of propagation could be clearly observed. The first, called *Line-of-sight* reception, occurs when the transmitter is above the horizon at the receiving antenna (Fig. 3). Line-of-sight reception appeared on about a 97-minute schedule for Sputnik I and a 104-minute schedule for Sputnik II. The transmissions on these schedules were strongest and came in and went out with some sharpness.

The second type of reception, called *Sky Wave*, is described in Fig. 4. Sky-wave reception occurs when the transmitter is well below the horizon and its waves are bent by the radio refracting layers of the upper atmosphere. This type of reception was very much weaker and marked by echos, fading and flutter, and came in at irregular times. It was common on 20 *mc* signals, rarer on 40 *mc* signals. The result of checking these sky-wave observations against the known positions of the satellites should soon provide us with new information on the properties of the radio mirrors in the atmosphere.



(A) Frequency standard checked against WWV; (B) selectivity control set fairly sharp but not too sharp; (C) speaker; (D) 24-hour clock set to GMT; (E) "S" meter; (F) beat oscillator turned on; (G) Hammarlund SP 400 communications receiver; (H) main tuning; (J) fine tuning or band spread; (K) log.

Close-up of the equipment the author used to monitor signals from the Russian satellites.

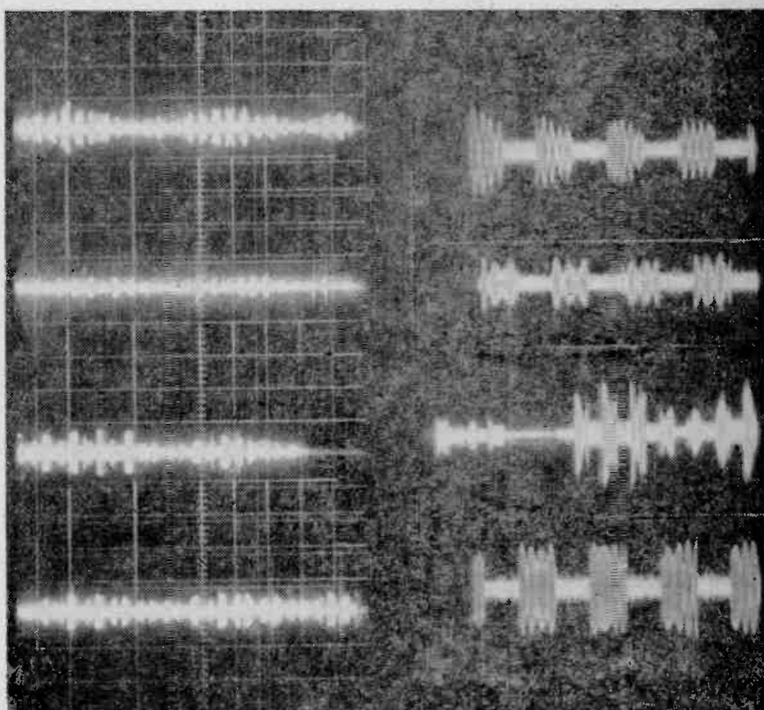
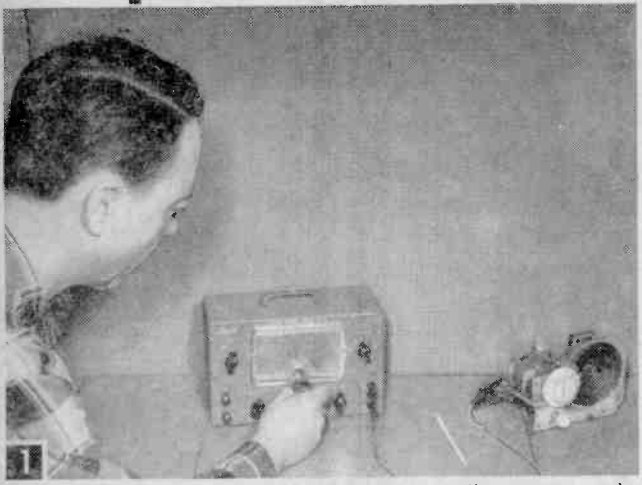


Photo courtesy Sky and Telescope magazine.

These photos of the screen of an oscilloscope fed by a short-wave receiver, show 20.005 megacycle pulses from the Russian satellite. They were made during the night of Oct. 5, 1957, one day after the satellite launching. Different pulse patterns may indicate actual telemetering or the effects of atmospheric interference. Photos were made by Robert Slavin and G. R. Miczaika, Geophysics Research Directorate, Air Force Cambridge Research Center, Bedford, Mass.

How to Align Superhet Circuits



Signal Generator output cable connects to radio antenna and ground. A plastic blade screwdriver is only tool needed.

Because of the precise fixed-tuning required by transistor and tube-type frequency conversion circuits, a signal generator is a vital tool. Here's how you can understand and use these now reasonably priced instruments

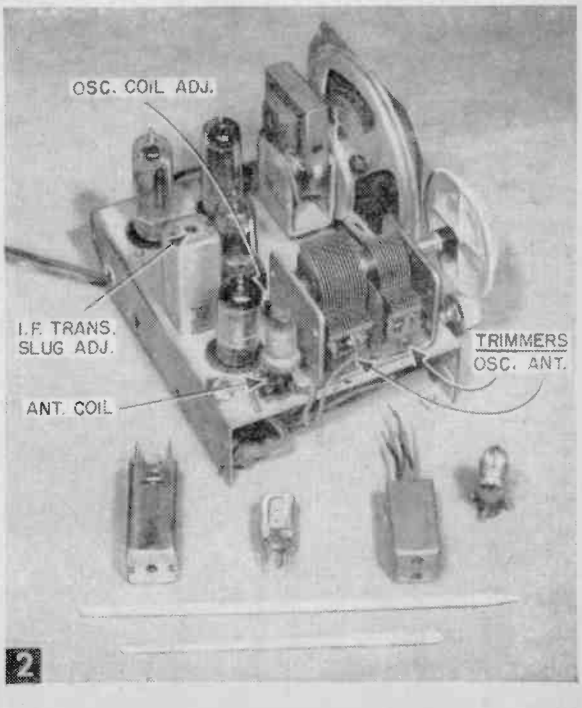
By THOMAS A. BLANCHARD

IN MANY tube and transistor radio projects described in past issues of the *Radio-TV Experimenter*, the reader has been advised to have superheterodyne sets, after completion, aligned by a local service organization to insure proper reception. The essential instrument for superhet alignment is a signal generator, and in the past such generators have been quite expensive—even when capable of tuning only the broadcast band. Recently, however, modern manufacturing methods have made possible reasonably priced signal generators that tune from a low 120 *kc* to an ultra-high 260 *mc* so that anything from a communications receiver with a 132 *kc* intermediate frequency to ultra-high TV or mobile equipment can be aligned as conveniently as a regular broadcast radio with a standard 455 *kc* IF.

The signal generator is, in effect, a miniature broadcasting station with a band selector switch to cut in the oscillator coil that will cover the desired frequency range. The oscillator is tuned with a variable capacitor which has a dial calibrated in kilocycles and megacycles in six frequency bands. In addition, a 190° Log in 1° increments is included for quick reference to a precise adjustment of a dial reading.

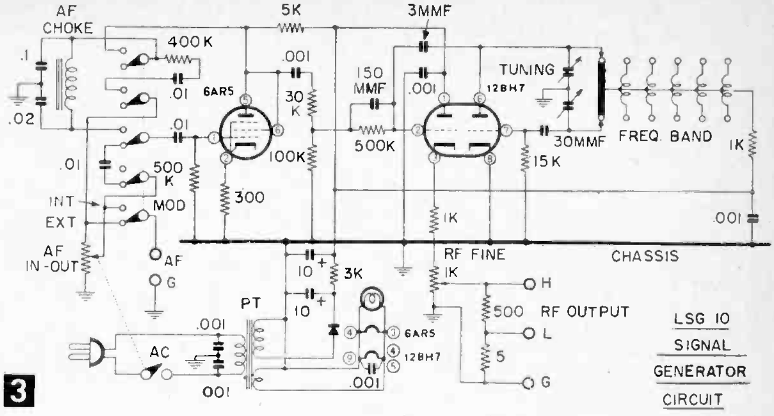
Tuned-radio-frequency type circuits require separate variable tuning for each stage of amplification, are deficient on gain, sensitivity, selectivity, and require more components than a superhet of equal efficiency. A typical modern three-tube table superhet (plus rectifier) greatly excels in performance a five-tube (plus rectifier) TRF set. It follows that it is cheaper to align a frequency conversion (superhet) circuit, than to build the TRF set.

Successful operation of a superheterodyne tube or transistor circuit requires that the set builder feed certain specific signals into the receiver so that its IF transformers can be tuned to 455 *kc* for the conventional broadcast band set, or to whatever frequency the maker of the FM, TV or communications receiver has designated. Television set IF's may be as low as 4.5 *mc* and as high as 47.25 *mc*.



Adjustment points on typical small superhet radio. Foreground shows three types of IF transformers, at far right is a typical local oscillator coil. Screwdrivers are made of plastic crochet needles.

Once the correct IF frequency has been established, the signal generator provides the necessary 400-cycle tone signal for the correct adjustment of the radio's tuning capacitor's, antenna and oscillator sections as well as the proper slug or padder tuning of the local oscillator coil. The accompanying Alignment Procedure (boxed copy) gives the simple step-by-step information necessary for doing a good job.



3

In addition to the signal generator, the only tool you'll need is a plastic-blade screwdriver. A metal blade screwdriver should not be used since it will produce adverse capacitive and inductive effects. Plastic screwdrivers are easily made by filing a blade on the end of a dime-store plastic crochet needle. Several sizes of needles may be used in order to fit the slug or trimmer openings in the various sizes of IF transformers.

Figure 2 shows a small superhet receiver and the points on it that are adjusted or "tuned" with the plastic screwdrivers. In the same picture are shown three different IF transformers. The transformer at left is a modern, slug-tuned type as found in modern, tube-type receivers. The hole in the top of the can provides access to one tuning slug. The second slug is tuned through the eyelet hole in the can's bottom centered between soldering lugs.

The small IF transformer in the center of the Fig. 2 photo is a miniature type found in transistor sets. Transistor IF's have only a single slug adjustment located on the bottom of the can. The transformer at the right in the photo is found in tube receivers and has both tuning adjustments on the top of the can. Such transformers are tuned by small silver mica compression (trimmer) capacitors, rather than threaded slugs.

With increasing stress being placed on transistorized circuits, the use of a signal generator for alignment becomes even more important. Whereas the internal characteristics of vacuum tubes are highly uniform, this is not the case with transistors, a fact which becomes apparent when it is necessary to replace these semi-conductor units in the IF stages of a transistorized receiver. Because transistor characteristics vary from unit to unit, nearly every manufacturer of transistors or transistorized radios specifically advises realignment whenever a transistor is replaced in the IF stages.

A signal generator is also useful in locating foreign shortwave stations by using it as a frequency spotter. For example, *White's Radio Log* (see page 161) provides a comprehensive listing

ALIGNMENT PROCEDURE

(1) Attach output leads from signal generator to set: outer braid lead to Ground terminal, inner (hot) lead to Antenna terminal. Sets with "hank" antenna, connect hot lead here, and braid lead to set chassis. (See separate notes below for loop sets.)

(2) Turn on receiver and advance volume control to maximum. Turn on signal generator. Set dial to 455 *kc*. Set attenuator (RF Vol.) knob on generator at lowest clearly audible position. Excessive signal to set will create two resonance points making proper alignment impossible.

(3) Turn set's tuning dial so capacitor plates are fully open. (16-1620 *kc* on dial). If set has more than one IF transformer, start with the last one (nearest detector tube) and adjust transformer slugs with the plastic screwdriver until the 400-cycle tone from signal generator is loudest.

(4) Repeat slug adjustments above on remaining IF transformers (if any). If signal becomes too loud, retard generator's attenuator knob. After adjusting the input IF, start over again as in step No. 3, adjusting slugs for any further minute increase in signal that may result.

(5) Now tune the signal generator to 1620 *kc*. Turn the trimmer screw on the Osc. section of the tuning capacitor until the 400-cycle tone can be heard. Next turn the trimmer screw on the larger (Antenna) section of the tuning capacitor until signal is loudest. Use plastic screwdriver for these adjustments.

(6) Rotate tuning capacitor until plates are fully closed. Set signal generator to 550 *kc* and adjust slug of oscillator coil or padder capacitor (as case may be) for maximum 400-cycle tone. Use plastic screwdriver except where oscillator slug has brass external adjust screw. Here metal blade may be used.

(7) In some instances, adjustment of the low (550 *kc*) end of the dial may cut off tuning at the high (1600 *kc*) end. In such instances, repeat step No. 5 until the 400-cycle signal can be tuned in at both ends of the radio dial.

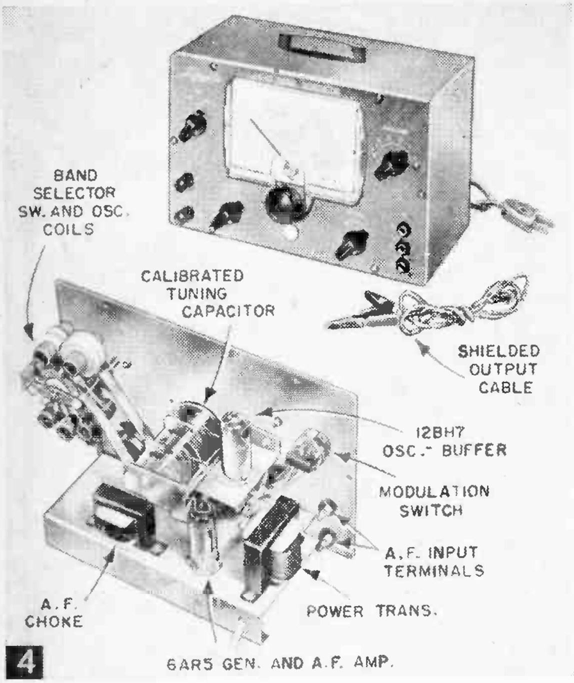
(8) If above steps have been followed, your set is now correctly aligned.

LOOP SETS

(A) If set has a flat loop mounted on back of set, make a three-turn coil with insulated wire (bell or solid hook-up). Coil should be about 3 in. dia. Affix to back of set with scotch tape. Connect ends of coil to the output leads of signal generator. Follow through with steps No. 2 to 7 above.

(B) If set uses a ferrite rod type antenna, wind one or two layers of flexible corrugated board about 2 in. wide on the rod. Wind five-turns of wire over the cardboard. Connect ends of coil to signal generator. Slide coil along ferrite rod to point where signal tone is loudest. Continue with steps No. 2 to 7.

(C) For transistor sets, align IF stages by connecting hot output lead of generator through a 100 mmf. ceramic capacitor to Base pin of Input or Converter Transistor. Connect ground braid lead of generator to chassis. With IF stages aligned, connect generator to set as indicated for external or loop sets and follow alignment procedure steps No. 3 through 7.



External and internal details of the Lafayette LSG-10 Signal Generator. Unit weighs 6 lbs.

of world-wide shortwave stations and their frequencies. Except for costly sets, however, the calibrations on the tuning dial of a receiver are not very accurate. (And of course, those of you with homemade receivers seldom have any choice *but* to "fish" for stations.) With the signal generator, however, you simply set the band switch to the proper range, turn the calibrated dial to the frequency of the foreign station and attach the generator's output cable to the set's antenna and ground. Then tune the set until the signal generator's 400-cycle tone is heard and you are tuned to the desired frequency. After making a note of the dial position for future reference, disconnect the generator from set.

Construction of a signal generator from "scratch" or kit is not usually practical for several reasons. The homemade instrument poses the problem of obtaining the proper set of oscillator coils, suitable chassis, cabinet and calibrated dial. Now, while these items would be included with a kit, its calibration after assembly would still be in doubt and a heterodyne frequency meter would be needed to check out its accuracy.

Since every experimenter is interested to know "what makes it tick," Lafayette Radio of Jamaica, N. Y., authorized our use of their Model LSG-10 Signal Generator specifications. This instrument (Fig. 4) is extremely light and compact, measuring only 4⅜ x 6 x 10 in. Its circuit (see Fig. 3) is divided into two sections. The radio frequency end employs a miniature 12BH7 twin-triode tube which functions as a combined RF oscillator and buffer. One triode section serves as a Colpitts oscillator, the other as the buffer stage. The RF Fine control, plus both a high- and low-output jack provide continuously variable attenuation of the output voltage. The audio section of the generator employs a miniature 6AR5 power-pentode tube. By means of a selector switch, the tube performs two functions. The switch in the first position couples the 6AR5 to a built-in 400-cycle tone generator which provides the ideal "beep" for accurate set calibration.

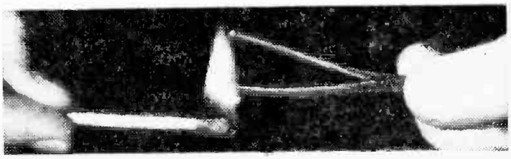
Turning the modulation switch hooks the 6AR5 up as an audio amplifier to feed into the Colpitts oscillator. It is now possible to attach any AF device (such as a radio tuner, phono crystal pickup, etc.) to the left-hand terminals on the panel so that the signal generator works much like the popular, wireless record player devices.

Although the LSG-10 sells for only $22.50, its direct scale readings over all ranges from 120 *kc* to 260 *mc* are accurate within 2%. Even greater accuracy (though seldom needed in radio work) can be obtained by using the seventh Log scale calibrated accordingly.

While neither space nor necessity allows it here, the experimenter will find it to his advantage to familiarize himself with the theory and operation of superheterodyne circuits. Two excellent textbooks are available at public libraries: *Radio Physics* by Alfred A. Ghirardi, E.E. (Radio-Technical Publishing Co., 45 Astor Plaza, N.Y.C.) and *Radiotron Handbook* by F. Langford Smith, B.Sc., B.E. (RCA Commercial Engineering Div., Harrison, N. J.).

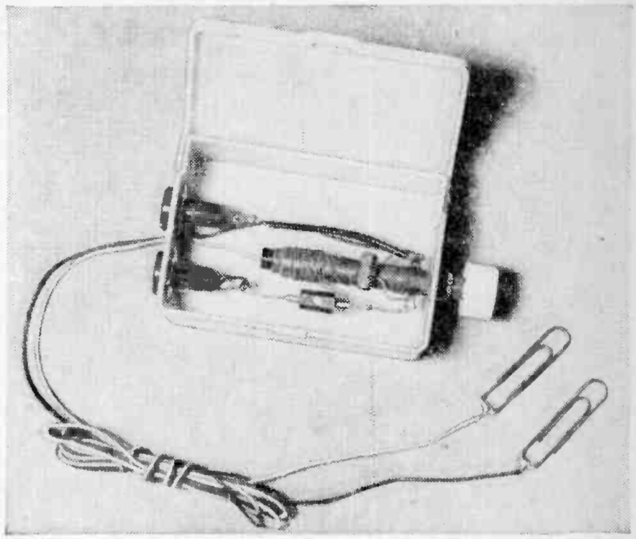
Burn Off Stubborn Insulation

• Ever experience difficulty skinning the insulation from electric wires and cables? Some types of wire insulation are very difficult to remove (for example, the inside cotton threads found in most ordinary rubber-covered lamp cords). When the wire strands are twisted together, the threads tend to get in the way by twisting up among the wire strands. An easy way to remove such stubborn insulation is to burn it away. Simply hold the frayed ends of the cord in the flame of a lighter or match, and then scrape away the charred insulation with a jack-knife.—John A. Comstock.

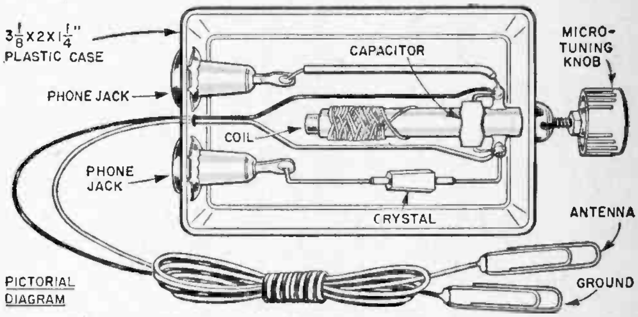


Small Fry Crystal Set

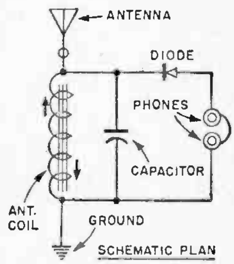
Single Alnico 2000-ohm phone may do but double headphone set of regular magnetic type gives better volume.



Although the case is tiny, there is no cramping of parts in it.



PICTORIAL DIAGRAM



SCHEMATIC PLAN

THIS extremely simple, yet highly selective, crystal set would delight any youngster (not to mention those of us oldsters who still are amazed by these tubeless, powerless receivers).

This set is housed in a 1¼ x 2 x 3⅛-in. plastic pin or jewel box. Two ⅜-in. holes are reamed in one end of the box with a rat-tail file and plastic phone jacks inserted. Just below these holes is a ⅛-in. hole through which the antenna and ground leads pass. These flexible insulated wires have "frictioned" paper clips soldered to the ends for connecting set to antenna. The finger stop on a dial phone is an ideal antenna. Ground is not needed except in outlying areas.

Ream a 5/16-in. hole in the opposite end of the plastic box and, into this hole, snap a micro-tuning type ferrite antenna coil. Then attach a 4-40 threaded plastic knob to the coil screw, providing precision tuning that will not drift once set to a particular station. As most U.S. and Canadian stations are located below 1200 *kc*, a 150-*mmf* ceramic capacitor is connected across the coil lugs to tune from 1600 to 1200 *kc*. In large city areas where the powerful stations (with some exceptions) are between 1200 and 550 *kc*, use a 250-*mmf* ceramic capacitor. But with no capacitor, the set will often pick up amateur, police and fire signals. The detector employed in this rugged pocket set is a germanium type IN81.

Good reception and volume depend upon sensitive headphones, so use conventional magnetic or Alnico double headphones with a resistance of 2000 ohms or more for best results.—T. A. BLANCHARD.

MATERIALS LIST—SMALL FRY CRYSTAL SET

1 plastic box. Original measured 1¼ x 2 x 3⅛ in.
1 1N81 germanium type crystal detector
1 150-mmf (or 250-mmf—see text) ceramic capacitor
1 micro-tuning type ferrite antenna coil
1 4-40 threaded plastic knob
1 magnetic or Alnico single or double headphones, 2,000 ohms or higher
Flexible insulated antenna and ground lead wires, and two paper clips

Note: Complete kit for building this set, including plastic case, coil, knob, germanium detector, 2 ceramic capacitors, jacks, hookup wire and clips (but not headphones) may be obtained from Electro-Mite, P.O. Box 636, Springdale, Conn., for $2.98 postpaid. Double set headphones are available at $2.25 postpaid.

1 If you have outgrown your present station, but carry a thin wallet, this low-power, amateur radiotelegraph station is for you. Designed to perform, it has unprecedented advantages for long-range communication.

The Isotron

Operating in the 21-megacycle—Fifteen-Meter—band, this effective and different low-power, amateur station has world-wide range

By C. F. ROCKEY, W9SCH/W9EDC

NO EXPENSIVE, special tubes or components are required to build this transceiver, and its total cost is less than that of a medium-priced communication receiver alone. Yet in less than two weeks of operation with it, I contacted all parts of the U.S.A. (from Chicago), as well as many locations in Europe, using only a simple dipole antenna.

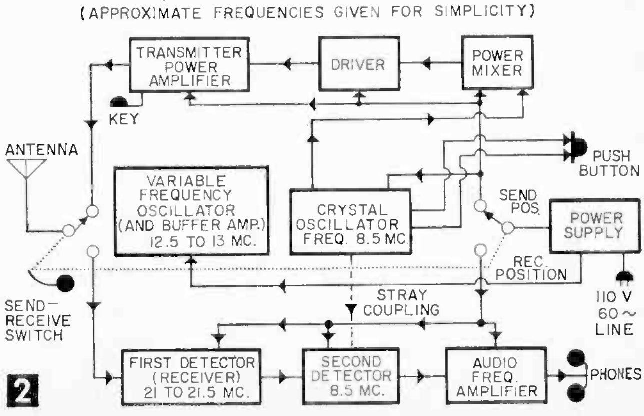
In both transmitter and receiver, this unit employs controlled positive feedback and the superheterodyne principle. Its name, "Isotron," arises from the fact that *transmission and reception occur on the same frequency* and are controlled by the same tuning dial. This feature greatly increases the chance of being heard, since after a CQ call amateurs customarily listen for answers on their own frequency first. Not only this, but the operator is automatically prevented from off-frequency operation, since the transmitting frequency can be checked in the "Receive" position provided the receiver is properly calibrated.

Operation. A variable frequency oscillator (see Fig. 2) is tuned to, let us say, 12.5 megacycles. Its signal is fed into a power mixer, along with the output of a crystal controlled oscillator on 8.5 megacycles. The power mixer adds and amplifies these two signals electronically to produce a signal of 21 megacycles (in the amateur band). This 21-megacycle signal is amplified further in the driver, and finally by the power amplifier, which feeds the antenna.

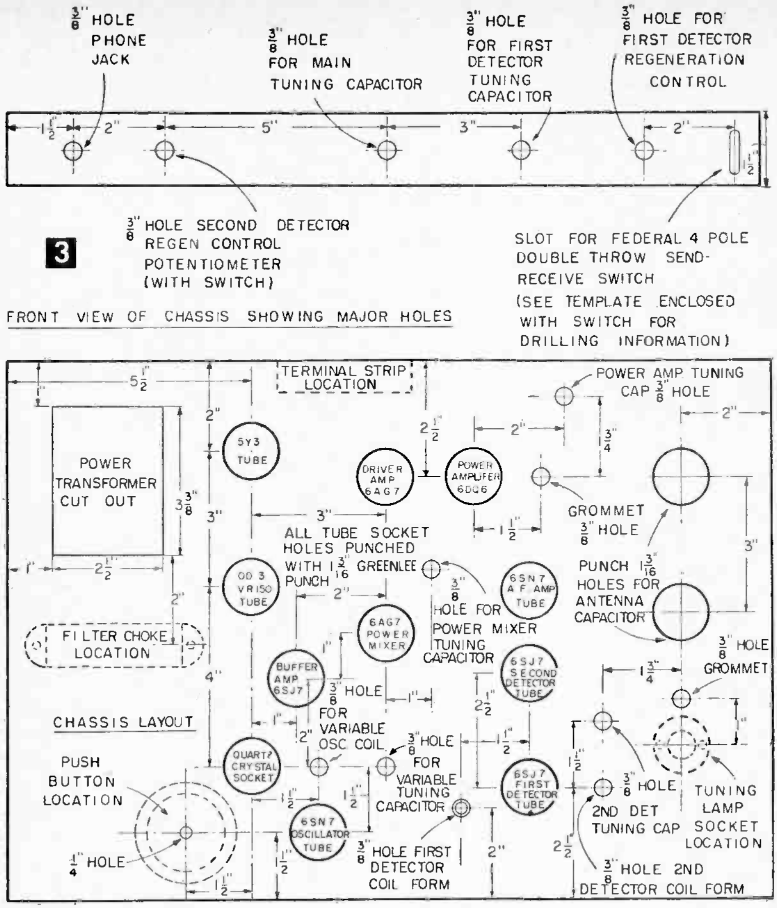
When receiving, the crystal oscillator is normally inoperative, but the VFO feeds its 12.5 megacycle signal into the first detector, which is also receiving the incoming signal on 21 megacycles. These are electronically subtracted, producing an output signal of 8.5 megacycles. The regenerative second detector then produces an audible signal which after amplification, is fed into the headphones.

As long as the second detector is tuned exactly to the crystal frequency of 8.5 megacycles, transmission and reception frequencies are identical, and remain so across the whole band. To definitely establish that this is the case, you simply press the push button while the Send-Receiver switch is in its receiving position. This will feed a small voltage to the crystal oscillator, causing it to produce enough signal to reach the second detector. Transmission and reception frequencies may then be synchronized.

BLOCK DIAGRAM OF "ISOTRON" SHOWING PRINCIPLE OF OPERATION (APPROXIMATE FREQUENCIES GIVEN FOR SIMPLICITY)



2



3 FRONT VIEW OF CHASSIS SHOWING MAJOR HOLES

Entirely free from hand-capacity and "crankiness," the receiver produces a stable signal which will remain tuned-in for hours. In fact it outperforms a number of commercially-built receivers in this respect, and will hold a critical single-sideband signal—a real test of stability. The sensitivity is more than adequate; European and African stations have been regularly audible several feet from the headphones both on code and radiophone.

The transmitter produces sufficient output to provide regular communication with foreign stations (Europe and Africa) when a good antenna is used. Signal output is "clean" and meets Federal regulations for the general-class license in every respect. A *general*, or higher-class, amateur license is required before this station may be legally used in the U.S.A. The Novice or Technician class license is not adequate.

Construction. Begin by cutting out the power transformer hole in the rear left-hand corner of the chassis (Fig. 3) using either a "nibbling tool," or by drilling a number of 1/8-in. holes around the outline. Then punch out all the socket holes shown in Fig. 3, using a 1 3/16-in. socket punch. Next, drill holes for mounting tuning controls.

Now mount sockets, using 6-32 machine screws and nuts. Fasten insulated tie-lugs under appropriate socket-mounting nuts as shown in Fig. 5. When all sockets have been mounted, screwfasten the terminal strip at the rear of the chassis and drill the wire-through holes for it, being careful to remove burrs on these holes lest they damage the insulation of the wiring.

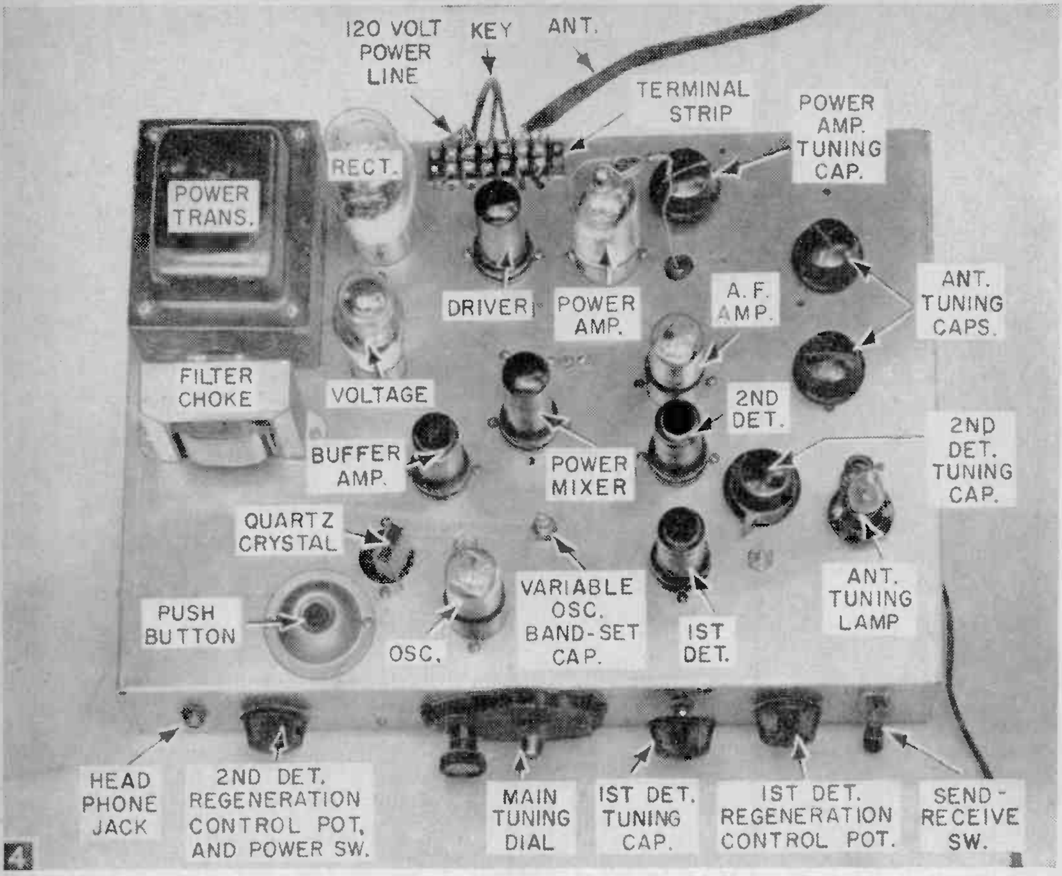
Mount the filter choke on the top of the chassis, using 6-32 screws and nuts, and drill a 1/4-in. hole between it and the power transformer through which to pass its leads, and mount the power transformer. Then mount the *second detector* regeneration control potentiometer, (the pot with the switch) and begin wiring.

Wire the power-supply first (see Fig. 6), beginning with the 120-*v* primary circuit. When this is completed, connect the leads from the transformer to the 5Y3 rectifier socket, and proceed with the filter circuit. The 20 *mfd* filter capacitors are suspended by their leads from suitably-placed insulated tie lugs—use the unused lugs on the OD3 regulator tube socket for mounting the 6000-ohm voltage-dropping, wire-wound resistor. (Do not use pins 3 or 7.)

Connect a line-cord to the line terminals on the terminal strip and turn on the switch. The filaments of the 5Y3G tube should glow, and so should the OD-3 voltage regulator tube. A *dc* voltmeter connected across the output of the second filter capacitor should indicate about 350 *v*, give or take 30, and the voltage across the OD-3 tube should be approximately 150.

When the power supply is operating correctly, disconnect power cord and then connect B+ to the proper point on the Send-Receive switch as shown in Fig. 6.

Transmitter. When building this project, it is more convenient to complete the transmitter before the receiver (to make sure the oscillator frquency relationships are correct). The receiver is then completed and "tracked along" with the transmitter. Therefore, when the power supply is completed, begin wiring the variable frequency oscillator. First, carefully remove one of the rotor plates from the rear of the 15 mmf Bud MC1850



Top-chassis view of completed set.

variable capacitor. This will enable this capacitor to provide much better band spread than would otherwise be the case. When the capacitor has been altered, check that the plates do not rub as the capacitor is rotated. Then mount it, along with the vernier tuning dial, on front-center of the chassis.

Next, wind the VFO coil (see Fig. 10). (Hold the turns in place with coil dope.) Mount it and the 100 mmf "band-set" capacitor and begin the wiring as detailed in Fig. 7.

One side of the heater of all tubes used except the 5Y3 is pin No. 7. Run a wire between all No. 7 pins and connect it to one side of the 6.3 *v* heater winding of the power transformer. The other side of each heater (and the transformer winding) is grounded. Bypass heater pins No. 7 to ground with .005 mfd capacitors on the oscillator's 6SN7, 6AG7 and 6SJ7 tubes and on the transmitter's 6DQ6 and 6AG7 (see schematic Figs. 7 and 8).

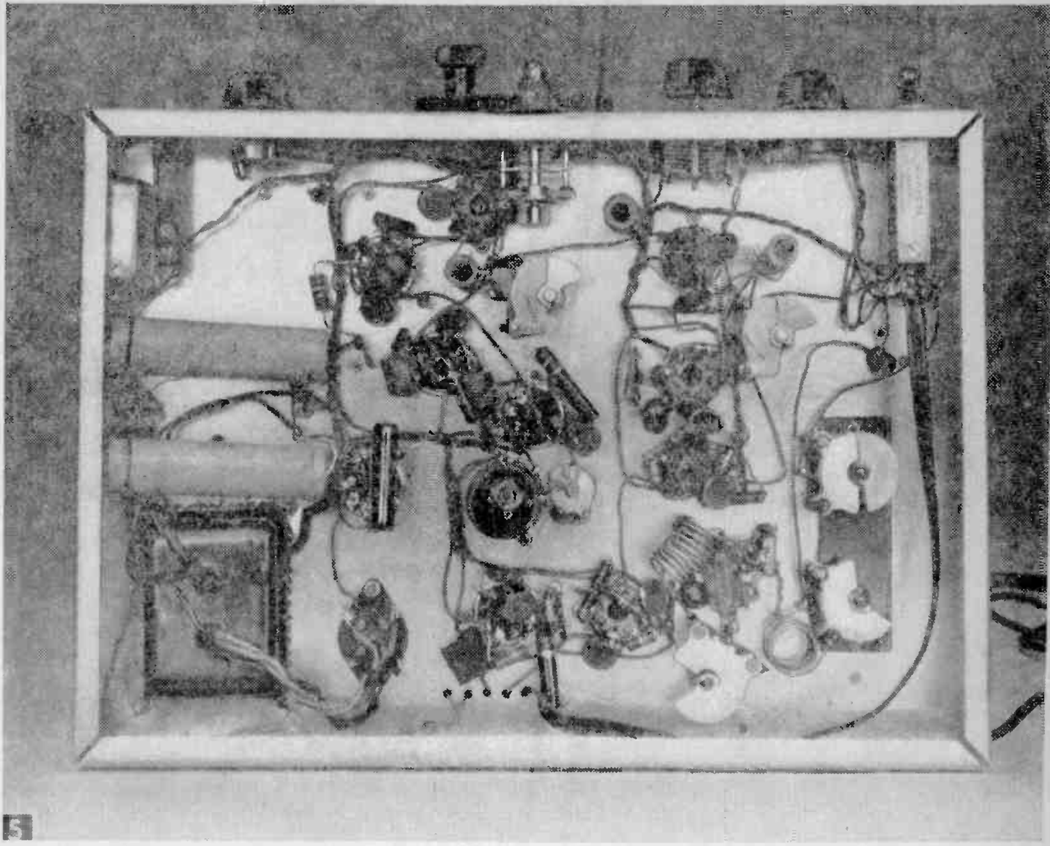
Arrange RF leads of the VFO so that they do not flop around and spoil the oscillator's stability, and when wiring is completed, insert the 6SN7 tube and test this circuit for oscillation by holding a grid-dip-meter coil (your own, or borrowed) near the oscillator coil. A definite indication of oscillation should be obtained. If not, wiring or the tube is defective.

VFO range depends upon the frequency of the quartz crystal you have purchased. If your crystal has a frequency of 8450 kilocycles, as recommended, the band-set capacitor should be adjusted (by use of the grid-dip meter) so that the frequency range of 12.55 to 12.85 megacycles, at least, will be included within the range covered by the main tuning dial. (A somewhat wider tuning range may exist; it is not harmful.) To improve the frequency stability of the oscillator, adjust the slug within the coil so that at least one-half of the capacitance of the band-set capacitor is used; that is, the plates should be enmeshed halfway or further.

In the event a crystal frequency *different* from that recommended is used—there is nothing sacred about the particular frequency recommended, any from 8 to 9 megacycles will do—you can find the VFO tuning range by the following formula:

Low-Frequency = 21000 - (crystal freq. in *kc*)
High-Frequency = 21300 - (crystal freq. in *kc*)

This tuning range will cover the radiotelegraph portion of the 21-megacycle amateur band plus a little to spare.



5

With the VFO completed, wire the crystal oscillator using the other half of the 6SN7 used for the VFO (see Fig. 7). This is a simple Pierce circuit, one of the most vigorous and reliable of oscillators. Test it by holding a neon bulb (glass portion) near the RF choke (set On, of course). The bulb should glow. Remember, when testing, that the Send-Receive switch must be in the Send position so that the crystal oscillator will receive B+ from the power supply.

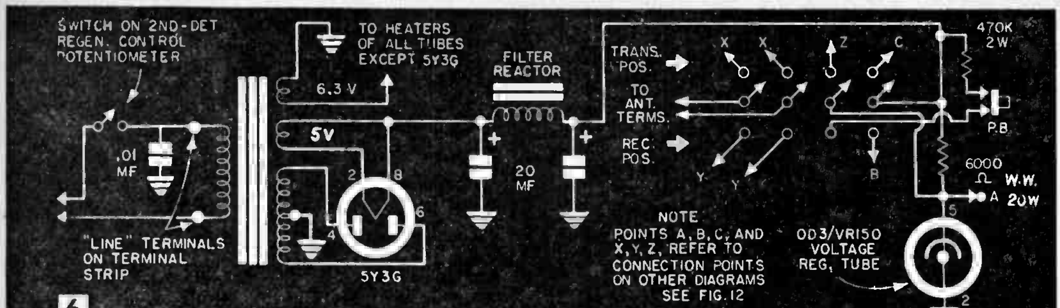
With the two oscillators operating properly, wire the buffer amplifier (Fig. 7). Be sure to ground pin Nos. 1 and 2 of the buffer amplifier tube socket to complete the heater circuit and ground the metal shield. To test, allow tubes to warm, throw S-R switch to Send position, and look for output within the VFO frequency range by holding the grid-dip meter against the RF choke in the buffer amplifier plate circuit. A small, but definite indication proves the circuit is functioning as it should.

Wind the power mixer coil as indicated in Fig. 10. Mount it on chassis with a machine screw and nut, then mount the APC-50 variable capacitor which tunes the output of the power mixer.

The Isotron's transmitter's power mixer differs from ordinary RF amplifiers only in that its screen grid circuit is *not* bypassed to ground in the customary manner. Instead, the output of the crystal oscillator is fed into the screen, "screen modulating" it at the crystal frequency, as it were. The signal of the VFO, amplified by the buffer amplifier, is fed into the control-grid of the power mixer.

With wiring completed and checked, insert tubes and apply power. Tune the grid-dip meter to 21 megacycles, and with the S-R switch in Send position, tune the power mixer tuning capacitor for maximum output at this frequency. A neon bulb held against the coil should give a bright pink glow, and a check with the grid-dip meter should indicate output *only* in the vicinity of 21 megacycles. If output is also at the VFO frequency, this is due to mistuning. Proper adjustment of the mixer tuning capacitor will eliminate the condition.

The transmitter driver circuit (see Fig. 8), is known as a "cathode-follower." Similar circuits are widely used in TV and radar. The output is taken from the cathode of the tube instead of the plate which gives a low output impedance for driving the power amplifier. The "2-meter" RF choke in series with the cathode resistor serves as a peaking-coil, increasing the 21-megacycle output. With wiring of the driver stage completed, apply power, and holding a 2-watt neon lamp by the glass envelope (careful!) touch its tip to pin No. 8. If this stage is operating prop-

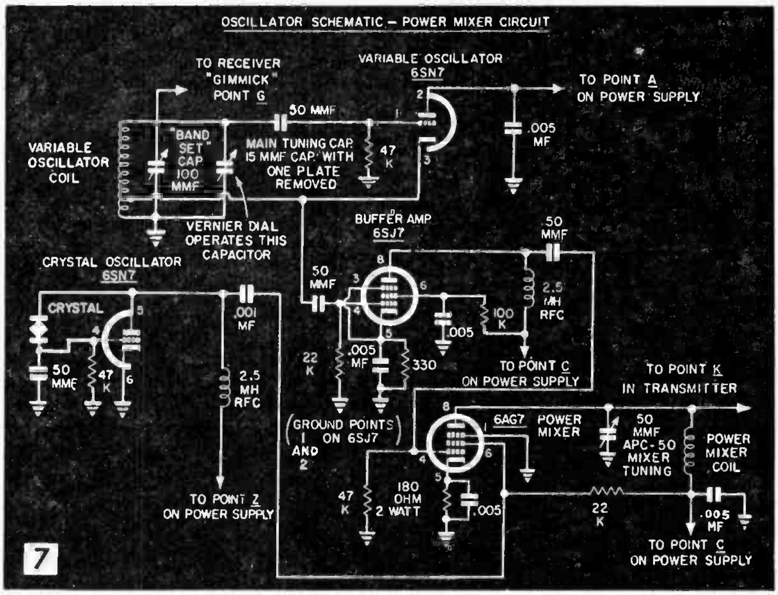


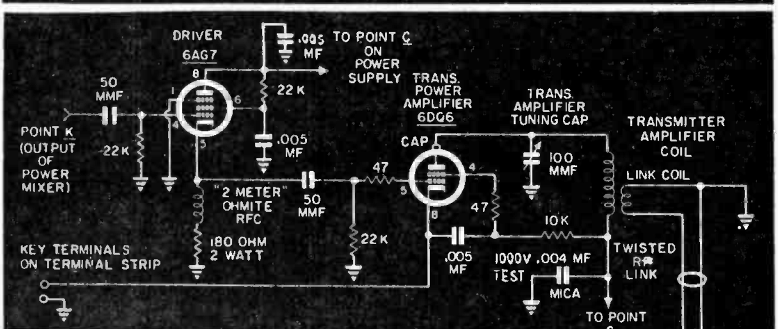
6 POWER SUPPLY SCHEMATIC DIAGRAM (INCLUDING TRANSMIT-RECEIVE SWITCH)

erly, the neon lamp should glow. Try touching up the power mixer tuning for maximum glow at this point. If no glow is observed, check tube and wiring — and make sure S.R. switch is in Send position.

Wiring of the power amplifier finishes the transmitter section. The circuit of this amplifier is standard (see Fig. 8) and practically identical to that used in most modern low-power transmitters. Mount the tuning capacitor, then the .004 *mfd* mica capacitor, the latter with one lug grounded by screwing it tightly to the chassis with a 6-32 machine screw and nut.

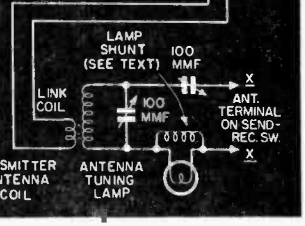
The 47-ohm resistors in series with control-grid and screen-grid effectively suppress those parasitic oscillations which cause instability and interference to neighboring TV receivers. These are connected from the screen and grid terminals to the adjacent unused lugs on the tube socket and are thus firmly anchored in place.





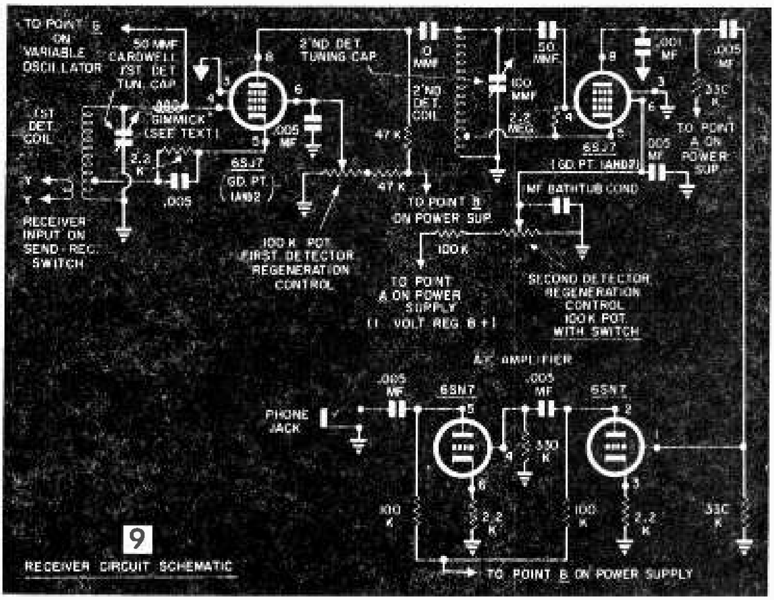
Connect the telegraph key in series with the cathode of the power amplifier, running one lead from the cathode terminal (pin No. 8) to one of the key terminals on the terminal strip. Ground the other key terminal at a convenient point. Drill a hole near the tuning capacitor and insert a rubber grommet to pass the plate lead which connects to the cap on the top of the 6DQ6 tube.

The remainder of the wiring is straightforward. Wind the power amplifier coil of No. 14



8 TRANSMITTER CIRCUIT SCHEMATIC

tinned copper wire (see Fig. 10) and connect it by short leads to the stator of the tuning capacitor and to the ungrounded end of the .004 *mfd*



9 RECEIVER CIRCUIT SCHEMATIC

mica capacitor. Make sure all connections are carefully soldered, fasten a spring clip to the cap of the tube, and put knobs on all control shafts.

Insert all tubes and apply power. Then with the S-R switch in Send position, set the final amplifier tuning capacitor to resonance at 21 megacycles using a grid-dip meter. Connect a short wire jumper between the key terminals and adjust the tuning capacitor for maximum light in a neon bulb whose glass portion is held against the cap of the 6DQ6. With the amplifier operating, check the frequency of the amplifier's output signal. There should be a *lot* of output in the vicinity of 21 megacycles, but none on any other frequency removed from 21 megacycles.

Antenna tuner. First make the insulating strip for mounting the antenna tuning capacitors (Fig. 11) and mount it upon the bottom of the chassis. The 3/8-in. holes should center within the 1 3/16-in. holes previously punched in the chassis. Fasten the insulating strip with two 6-32 machine screws and mount antenna tuning capacitors.

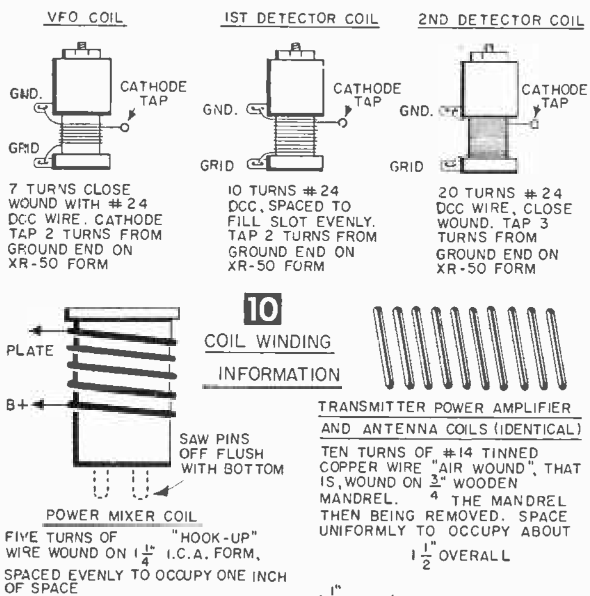
Wind the antenna tuning coil just as you did the power amplifier coil (Fig. 10) and solder in place across the antenna tuning capacitor (see Fig. 5). Mount the miniature cleat lamp socket for the antenna tuning lamp atop the chassis, drill a 3/8-in. hole for its leads and insert a rubber grommet.

Wire the antenna tuner as shown in Fig. 5. For the "lamp shunt," wind 10 turns of hook-up wire around a pencil, remove the pencil and connect the shunt directly across the lamp's socket terminals.

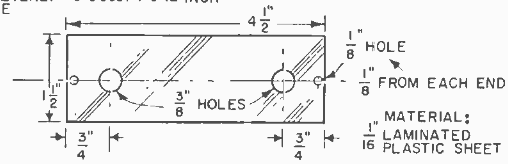
Each "RF link coil" consists of two turns of No. 18 solid hook-up wire. One of these is inserted into the amplifier coil between the last two turns at the "cold" end of the coil, the end connected to the mica capacitor and B+. The other is inserted between the two center turns of the antenna coil. Push these link-coils into the respective tuning coils as far as possible, and fasten in place with coil dope or *Duco* cement. The two link-coils are connected together by two lengths of hook-up wire twisted together as shown in Fig. 5. Grounding one side of the link reduces stray capacitive coupling and helps prevent possible interference with TV sets.

Connect the output of the antenna tuner to the S-R switch as shown in Figs. 8 and 12. Then connect the antenna arms of this switch to the antenna terminals by means of a length of 300-ohm "twin-lead."

A final test of the transmitter is now in order. Insert all tubes and the crystal into their proper sockets. Connect the telegraph



10 COIL WINDING INFORMATION

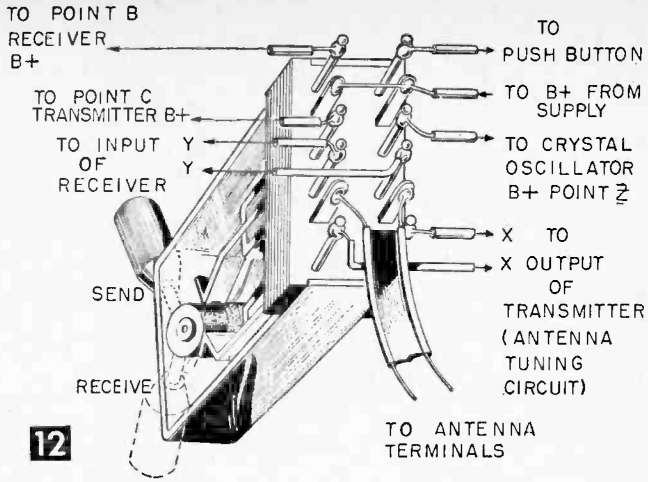


11 ANTENNA TUNING CAPACITOR INSULATING STRIP

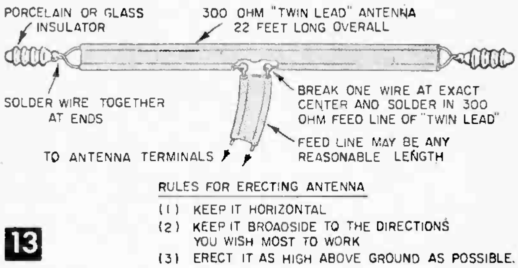
key to its terminals with a length of lamp cord, and connect a 15-watt, 120-*v* lamp across the antenna terminals with leads as short as convenient. Apply power and throw S-R switch to Send position. When the key is pressed upon adjustment of the antenna tuning capacitors and slight touching up of the power amplifier tuning capacitor, the 15-watt lamp should light nearly as brightly as when screwed into a regular lamp socket on the power line. A slight retouching of the power mixer tuning should provide rated output of about 15 watts.

The final test is to listen to the signal quality on a good communications receiver tuned to the 21-megacycle band. The note should be absolutely clean and free of ripple. Keying should be clean—the slight "key-up" signal is direct radiation from the power mixer and will be inaudible under normal operating conditions.

Any transmitter, even when commercially-built, *may* cause interference to a poorly designed or improperly installed TV receiver. However, reasonable precautions have been taken to avoid such interference with the Isotron, and no more interference should be caused by it than by any other similar transmitter on the same frequency.



12



13

Receiver. Remove all tubes from the partially completed set and begin construction of the receiver by mounting the phone jack, the first-detector regeneration control potentiometer, and the first-detector tuning capacitor on the front of the chassis (see Figs. 3, 4 and 5). Then mount the 1 *mfd* "bathtub" capacitor adjacent to the second-detector regeneration control.

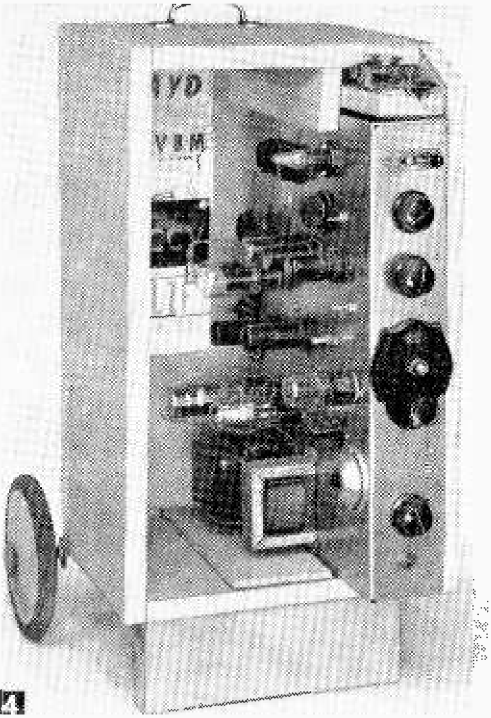
By wiring the receiver (see Fig. 9) from the headphone jack and working forward it will be possible to test each stage as it is completed. The 6SN7 vacuum tube is used as a two-stage audio amplifier of the simplest type. Wire its second stage first, and when it is completed, insert the rectifier and voltage regulator tubes in the power supply circuit, insert the AF amplifier 6SN7, throw the S-R switch to Receive and plug the phones into their jack. Now touch pin No. 4 of the 6SN7 with a screwdriver. A noticeable click and buzz should be heard in the phones. Next, wire and check the first stage similarly by touching the screwdriver to pin No. 1. A much louder buzz should be heard in the phones with this stage in operation.

Now mount the parts for the second-detector coil on a National XR-50 coil form (see Fig. 10). With coil and second-detector tuning capacitor (100 *mmf*) mounted, wire the second-detector stage. Keep RF leads short and direct. Note that the second detector (and the VFO) receives its B+ from the VR tube. This insures smoothness and stability in the receiver's operation.

With second-detector wiring completed, insert tubes, apply power (S-R switch in Receive position) and plug in phones. Slowly advance the second-detector regeneration control. An increase in noise level and a barely noticeable "plunk" indicates proper oscillation of the second detector. To further test the second detector, bring one end of an outside antenna near the coil and adjust the regeneration control just beyond the oscillation ("plunk") point. If you live in a reasonably good reception location, rotating the second-detector tuning capacitor should produce a myriad of code and radioteletype signals, especially after dark. This is positive evidence of proper second-detector action. Improper operation usually means improper oscillation which, if wiring and tube are good, is traceable to the coil, which *must* be connected as shown in Fig. 9.

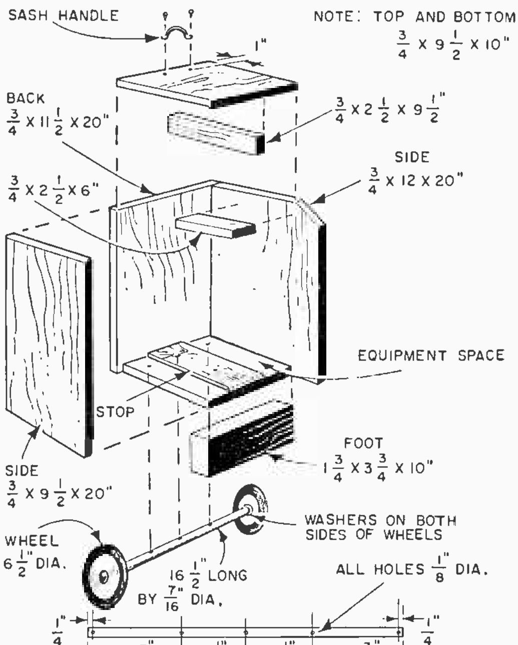
When the second detector is working correctly, wire in the push-button circuit (see Fig. 6) if you have not wired this earlier. Then, with the second detector oscillating, press the push button and rotate the second-detector tuning capacitor until the crystal oscillator signal is at zero beat. The second detector is now on the right frequency. For stability of operation, adjust the slug in the second-detector coil to make this signal come in with the capacitor plates more than half enmeshed.

If, with the push button depressed, you do not hear the crystal oscillator signal (it should be loud), check the contacts in the button and



14

The completed unit.



15

the 470K resistor. Finish by installing the first detector. (The first-detector coil is wound in accordance with Fig. 10.) The first-detector circuit is quite similar to that of the second detector (except for the grid-bias method used), so it should present few difficulties.

Couple the antenna to the first-detector coil by winding two turns of hook-up wire around the ground end. The leads to this coil are twisted and run to the proper point of the Send-Receive switch (see Figs. 6, 9 and 12).

With all wiring now completed, insert all tubes, apply power, plug in phones, and switch S-R switch to Receive position. With the second detector in smooth oscillation (just above the "plunk" point), press the push button and reset the second detector to zero-beat with the crystal oscillator. Then connect an antenna (see Fig. 13) to the antenna terminals and advance the first-detector regeneration control about a third of the way above the Off position. Then rotate the first-detector tuning capacitor (front of chassis) slowly. At one point, signal strength of "sounds from the depths" should markedly increase. If it does not, take the grid-dip meter and check to make sure that the first-detector tuned-circuit will tune to 21 megacycles. Then advance the first-detector regeneration control a bit more and tune the first detector through its range again. If there is no increase in noise (or possibly a signal or two) check wiring and tube. Or perhaps the variable oscillator band-set capacitor has been disturbed. Better check the VFO frequency range again just to make sure.

When the first-detector tuning "peaks-up" as described you should be able to hear a number of 21-megacycle amateur signals, but practice is necessary before truly effective long-range reception is experienced. For instance, you should always keep the first-detector tuning capacitor peaked up for maximum strength. Secondly, the first-detector regeneration control must always be kept *below* the oscillation point. (In contrast to the *second detector*, which always oscillates when receiving code signals.) If the first detector oscillates it obscures the signals and, also, may radiate a disturbing signal to other receivers. If this control is kept just below oscillation, maximum sensitivity is achieved and no disturbance is possible. (The first-detector control also serves as a gain control; back it off to prevent overloading on very strong signals.)

With the receiver operating properly, connect the telegraph key, and throw the Send-Receive switch to Send. Press the key and adjust the antenna tuning capacitors until a 6-*v*, brown-bead pilot light in the miniature cleat socket (antenna tuning lamp) lights at maximum brilliancy. A retouching of the power amplifier tuning may help here. As a check, when properly tuned and loaded, substitute a milliammeter for the key (connected to key terminals). It should read between 60 and 90 milliamperes. Just to make sure, check output at antenna terminals with a grid-dip meter. There should be output on the 21-Mc. band only, to avoid unpleasantness from the FCC.

With your transmitter thus tuned up, find a station calling CQ and when he stands by, call

MATERIALS LIST—ISOTRON

No. Req.	Description
1	aluminum chassis 3 x 12 x 17"
11	Amphenol 8-prong tube sockets (MIP)
1	6-terminal barrier terminal strip, small-size Jones
7	plastic knobs for ¼" shafts
1	push button (obtain from hardware store)
1	miniature type, cleat-lamp socket, screw-base
1	Vernier tuning dial (National type BM, etc.); heirloom type shown in Fig. 1 used for sentimental reasons
1	4-pole, double-throw, anti-capacity switch, Federal Telephone
1	single circuit phone jack
1	spring clip Mueller midget
1	James Knights type H73 quartz transmitting crystal, frequency of 8450 kc
1	power transformer, Chicago-Standard, Stancor No. PM 8411
1	filter reactor, Chicago-Standard, Stancor type C-1001
2	100 K linear taper potentiometers, 1 with switch (Mallory)
5	100 mmf variable capacitors, Bud No. MC1875
1	15 mmf variable capacitor, Bud type MC 1850 (see text for modification)
1	50 mmf variable capacitor, Hammarlund type APC 50 (Power Mixer tuning)
1	50 mmf variable capacitor Cardwell type PL 6004 (First Detector tuning)
3	National XR-50, slug-tuned coil forms
1	I.C.A. coil form, No. 1108 B, 1¼" dia.
2	electrolytic filter capacitors, 20 mfd, 600 w. v. Sprague type TVA-1966
1	.01 mfd, 400 w. v. paper capacitor
1	1 mfd paper "bath tub" capacitor, Aerovox, type P30ZN, or tubular
1	6000-ohm, 20-watt, wire-wound resistor (Ohmite)
1	470,000 ohm, 2 watt composition resistor
2	180 ohm, 2 watt composition resistor
4	100,000 ohm, 1 watt composition resistor
6	47,000, 1-watt composition resistor
5	22,000, 1-watt composition resistor
1	2.2 Megohm, 1-watt composition resistor
3	2200, 1-watt composition resistor
1	10,000, 1-watt composition resistor
2	47 ohm, 1-watt composition resistor
1	330 ohm, 1-watt composition resistor
2	2½ millihenry R.F. chokes (National R-100)
1	"2-meter" R.F. choke (Ohmite)
18	.005 mfd, disc-type, ceramic capacitors
2	.001 mfd, disc-type, ceramic capacitors
6	50 mmf, disc-type, ceramic capacitors
1	10 mmf, disc-type, ceramic capacitors
1	.004 mfd, 1000-v. test, mica capacitor (Sangamo)
1 pc	laminated plastic, $^1/_{16}$ x 1½ x 4½"
2	rubber grommets for ⅜" hole
1	piece 300-ohm, "twin lead" 18" long
1	line cord and plug
1	gross nickel plated steel machine screws, 6-32. These should be ½" long
1	gross nickel plated steel hex nuts for above
1	5Y3G vacuum tube
1	OD3/VR150 vacuum tube
3	6SJ7, metal vacuum tube
2	6AG7 vacuum tube
2	6SN7GTB (or 6SN7GTA) vacuum tube
1	6DQ6 vacuum tube
1	telegraph key
1	pair magnetic head phones, 2000 ohms or higher
1	phone plug
	hook-up wire, rosin core solder, insulated tie lugs No. 24 dcc magnet wire, 6-volt "brown bead" pilot lamp screw base, type No. 40 2-watt neon lamp. 20 feet of No. 14 tinned wire, one 15-watt 120 volt lamp for testing purposes, one bottle of coil dope, or polystyrene cement.
	A grid-dip meter must be used in adjusting this unit. A 0-150 ma dc milliammeter is also convenient.
Cabinet parts required:	
1	small sash handle
2	velocipede wheels 6½" dia. including tire (obtain from toy or bicycle shop)
16½ in.	$^7/_{16}$" steel rod
4	washers $^7/_{16}$" hole dia.
30½	linear inches of white pine 9½" wide by ¾" thick
1 pc	20½ x 12 x ¾" white pine
1 pc	1¾ x 3¾ x 10" white pine

him. The odds are good that he'll "come back," no matter how far away he is. Good hunting!

Building the Cabinet. First saw three pieces 3¼ x 9½ x 10 in. for the top, bottom and shelf, and two ¾ x 9½ x 20½-in. pieces for the sides. Sand off the saw marks, glue meeting edges and assemble, nailing through the sides into the ends and shelf with 2-in. long finishing nails. Then cut a ¾ x 11¾ x 20½-in. piece for the back and glue and nail it in place. A 10-in. long piece of "two by four" (actually 1⅝ by 3⅝ in.) is nailed in place for the foot.

Set all nail heads with a nail-set, and fill these holes and any other fissures with wood putty.

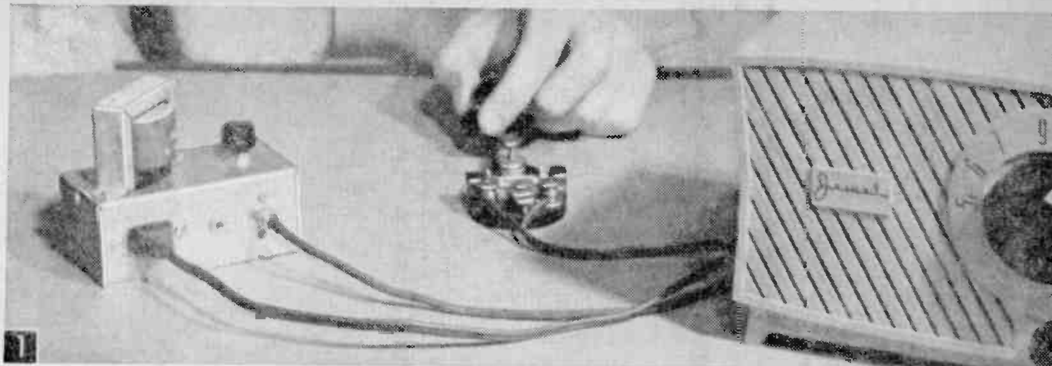
While the wood putty is drying, cut and drill the $^7/_{16}$ in. dia., 16½-in. long shaft for the wheels, as shown in Fig. 15. The end holes are for screws to hold on the wheels, while the three-center holes are for nails to fasten the shaft to the bottom of the cabinet. This shaft should be nail-fastened to the bottom, parallel to the back of the cabinet and ½ in. from back edge of bottom piece.

Finish the cabinet with paint or walnut or mahogany stain, followed by two coats of spar varnish. When the finish is dry, put on the wheels, with a washer in front and back of each. Fasten each wheel in place with a 6-32 machine screw passed through the end holes and secure with a nut. Then screw the sash handle to the top center of the cabinet one inch from the back.

Screw the telegraph key to brace piece and with the knob near the front edge, "skin-back" 18 in. of POSJ line cord, and clamp under the terminals of the key. Then pass the other end through the ¼-in. hole in the chassis.

Pass the line cord, and about 5 ft. of insulated wire (for receiver antenna) through one of the lower holes in the back of the cabinet. Now connect the line cord, the telegraph key leads, and the receiving antenna lead each to the proper terminal on the 6-terminal Jones strip on the chassis.

Slide the set into the cabinet as shown in Fig. 14. When ready to operate, wheel the unit beside your favorite chair, connect the antenna, plug in the power cord, and you're on the air.

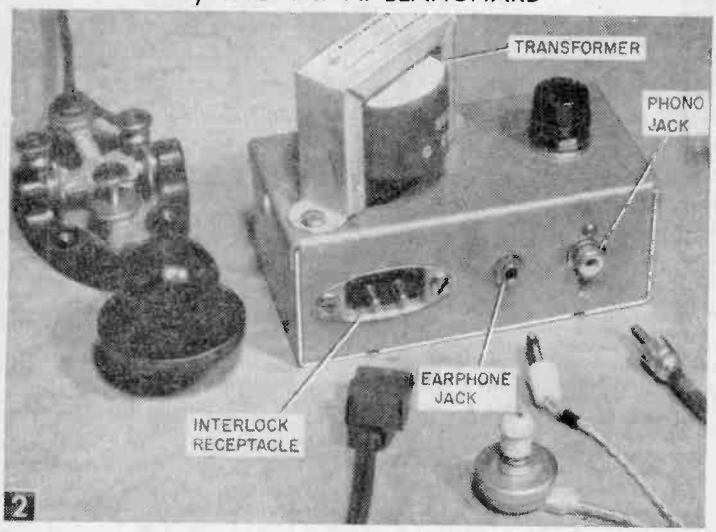


1

Three-octave tone generator can be plugged into the phono record jack of any radio for loudspeaker code-practice or musical effects.

Transistorized Tone Generator

By THOMAS A. BLANCHARD



Complete tone generator is housed in a 1½ x 2 x 4-in. radio utility type box. Key plugs into interlock receptacle. Center jack is for earphone use. Jack at right allows for connection to radio, TV or hi-fi amplifier.

THIS unit not only provides a springboard for interesting experiments with electronic music, but also may be used as a code practice oscillator by radio amateurs (Fig. 1).

The circuit is a transistorized version of the Hartley vacuum tube oscillator. The oscillator is the tapped secondary winding of an audio driver transformer. The transformer's primary provides inductive coupling to either a magnetic earphone or to the phono jacks of your radio or TV set for loudspeaker operation. Or connection can be made to the high impedance input jack of any amplifier. The tone generator is a completely self-contained unit requiring an inexpensive P-N-P type A.F. transistor. A single 1½-volt penlite battery is the sole source of power.

Mount the transformer on top of the 1½ x 2 x 4 in. aluminum box with a clearance hole beneath to allow for passage of primary and secondary leads (Fig. 4). Drill a hole for mounting the 500K (½ meg.) potentiometer, also located on the top of the box. On the front apron of the box, provide mounting holes for earphone jack, phono jack, and a male interlock receptacle to which the code practice key is connected. A jack such as used for the earphone connection may be substituted for the interlock receptacle if more convenient.

When mounting the jacks to the metal chassis, be sure that the outer shell lug of the phono jack is to the grounded side of the circuit. The same applies when connecting the earphone jack; otherwise, the unit will be inoperative due to a shorting of the output circuit.

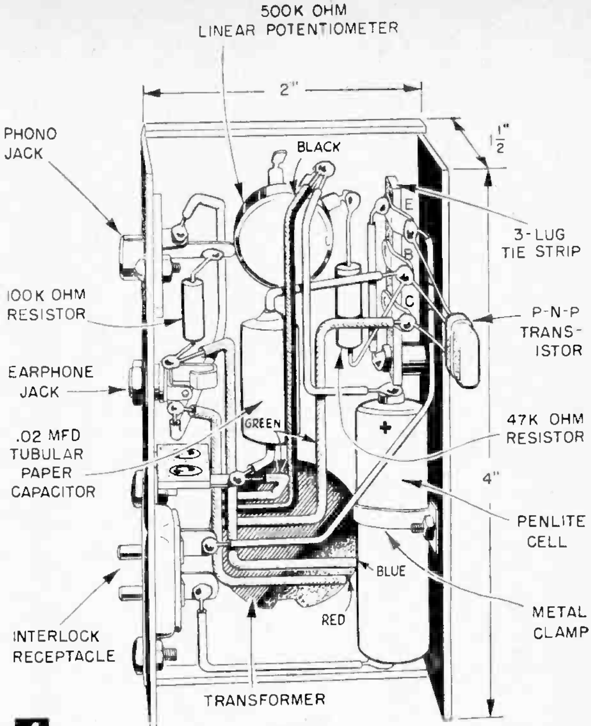
Use a 3-lug tie strip (with or without isolated mounting eyelet) to secure the transistor (Fig. 4). This is more practical than trying to work with a flea-size transistor socket. When soldering in transistor leads, wrap a small wad of wet cleansing tissue around the leads to form a "heat sink" so that heat is not carried into the transistor to damage or destroy its delicate internal characteristics.

Because the penlite cell normally lasts for several weeks, solder it directly into the circuit and secure with a metal clamp cut from a strip of copper, aluminum or tinplate. A power switch is not required since the circuit only draws current when the key is closed.

For group code instruction, fit a length of single conductor shielded phono cable at both ends with a pin plug. Connect inner wire to plug pins and outer braided wire to plug shells. Attach cable to the radio and tone generator jacks and you are ready to roll.

In order to couple the comparatively low impedance winding of the driver transformer to the high impedance phono jack of radio or TV set, a 100K resistor is connected in series with the "hot" output lead (Fig. 3). If the completed unit operates erratically reverse the red and blue transformer leads at the earphone jack connection.

Musical Effects. Note in Fig. 3 that *feedback* to the B (base) of transistor is through the .02 *mfd* capacitor when a negative voltage is applied to the base point. When the maximum resistance of 547,000 ohms allows a minimum of power to reach the transistor base, the rate of oscillation will be slowed down, creating low musical tones. As the 500K linear potentiometer is rotated toward minimum, more voltage reaches the transistor base and frequency of oscillations generated increases, thus producing higher tones. Rotating the potentiometer from minimum to maximum will produce *three* octaves of tones, including, of course, not just the major, but sharp and flat tones as well.



4 PICTORIAL DIAGRAM

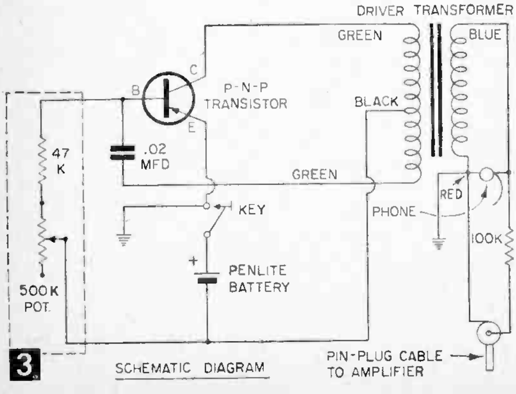
Because a point would be reached in the high frequency ranges where too much voltage applied to the base would result in a breakdown of oscillations, you add a 47K resistor in series with the 500K potentiometer to prevent this from happening. However, should your clear high-pitched tones break down with the potentiometer in minimum resistance position, replace the 47K resistor with the next higher value that is available, which would be 51K.

To either raise or lower the three octaves covered by the tone generator, it is only necessary to use another size coupling capacitor in the feedback circuit. A .005 or .01 *mfd* will produce higher pitched tones, while .03 to .05 *mfd* will yield bass to sub-bass tones. For example, with .05 *mfd* in this circuit we obtained tones identical to the 13 pedalboard tones on a genuine electronic organ. Using the normal .02 *mfd* value, we closely duplicated genuine organ tones with *violin* tablet on upper manual engaged.

To convert this tone generator into a simple musical instrument, refer to the *Uke-Atron* project (see p. 77, of *Radio-TV Experimenter*, Vol. 3, published by SCIENCE AND MECHANICS, price 50¢). The "playing device" employed in Uke-Atron (Figs. 3, 6 and 7 of that article) may be used with this transistorized tone generator simply by adding a push switch in series with the 47K resistor and 500K potentiometer and replacing the key receptacle with a toggle or slide switch to turn on or off battery power.

MATERIALS LIST—TONE GENERATOR

No. Req.	Description
1	aluminum radio utility box. 1½ x 2 x 4" (LMB, etc.)
1	P-N-P A.F. transistor (2N107, 2N34, CK-722 etc.)
1	audio interstage driver transformer; single 10K ohm plate to push-pull grids. Ratio: 2½ to 1. (Stancor A-4292 or Triad A-81X)
1	100K (100,000) ohm ½-watt composition resistor
1	47K (47,000) ohm ½-watt composition resistor
1	500K (500,000) potentiometer with linear taper (Mallory, IRC, etc.)
1	.02 *mfd* tubular paper capacitor (any voltage rating)
1	3-lug tie strip
1	midget phone jack and plug set (Lafayette)
1	RCA type phono jack and 2 matching plugs
1	interlock receptacle and cord
1	length single conductor shielded phono cable
1	penlite battery, 1½v.
	standard or miniature earphones may be employed, but they must be magnetic type with *d*-c resistance of 1500 ohms or higher.



3 SCHEMATIC DIAGRAM

Your own heart beat—or that of another human, or animal, can be heard loud and clear with this electronic stethoscope. (A dog's heart beat, when compared to that of a normal human, is usually very irregular.)

1

Building an Electronic Stethoscope

By HAROLD P. STRAND

HAVE you ever wondered what your heart beat sounds like to a physician as he puts his stethoscope to your chest? Build this unit and you can find out. With it, heart beats are picked up with a special microphone (which you build yourself) and amplified by a three-stage battery-powered amplifier. No layman, of course, should attempt to diagnose a heart condition with this—or any other—instrument, but if you are a physician (or veterinarian), you'll find this instrument useful in your practice; and if you're not, you'll find it simple and inexpensive to build, and a lot of fun to use as either a conversation piece or for more practical applications.

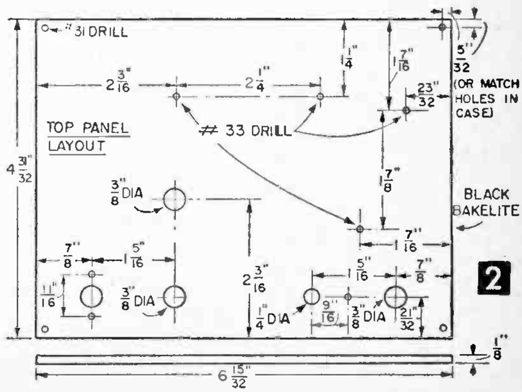
Sounds picked up by the stethoscope are much louder with a thin person than one with much fat on the chest since fat acts as a sound insulator. The volume control should be set at about 7 or 8 when first placing the pickup on the chest. If you want more volume, increase the setting. Moving the pickup around to various positions with the volume turned fully on, however, will give you a lot of noise, due to the sensitivity of the mike and the gain of the amplifier. The unit's tone control gives some control over the frequencies heard, suppressing the high frequencies and accentuating the lows. Most heart sounds fall within a range from about 40 to 600 *cps*, so that we are principally concerned with the low frequencies. The lowest frequency position of the pointer knob is fully counterclockwise.

Two phone jacks located in the top panel of the unit accommodate either the standard large phone plug or the miniature type. Batteries used are one 67½ *v*. B battery and a flashlight D cell for the A battery.

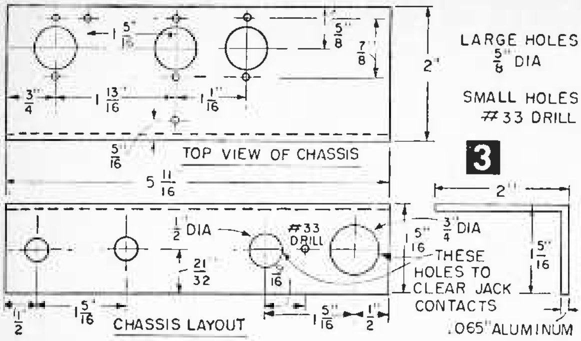
A simple general test for sensitivity can be given the equipment by plugging the mike into the input jack of the amplifier and turning up the volume control. Very light taps on the diaphragm should produce loud sounds in the ear phones. If the mike is laid face down on a table top, tapping the table anywhere on its surface should produce clear audible sounds. If these tests prove satisfactory, try it on your own chest in the general mitral area. The heart beat should come through with good volume as the control is advanced.

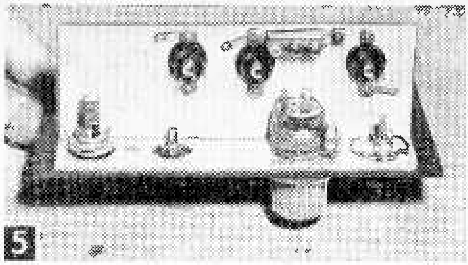
Construction. Start with the amplifier, using a piece of ⅛-in. thick Bakelite for the top panel. This fits in a recess in the Bakelite instrument case. Cut it carefully to size and drill four corner holes for the 4-40 attachment screws, lining these holes up with those in the case corners. Then drill the other holes detailed in Fig. 2.

The chassis is L-shaped and bent from .065-in. aluminum. It is fastened to the top panel by the screws used at the phono jack, the locking nut on the volume control and a screw and nut placed between the two output jacks (see Fig.



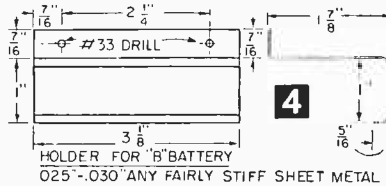
2




5

All underside parts have been secured in place in this view, ready for wiring. Note the clearance between the output jacks and the chassis by providing large holes.

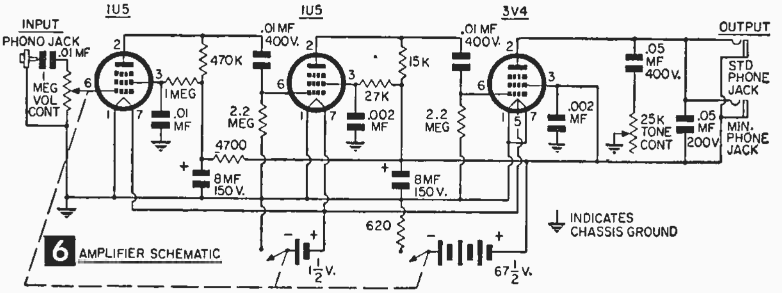
3). The holder for the A battery is a standard, commercially available holder. A clip sheet metal holder (see Fig. 4) is made for the B battery to hold it over the tubes and just below the edge of the panel. This holder can be made from any fairly stiff sheet metal.

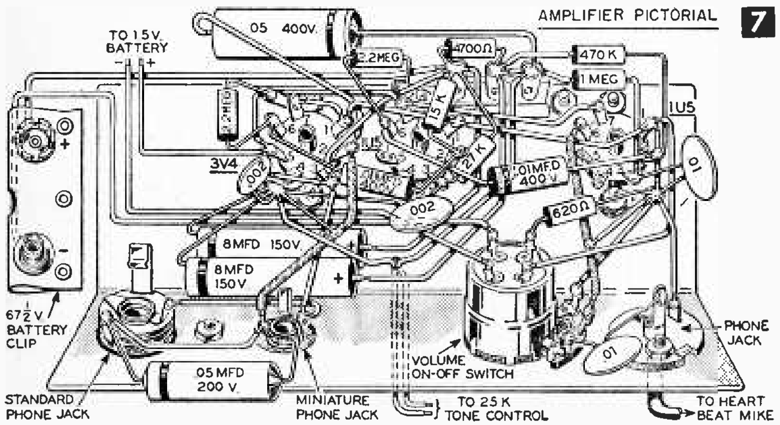


When drilling the large chassis holes, use a counterbore or a twist drill specially sharpened for sheet metal or plastic to avoid tearing the metal. Assemble the sockets in their holes, using 4-40 screws and nuts, as well as the other chassis parts and attach the chassis to the panel (see Fig. 5).

Wire with #24 plastic insulated stranded hookup wire (see Figs. 6 and 7). The B and A batteries, their holders, and also the terminal piece for the B battery are shown in the process of assembly in Fig. 8. Connect the red lead of the B battery terminal piece to the plus (+) side of the circuit. At the A battery holder, mark one terminal (that with the lead going to the plus side of the filament circuit, see schematic Fig. 6) with a plus sign on a piece of white tape placed on the holder under this terminal to assure that the cell will be correctly installed later.

A short piece of shielded wire is used at the input jack to the volume control, another piece between the volume control and pin #6 of the first 1U5 tube and also a piece between pin #2 of the 3V4 tube and the output jack (see Fig. 9) to curtail hum. Ground the braid of this cable to the chassis with short soldered wires. Keep the strands of shielding away from the terminal connections. After placing the tubes in their sockets and installing the batteries (Fig. 10) check the amplifier by plugging in the ear phones and turning on the switch, advancing the volume control fully clockwise. A hum should be heard and if you touch the inner end of the phono jack with a finger you should get a loud click. Plug a crystal microphone into the input jack and have someone talk into the mike; voice should be heard loud and clear in the phones. Lack of sound indicates an error somewhere which must be checked and located.





ELECTRONIC STETHOSCOPE—MATERIALS LIST
AMPLIFIER

1 2¼ x 5¼ x 6¾" Bakelite instrument case (MS-218)
1 1 meg. volume control, ½ watt linear taper, with D.P.S.T. attached switch
3 7 pin Bakelite miniature sockets
1 battery holder for one size D Burgess or 2LP Ray-O-Vac flashlight cell
1 flashlight cell of either make as above
1 67½ v. B battery Burgess P 45 M or equivalent
2 1U5 tubes
1 3V4 tube
1 telephone jack, single circuit standard size
1 telephone plug standard size
1 miniature jack MS-282
1 miniature plug MS-281
1 phono jack RCA type
1 phono plug RCA type
1 dial knob type HRS National 0-10 HRS-3
1 miniature knob with pointer for ¼" shaft
1 25,000 ohm volume control linear taper (for tone control) ½ watt
2 8 mfd. 150 volt electrolytic capacitors Sprague TVA-1405
2 .05 400 volt paper capacitors
2 .01 400 volt paper capacitors
2 .01 disc ceramic capacitors
2 .002 disc ceramic capacitors
2 2.2 meg., ½ watt resistors
1 620 ohm, ½ watt resistor
1 4700 ohm, ½ watt resistor
1 470,000 ohm, ½ watt resistor
1 1 meg., ½ watt resistor
1 27,000 ohm, ½ watt resistor
1 15,000 ohm, ½ watt resistor
1 3-terminal terminal strip Cinch-Jones #2003
6" shielded cable small diameter size
1 terminal pc. with snap connectors for Burgess P 45 M battery with red-yellow leads attached
Approx. 5' #24 plastic covered stranded hook-up wire and about 10" of small spaghetti tubing
1 set of white alphabet decals Walsco #2115
1 Cannon double headset, 3000 ohms AM-15-3

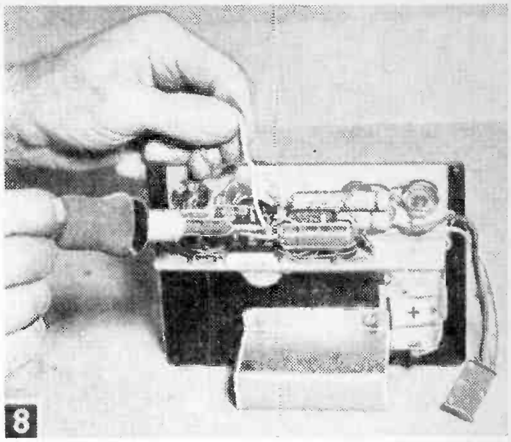
The above materials can be supplied by Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, N. Y., or in New England from their branch, 110 Federal Street, Boston, Mass.

Misc. materials
1 pc. black paper base Bakelite ⅛ x 5 x 6½" (case panel) Forest Products Co., 131 Portland Street, Cambridge, Mass.
1 pc. aluminum about .065 x 3⅜ x $5\frac{11}{16}$" (metal working shops)
1 pc. sheet metal (soft steel, brass or semi-hard aluminum) about .025"-.030" x 3⅛" x 3¾" (B battery holder)

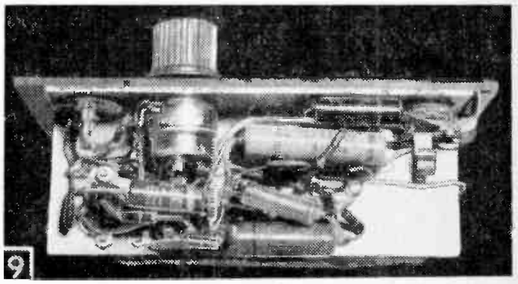
If sound is distorted and undesirable noises are evident, wrong values of resistors or capacitors, or an unsoldered connection may be the trouble. If other remedies fail, test the tubes. If the volume control gives the loudest volume when the dial is on 1 rather than on 10, connections are reversed at the two outside terminals. Trouble in an amplifier can also be due to a resistor or capacitor which is defective; a substitution test may be required in order to find the faulty component. Also make sure that the electrolytic filter capacitors are connected so that the ends marked plus go to their correct locations on the terminal strip, the negative sides to chassis ground.

The completed unit with the head set and microphone plugged in is shown in Fig. 11. Lettering has been added from one of the decal sets sold by most electronic supply stores.

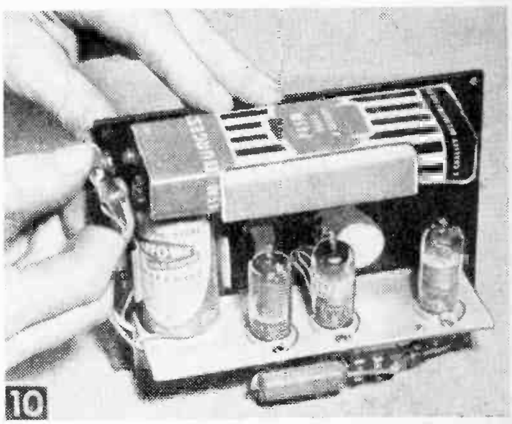
The Microphone. Basically, the pickup unit consists of an Argonne MS-108 crystal cartridge. An aluminum diaphragm with a sanitary rubber covering and a method of transmitting sounds from this diaphragm to the crystal element are needed, the latter consisting of an element made of Rochelle Salt in the form of a crystal which



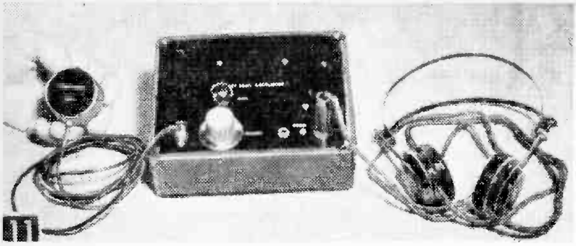
8 The wiring is comparatively simple, though it must be compact to allow the chassis to fit in the Bakelite case. Use a soldering pencil on connections requiring low heat and a 60-watt iron where greater heat is needed, as on terminals having multiple leads.



9 A close-up of the completely wired chassis. Leads over edge at right go to batteries.



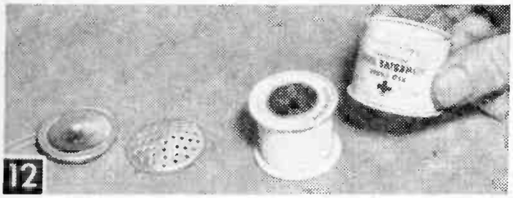
10 Tubes and batteries have been positioned and the snap-on terminals at the B battery are being pressed on. A piece of adhesive tape should be placed between the lower terminal of the A battery and the chassis so that this terminal will not short to the chassis. Note the tone control located between the two widest spaced tubes. Be sure that the 3V4 tube is next to the A battery or is in the output jack circuit.



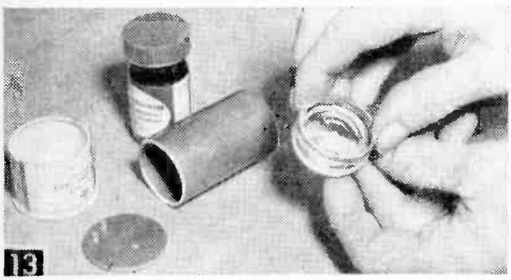
The complete unit, with a 3000-ohm headset plugged in. The back of the special pickup is at left.

has the property of developing a small amount of electrical current if it is bent or distorted in any manner. This element, together with an actuating bar and thin aluminum foil diaphragm is supplied with the original microphone cartridge. Figure 12 shows the cartridge with its perforated cover removed and also the piece used for the outer casing for the new unit, the outer cylinder from a Johnson & Johnson 1-in. 2½ yard long adhesive tape roll. This piece has one rolled-in edge.

Cut a ring (use a lathe) about 5/32-in. thick, 1½ in. O.D. with a 1/16-in. wall thickness from a piece of Bakelite tubing and cement this piece to the edge of the original diaphragm base (see Fig. 13) to provide elevation so that a second diaphragm can be mounted in light contact with the apex of the cone. Some regulation of the height of this ring (which is critical) is afforded by the amount of depth put in the center depres-



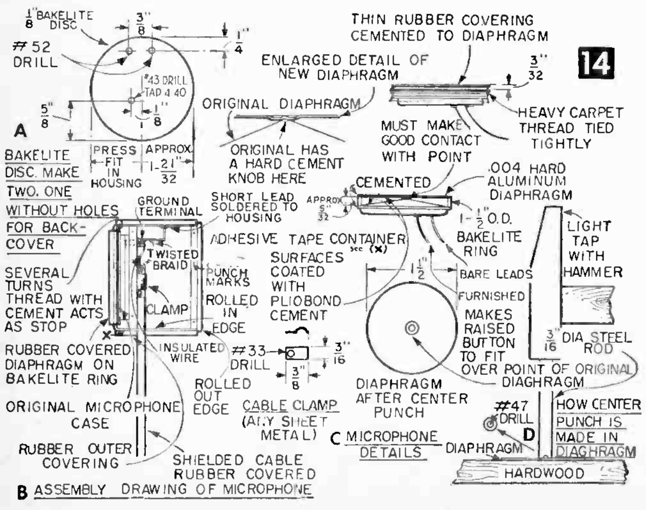
The basic part of the pickup unit is a crystal microphone cartridge (at left, cover removed). A conical aluminum foil diaphragm is used; the outer section of an adhesive tape roll houses the pickup.



Cut a ring from a piece of 1½ in. Bakelite tubing and cement it to the edge of the diaphragm to give elevation so that a second diaphragm can be fixed in position and make light contact with the point of the first. A Bakelite disc is also shown. It has "flea" terminals and will be pressed in the housing to hold the microphone in place.

MICROPHONE UNIT

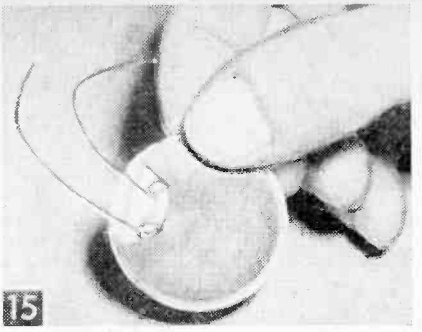
1	Argonne miniature crystal microphone cartridge MS 108 (Lafayette Radio)
1	Johnson & Johnson roll of adhesive tape 1" wide, 2½ yard size (for use of outer section of container only)
1	aluminum baking pan enclosed with package of Betty Crocker Answer Cake Mix. Can use other .004" hard aluminum sheet about 2" x 2" cut to 1½" dia. disc
2	pcs. ⅛" paper-base Bakelite about 2" x 2". Cut to make discs to fit in housing. Forest Products Co., or piece of scrap radio panel
1	pc. latex rubber sheeting about .016" thick x 2" x 2". Cut to make covering for diaphragm. A piece of Davol rubber leg bandage is type material wanted, or can use rubber sheeting of similar grade
2	flea terminal clips (Lafayette Cat. #MS 263, pkg. 12)
1	pc. of old inner tube about 1½" x 1½". Cut to make piece for back of microphone case
1	pc. of old inner tube about 6" x 1 5/16". Cut to make outer covering
1	pc. microphone cable with rubber outer covering S-51 or Belden 8411. (Lafayette Radio) Length to suit or about 4-5 feet
1	pc. of sheet metal, soft steel or brass, about .016" x ½" x 3/16". Bend to make cable clamp
1	pc. Bakelite tubing 1½" O.D. with 1/16" wall and about 2" long. Cut off ring in lathe to make piece shown in drawing. (Forest Prod. Co.)
1	2 oz. bottle of General Cement Pliobond. (Lafayette Radio)
	Misc.—heavy carpet thread

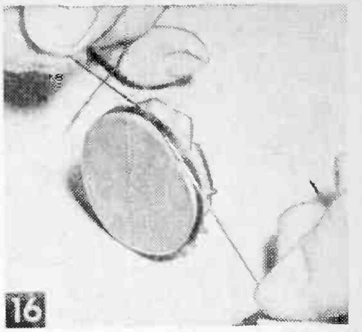


sion (see Fig. 14 details). The ring height can be tested after cementing in place by laying a steel scale on the edge. The scale should come in contact with the hard cement found at the point of the original diaphragm.

Next, fit the back surface of the microphone with a piece of rubber cut from an old inner tube and cement it in place. Cut a notch out of the rubber to clear the terminals (Fig. 15). Either contact or Pliobond cement can be used, Pliobond is somewhat easier to apply since it is thinner. For most joining of materials, apply a coat to each surface and after this has dried a few seconds, press them together.

Cut the new diaphragm from the bottom of an aluminum baking pan, the type that is supplied with a popular cake mix. This is about .004" thick and is semi-hard; it makes a thin but substantial diaphragm. The disc should be of the same diameter as the outside of the ring to which it will be attached. Figure 14D shows the tool made from a piece of 3/16 in. dia. steel rod with a shallow hole drilled in one end with a #47 drill used to make a ring depression with a raised center to fit over the point of the other diaphragm. The depth of the depression can be adjusted by trial so that light but firm contact with the other diaphragm is made. The diaphragm surface should be otherwise flat and smooth.





Cement a piece of rubber cut from an old inner tube to the back of the microphone, with a notch cut out to clear terminals. Upper non-insulated terminal connects to the shielded braid of the microphone cable and the inside of the housing to ground it (left). Apply a thin latex rubber covering over the diaphragm with cement, pulling the material tight and smooth and tie several turns of heavy thread around the edge, about 3/32 in. down from the edge (right).

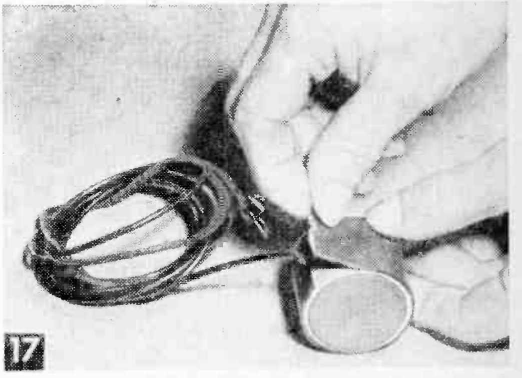
Apply a coating of Pliobond to the underside of the disc, holding the piece with the point of a pencil and apply two light coats in a careful manner to the original diaphragm (to minimize airborne sounds). Apply cement to the top edge of the ring and then center the disc and press it down. The cement should be quite thin.

Now apply a thin rubber covering over the diaphragm. Apply cement to diaphragm and also to one surface of the rubber. Stretch the rubber a bit in the hands, press it down and then wrap several turns of heavy thread around the edge of the ring about 3/32 in. down from the top (see Fig. 16). Tie tightly. The rubber I used was from an all-rubber latex leg bandage.

The assembled unit is now pressed in the adhesive tape container until the end projects just beyond the rolled-in edge. It should come to a stop against the thread turns.

The next step is to cut a disc of 1/8 in. Bakelite for a light press fit in the housing. Drill two holes for the tiny flea clips, using a #52 drill (see Fig. 14A). Press the clips in carefully and then cut off the projecting ends. Drill and tap a hole in the disc for a 4-40 screw used for a cable clamp. Apply some cement to the rubber backing on the microphone case and also to the inside surface of the disc and then push the bare leads through the clips and press the disc in place tightly to the microphone. Feed the leads through the clips carefully so that there will be no slack loops inside.

From measurements of the disc position, scribe a pencil line around the housing on the exact center of the disc thickness and then use a sharp prick punch to make a series of light indentations on the line to fix the disc permanently in place.



Apply a covering of rubber (with cement) to the outside of the pickup housing to dress it up and also to provide a sound-insulating grip surface.

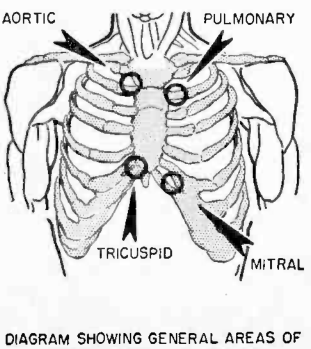
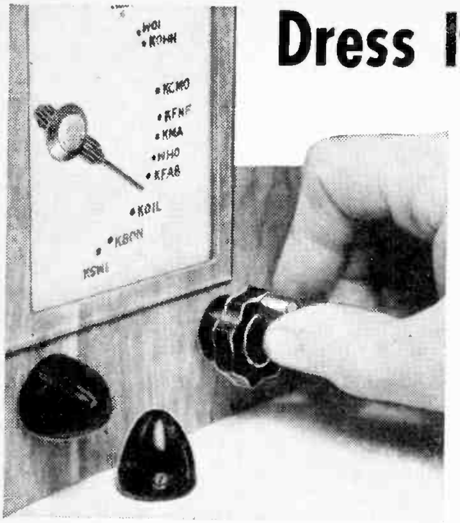


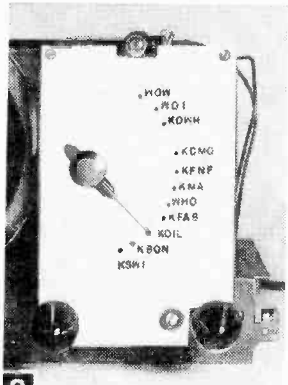
DIAGRAM SHOWING GENERAL AREAS OF THE HEART VALVES WHERE A STETHOSCOPE IS GENERALLY USED

The center insulated wire of the shielded cable is soldered to the terminal through which the lead from the insulated microphone terminal projects, together with the microphone lead that has been cut off at the end of this terminal. Form the metallic braid into a cable and solder it to the other terminal with the grounded microphone lead. Connect a short jumper from the grounded terminal to the housing at a soldered spot where the paint has been scraped off. A phono plug is connected to the other end of the cable. Solder the trimmed end of the insulated conductor to the end of the plug, a section of the shielded braid, to the base. The housing open end is enclosed by making a second Bakelite disc which is pressed in flush and held with prick punch spots around the housing on a center line of the disc. Cover the outside surface with a strip of rubber cut from an old inner tube (see Fig. 17).

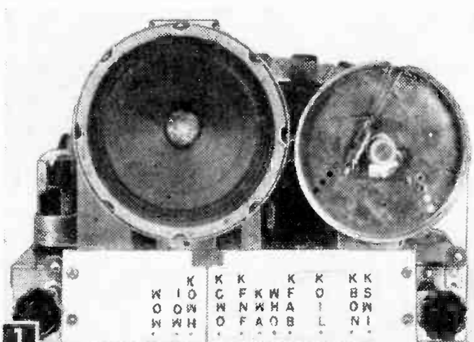
Dress It Up, For Convenience



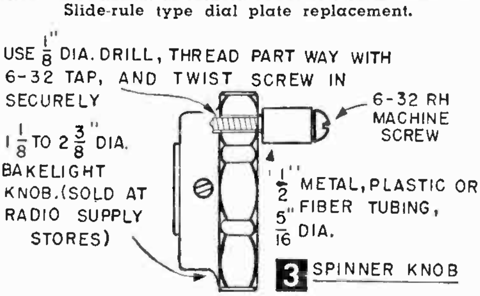
Replace the original dial plate with one that is custom call-lettered, and the original tuning knob with a spinner-type, and you've dressed up your radio as well as greatly adding to its convenience.



2 Rotary-pointer type dial plate replacement.



1 Slide-rule type dial plate replacement.



3 SPINNER KNOB

IF YOUR radio is not equipped with automatic tuning levers or pushbuttons, you'll appreciate the time-saving convenience of having the call letters of your favorite stations lettered on the dial plate so that you can tune to them quickly and accurately. (As radio servicemen and experimenters have discovered—to their profit—many people want and appreciate this added convenience.)

The radio's original dial plate is in no way defaced or spoiled. Instead, a duplicate dial plate is cut from Bristol board (a heavyweight drawing paper) and either replaces or is placed over the original plate, depending on the design of the radio. Thus, if you move to another part of the country where there are different stations with different call letters, you can make a different plate, or you can replace the original plate if you want to sell or trade-in the radio.

Figure 1 shows the chassis of a table radio (cabinet removed) with a slide-rule type dial. By pulling out the four snap-in trimounts, the original dial plate was removed and then replaced with a strip of Bristol board the same size. The call letters of the most-listened-to stations were then lettered onto the new dial plate with pen and India ink. Figure 2 shows the chassis of a table radio (cabinet removed) with a rotary-pointer type dial. An exact duplicate of the original dial plate was cut and punched from Bristol board and the desired station calls were lettered on it. (When working on an *ac-dc* chassis out of its cabinet, remember that it is likely to be "hot," so keep the radio disconnected when you are not actually tuning in stations for the purpose of spotting and lettering the stations on the new dial plate.)

Methods of fastening will, of course, depend upon the design of the radio. You can use small machine screws, thumbtacks, Scotch tape, or even glue, providing you apply it where it will not show if you should ever remount the original plate. On sets where a dial lamp is mounted behind and glows through the dial plate, your new plate can be made from artist's tracing cloth, celluloid, thin plastic, or any other transparent or semi-transparent material that will take India ink. (Clear plastic can be given a dull finish on one side so that it will take India ink, if you rub one side briskly with a damp cloth and a little scouring powder.)

The perfect complement to a lettered dial plate is a spinner knob enabling you to "crank in" your favorite stations in a hurry. Figure 3 gives construction details of such a knob. The larger its diameter, the smoother and easier will be the spinning action. It should, of course, be used only with a drum-and-cord type of dial arrangement (the type most commonly used), since no advantage would be gained by installing it on sets without such a vernier arrangement, that is, sets in which the tuning knob is fastened directly to the capacitor shaft.—A. T.

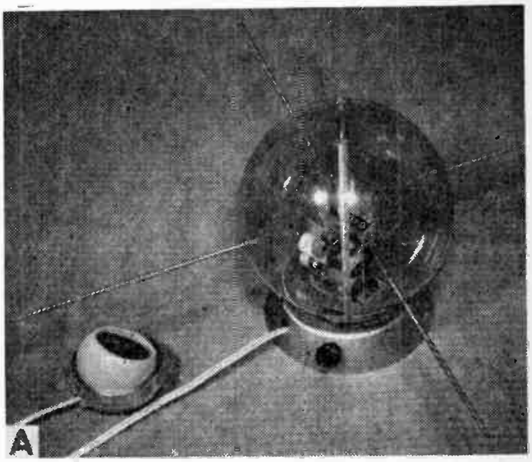
Model Satellite Transmits Voice and Signals

By THOMAS A. BLANCHARD

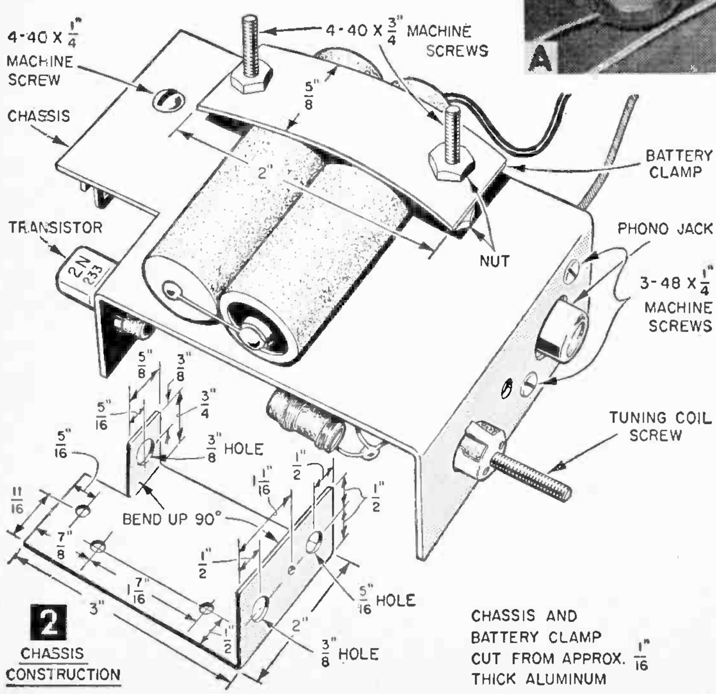
1

Fig. 1. The talking, beeping satellite is a small boy's delight. Transmitter is housed in a 6-in. plastic globe which mounts on a twist-lock base. Antenna elements are really aluminum knitting needles.

Fig. 1A. Closeup of model satellite and mike.



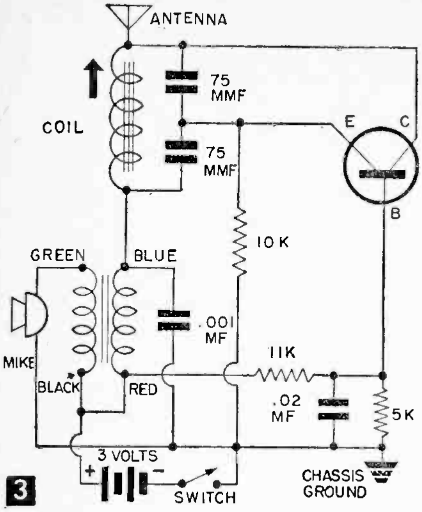
WHAT with all the talk about space travel and satellites, here is a simple electronic project (Fig. 1) that will broadcast both voice and simulated "beeps" out of any radio located within its broadcast range (100 to 200 ft.). Even more appealing is the fact that the "satellite's" transmitter is powered with just two penlite cells feeding a 1-transistor R.F. oscillator.



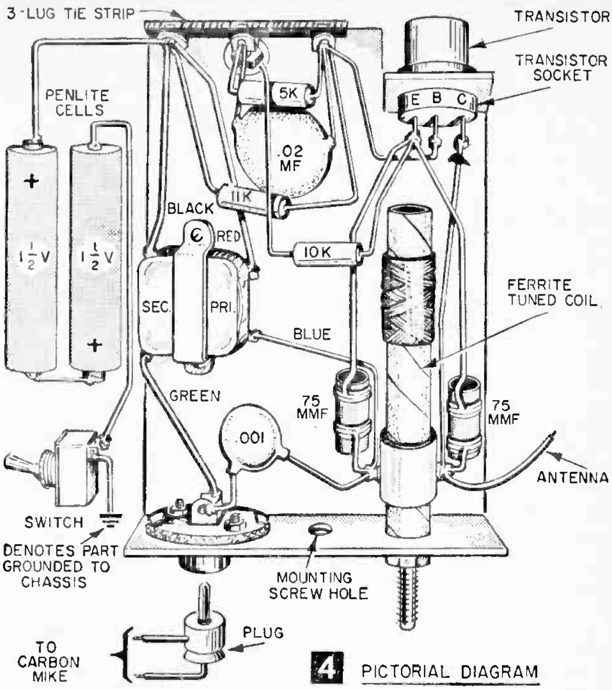
2 CHASSIS CONSTRUCTION

The oscillator is a transistorized version of the *Colpitts* circuit which is voice-modulated by inserting the high impedance winding of a miniature audio output or driver transformer in series with the hot side of the slug-tuned oscillator coil. The low impedance winding of the transformer is connected to a carbon telephone of mobile phone mike which is excited by the same penlite cells used to power the transmitter.

Because the voltage output of the humble carbon mike exceeds by a hundredfold crystal, magnetic or other microphones, there can be no substitution. Carbon mikes are less expensive than the unsuitable types, and there are many military surplus carbon mikes still listed at giveaway



3



4 PICTORIAL DIAGRAM

prices in various electronic parts catalogs.

The circuitry is so simple that little explanation is needed so long as the wiring details in Figs. 3 and 4 are carefully followed. The chassis is a 2 x 4-in. piece of light aluminum or other metal, with a 90° bend to serve as a mounting apron and holes for components drilled as shown in Fig. 2. When attached to the chassis with a 4-40 x ¼-in. machine screw, the center lug of the 3-lug tie strip is self-grounding (Figs. 2 and 5).

MATERIALS LIST—MODEL SATELLITE BEEPER

No. Req.	Description
1 pc	2 x 4" aluminum or other light metal approx. 1/16" thick (chassis)
1 pc	5/8 x 2" aluminum or other light metal approx. 1/16" thick (battery clamp)
2	1½-volt penlite cells
2	3-48 x ¼" fh machine screws for mtg. phono jack w/nuts
2	4-40 x ¾" rh machine screws for mtg. transformer w/4 nuts
2	4-40 x ¼" rh machine screws for mtg. chassis and tie strip
1	3-lug tie strip
1	RCA phono jack and plug
1	ferrite slug-tuned antenna coil
1	round transistor socket
1	rotary or toggle SPST switch
1	Argonne #AR-116 or #AR-153 miniature transformer (Argonne Corp., Dept. SM, 165-11 South Rd., Jamaica 33, L. I., N. Y.)
1	R.F. Type transistor NPN Type 2N233 (Sylvania) or 2N170 (GE) PNP can be substituted by reversing battery connections, but it must be R.F. type. A.F. transistors will NOT work.
2	75 mmf. disc or tubular ceramic capacitors
1	.001 mf. ceramic disc capacitor
1	.02 mf. ceramic disc capacitor
1	5K, ½-watt composition resistor (or 4.7K or 5.1K ohm alternates)
1	10K ½-watt composition resistor
1	11K ½-watt composition resistor
1	plastic sphere, 6 in. or smaller (such as bank made by Playwell Products, Inc., New York, N. Y.)
4	7" Silvalume knitting needles (#182 Susan Bates Brand) Available in sets of 4 at variety or knitting supply stores or from C. J. Bates & Son Co., Dept. SM, 18 Liberty St., Chester, Conn.
1	mobile carbon mike with push-button (military model available from Concord Radio Corp., 45-SM Warren St., New York 7, N. Y. Stock No. MOB-MIK-C6, $1.69. Minimum mail order $5).

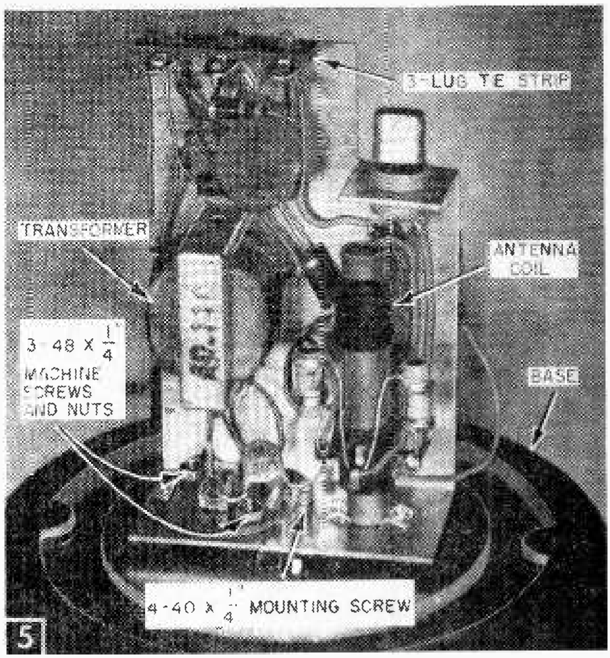
The phono jack also self-grounds when attached to chassis with 3-48 x ¼-in. screws and nuts. The ground lug on the jack is used as a tie point for the grounded side of the .001 *mf* ceramic capacitor. All other grounded components are connected to the center lug of the tie strip, including the 10K resistor from emitter lug of transistor socket. When wiring the transistor socket note that lug C is twice the distance from B that B is from E (Fig. 4).

The oscillator coil is a conventional ferrite "loop" which is snap-mounted to chassis. The transformer is mounted to the chassis with a pair of 4-40 x ¾-in. screws and nuts, which also secure the ⅝ x 2-in. strip of aluminum which clamps the two penlite cells in place (Fig. 2).

The 6-in. dia. plastic sphere which serves as our satellite (Fig. 1) is a modified toy bank sold in many toy, drug and stationery stores. Actually a smaller sphere can be used, or a plastic fish bowl, ball, planter or other such gadget.

Our clear plastic sphere mounts on a twist-lock base in which clearance holes for tuning coil and phono jack are drilled (Fig. 1). Mount completed chassis to base with one 4-40 x ¼-in. machine screw inserted in chassis between jack and coil (Fig. 5). Drill a clearance hole in side of base so that the phono plug fitted on mike cord can be plugged into the jack. The battery switch may be either a single pole toggle or rotary type, installed in the base as in Figs. 1 and 1A. A single lead from battery connects to one switch lug (Fig. 4). Remaining switch lug is connected with a short lead to the chassis mounting screw.

The antenna elements are #3 double-pointed



Chassis mounts to base by means of a single screw located between coil and jack. While model shows transistor socket mounted on a bent tab, this extra operation is unnecessary.

anodized aluminum knitting needles, 7 in. long. Thread one end of each needle with a 6-32 die a distance of ⅜-in., while needle is clamped in a smooth-jaw vise. Drill four equidistant holes in the sphere and secure antenna elements with 6-32 nuts front and back (Fig. 1A). The antenna lead can be connected to the elements, or they may be used for appearance only, with a 3-ft. length of dangling wire serving as antenna.

For the keen observer who notes that our mock satellite has only four antenna elements, let us note that if a perfectly round plastic ball can be obtained, two more elements (one at top and one at bottom) may be added, or just one (at top) may be added. However, while many satellites have been pictured with six antenna elements, models exhibited by one of the best-known electronic firms have four elements, just as in our project.

To test your transmitter, turn on any radio set and set the dial to a silent spot near 1600KC. While the transmitter will tune all the BC band, the range is greater at the high end. Switch on the satellite and rotate the slug screw of the transmitter's tank coil until a high-pitched feedback whistle is heard through the radio. Place the mike near the set's speaker to insure picking up this tone.

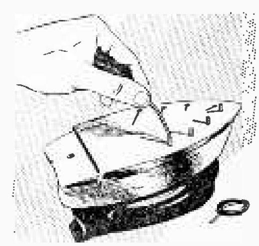
With coil screw turned back out of the coil your transmitter will be tuned toward the 1600KC end of the dial; with screw turned in the signal will be toward 550KC on radio dial. Experiment until the fundamental frequency is found, as various points on the dial will yield harmonic signals which are weaker than when set and transmitter are tuned to the true frequency.

Using a surplus military mike with a push-button and pointing the mike toward the radio speaker will generate a feedback each time the mike circuit is closed, thus stimulating a beep each time the button is depressed. As with all mikes in direct range of a vibrating reproducer, for speech you must face mike away from the radio speaker or retire to another room to prevent feedback. Anyone who has previously experimented with microphones and amplifiers is well aware of this problem. You probably have heard it happen on TV shows originating from theater studios, where a misplaced mike or too much gain sets up oscillations between the stage mikes and the PA system by which the audience hears the performers.

A concluding note about the microphone transformer. Transformers made specifically for this purpose are not as tiny as the audio substitute used. After completion of the transmitter, which was fitted with an Argonne #AR-116 output transformer, we discovered another unit, the Argonne #AR-153 driver transformer which might make a better impedance match than the #AR-116. The #AR-153 has a center-tapped primary winding. The center lead is simply ignored.

Note that the use to which we have put this type transformer makes the transformer hookup the reverse of its intended purpose. Thus the winding the manufacturer calls the primary (higher impedance) is actually hooked up in our circuit as the secondary winding. Color-coded transformer leads are indicated as they apply to this project so data supplied with transformers is disregarded in this instance.

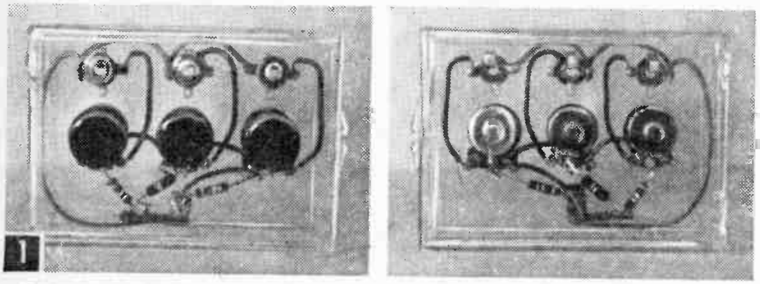
Steam Iron Holds Phone Tips



• When soldering wires to phone tip plugs, borrow your wife's steam iron to hold the plug while your hands are busy with wire and soldering iron. Just rest the iron bottom-side up or clamp it in a vise, and put the plugs in the steam vents in the soleplate. Since most irons have a minimum of six vent holes, it's possible to do at least six plugs at a time. When plugs are half-filled with solder, insert the ends of the wires, pull the line plug out of the iron and let it cool slowly. Or, if you prefer, lift each individual plug out with a pair of pliers while holding the wire in place.—John A. Comstock.

Your Amplifier Has More Inputs With This Simple Signal Mixer

By FORREST H. FRANTZ, Sr.



1 Front and back views of simple signal mixer which enables you to use a single input amplifier for several different input signals simultaneously.

THIS three-channel mixer will enable you to feed signals from a radio tuner, a microphone, and a phonograph pick-up into a single input amplifier, will give you individual volume control for each of the inputs, and enable you to talk or sing through the microphone input with music entering through the phonograph or radio input.

Signal mixer circuits vary considerably in configuration and complexity. Some mixer circuits use tubes or transistors; simpler mixer circuits use only resistors and volume controls. The circuit of this ultra-simple mixer is shown in Fig. 2. It uses three volume controls and three resistors, plus the input impedance of the amplifier to accomplish mixing. It can be built to work with a low-impedance input amplifier (such as a transistor amplifier), or to function with a high-impedance input amplifier (such as a vacuum-tube amplifier). The only difference between the two units is in the resistance values of the volume controls and the resistors used.

For a transistor-amplifier signal mixer the resistance of the volume controls should be 25K (25,000) ohms and the resistors, 10K. For a vacuum-tube amplifier mixer, the volume control should be 250K and the resistors, 270K. (This assumes that the matching to the three input devices is not too critical; in general, this is true.)

Construct the mixer in a plastic case, using miniature volume controls and input jacks. (There is, however, enough room in the case to use the conventional size volume controls and jacks if you wish.) The hole layout for the front of the plastic case is shown in Fig. 3. Make holes by punching small pilot holes with a heated ice pick and reaming them to size with a taper reamer and provide a hole in the back of the case for the mixer output lead. Cut volume control shafts to a length of 5/16 in.

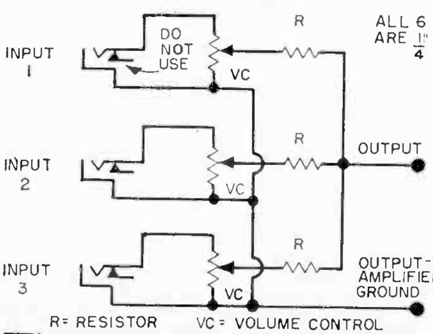
Solder leads to the input jacks before you mount them. If you don't, you may damage the plastic case by melting some of it. Mount jacks, volume controls, and the insulated tie-down terminal, complete the wiring and fasten an output lead with a connector or plug that fits your amplifier input.

Input jacks and matching plugs are available as an inexpensive combination (the combination is called out on the Materials List). Equip the output leads from the three signal sources you'll be using as mixer inputs with these miniature plugs. The "ground" leads connect to the body of the plugs, the other leads connect to the tips.

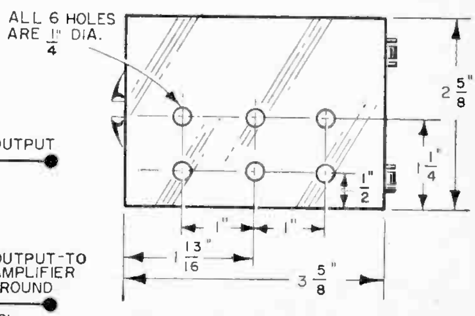
The mixer may have to be shielded to prevent *ac* hum pick-up if it's built for use with a vacuum-tube amplifier. Do this by lining the inside with aluminum foil before mounting components. The shield connection to mixer ground can be made through the volume control mountings by connecting a lead from any or all of the volume control cases to the mixer ground terminal.

There's a small signal loss in the mixer since it is made up entirely of resistive components. The loss is very small and for usual input levels and amplifier gains is of no consequence.

The inputs to the mixer should be free of di-



2 SCHEMATIC



3 HOLE LAYOUT FOR PLASTIC CASE FRONT

rect current. If any of the inputs contain *dc* components, insert .1 mfd, 600v capacitors in series with input leads to isolate the volume controls.

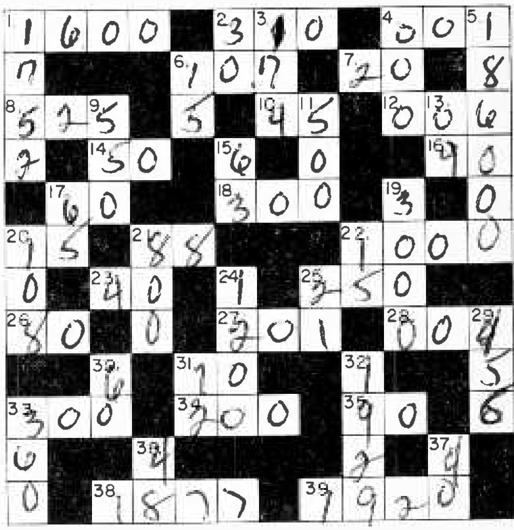
MATERIALS LIST—SIMPLE SIGNAL MIXER

No. Req'd.	Description
1	1 x 2⅝ x 3⅝" plastic case (Lafayette MS-159)
3	miniature phone jack & plug sets (Lafayette MS-370)
3	miniature knobs (Lafayette MS-185)
1	insulated tie-down terminal
3	½ watt carbon resistors (use 10K with transistor amplifier, 270K with vacuum-tube amplifier)
3	miniature volume controls (use Lafayette VC-24 25K with transistor amplifier, or Lafayette VC-37 250K with tube amplifier)

RADIO-TV CROSSFIGURE PUZZLE

By JOHN A. COMSTOCK

Ever work a crossfigure puzzle? This one deals with figures often encountered in radio-television and electronics. You'll find many of them already familiar to you; others you may have to figure out using simple arithmetic. In any event, this puzzle will supply an enjoyable 30 minutes or more of juggling numbers fun. And it's educational, too!



CLUES

ACROSS

1) Upper frequency limit of standard AM broadcast band.
2) Value of resistor color-coded orange, brown, brown.
4) The tip radius of a microgroove phono needle (decimal).
6) FM superhet I.F.
7) Current flow in a circuit when resistance is 10 ohms, voltage 200 volts.
8) Total scanning lines in one television frame.
10) Voltage dropped when 1 ampere flows through 45 ohms of resistance.
12) Six microhenries inductance expressed in henries.
14) Heater voltage of 50B5 vacuum tube.
16) Number of electrical degrees in one-quarter cycle of an *ac* signal.
17) Ripple frequency of a half-wave, two-phase rectifier.
18) Impedance of ribbon television twin-lead.
20) The diameter of a large hi-fi speaker.
21) Lower frequency limit of standard FM broadcast band.
22) 1.34 horsepower expressed in watts.
23) Impedance of a circuit when applied voltage is 40 volts, current flow 1 ampere.
25) Number in radiotelegraph code: two-dits, three-dahs, five-dits, five-dahs.
26) Power expended in a circuit which draws 2 amperes at 40 volts.
27) Mid-frequency of television channel 11. (Upper and lower limits are 198 and 204-megacycles respectively.)
28) Frequency of 4 kilocycles converted to megacycles.
31) In milliamperes, the current leaving a circuit when input current is 10 milliamperes.
33) Wavelength of a 1,000-kilocycle signal.
34) Width of a commercial FM broadcast channel.
35) Number of electrical degrees of current-voltage signal displacement through a capacitor.
38) Year Edison announced invention of the phonograph.
39) Year regular broadcasts began in the United States (KDKA).

DOWN

1) Year Benjamin Franklin flew a kite and discovered certain electrical phenomenon.
2) The frequencies in the VHF band extend from — megacycles to 300 megacycles.
3) The lower frequency limit of TV channel 7. (Upper limit of channel is 180 megacycles.)
4) Number of zeros represented by orange in resistor color code.
5) Velocity of radio waves in free space in thousands of miles per second.
6) Total resistance of three 5-ohm resistors connected in series.
9) Lower limit of AM broadcast band.
11) ½-kilowatt in watts.
13) Frequency of 90 cycles per second expressed in kilocycles.
15) Mid-frequency of television channel 3. (Lower channel limit, 60 megacycles.)
17) UHF television channel between 64 and 66.
19) Three kilocycles converted to cycles.
20) Upper frequency limit of standard FM broadcast band.
21) Second harmonic of 400 kilocycles.
24) Number of watt-hours consumed by a 60-watt transmitter operated for 20 hours.
25) Popular size television larger than 17 inches.
29) AM superhet I.F.
30) Television vertical scanning frequency.
31) Popular size speaker slightly smaller than 15 inches.
32) Year screen-grid tubes were developed.
33) Number of electrical degrees plate current flows in a class A amplifier.
36) Total voltage of 32, 1½-volt cells series connected.
37) Total number of watts capable of being dissipated by two 50-ohm, 20-watt resistors, series connected.

For answers, see page 144.

Want an Extra "Hand" for those long conversations?

Try this Telephone Amplifier

With a telephone on this amplifier, you not only hear what the person on the other end says, but can talk back by speaking directly into the front opening

By HAROLD P. STRAND

Anyone who has to write while listening to the telephone needs this amplifier, but it makes all long telephone talks easier.

THERE'S no longer any need for holding a telephone during long conversations, when the other party takes off to look up records or when you need both hands for writing while listening. With this amplifier, phoning becomes easy and pleasant. Here's how it works. To start the amplifier, just place the receiver into the pickup element and let it rest in the cradle (Figs. 1 and 2). An automatic switch operated from the weight of the telephone turns on the battery operated circuit. The other party's voice comes out the speaker at the right-hand side of the cabinet. To talk back, you simply speak into the cabinet opening around the transmitter. A volume control on the left-hand side allows you to adjust speaker volume, a big aid for persons slightly deaf.

The recess under transmitter works something like the head set in a bowl to amplify the sound so others could hear it as in the old days of crystal radios, except in this case, it works in reverse. Sound waves entering the cavity are reflected from its smooth surface into the transmitter and talking close and directly into the cavity in a normal voice, will give very comparable transmission to the other party. Sitting as far as 3 feet away and raising the voice a little, still permits conversation. From a distance of about six to eight feet you can still converse, but in a louder voice.

A small 2-stage amplifier builds up energy from the inductance pick-up coil to loud speaker volume. The

To put hand set in position, slip receiver into pick-up unit and let handle rest on cradle. Plunger in the rest automatically switches on amplifier.

MATERIALS LIST—TELEPHONE AMPLIFIER (Electronic)

1 metal cabinet, sloping front, 8 x 8 x 8", Insuline Corp. 3990
1 5" P.M. speaker, 1.47 oz. magnet or larger
1 output transformer, 8000 ohms to 4 or 3.5 ohms
1 volume control knob with 0-10 attached dial. National type HRS
1 telephone pick-up unit, Permoflux Corp., model M-53 (or M-55 for newer 500 series handsets). Available from Radio Shack, 167 Washington St., Boston
1 terminal strip, 6 terminals, Jones 6-140
2 miniature 7-pin sockets, Amphenol 147-500
3 rubber grommets for 1/4" hole
1 phono jack, RCA type. 1 phono plug, RCA type
1 volume control, 1/2 meg., Mallory Midgetrol U-48, #1 taper
2 chassis terminal strips, Jones lug type, 2 terminal
1 1S5 miniature 7-pin tube. 1 3S4 miniature 7-pin tube

Resistors—1/2 watt carbon

1 .47 meg. 1 1 meg. 1 2.2 meg. 1 680 ohm.

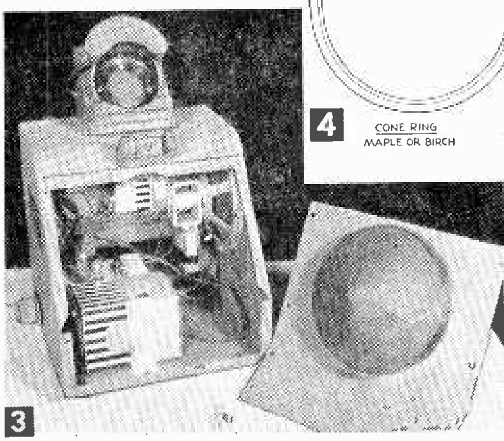
Condensers—Aerovox disc type—

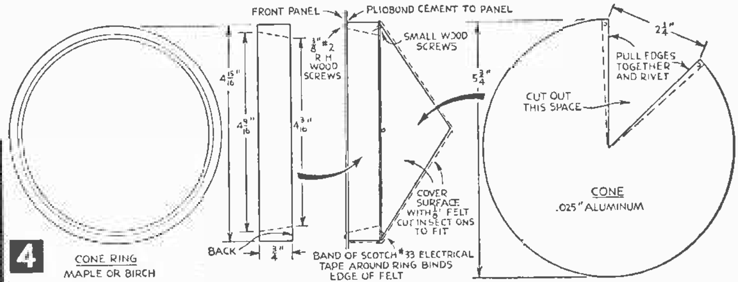
2 .005 2 .01
2 snap terminals to fit 90 volt portable B battery
1 terminal plug to fit 1 1/2 volt portable A battery
1 Burgess A battery 1 1/2 volt, type 4 F
1 Burgess B battery 90 volts, type N 60

Misc. Materials

1 sheet aluminum about .050 x 3 3/4 x 9", chassis
1 sheet aluminum about .035 x 3 1/2 x 9 1/2", pick-up bracket
1 sheet aluminum about .025 x 6 1/2 x 6 1/2", cone
1 birch plywood, 3 3/8 x 4", pick-up base
1 birch or maple 1/2 x 3/4 x 3", receiver rest
1 birch or maple 5/8 x 1 1/2 x 2", cut out for hand set rest
1 birch or maple about 3/4 x 5 3/4 x 5 3/4", cone ring
Sheet felt 1/8" thick as required to cover outside of cone
4 rubber knobs or feet with 10-32 machine screw studs, bottom of cabinet
1 3/16" Masonite hard board about 5 1/2 x 5 3/4", speaker baffle
1 grille cloth 5 1/2 x 5 3/4"
1 brass rod 1 3/4 long, 1/8" dia., switch plunger
1 brass tubing 1/8 I.D. 1/4 O.D. x 1 3/16", plunger bushing
4 phosphor bronze .014 x 5/16 x 3", switch springs
4 silver alloy contacts
1 Bakelite, canvas base, 1/8 x 7/16 x 1", switch spring spacer bar
1 Bakelite, paper base, 3/8 x 3/4 x 1 1/2", switch support block
2 pipe spacers, 1/8 I.D. x 1/4 O.D. x 7/16" long, switch spacers
1 perforated sheet steel, 2 1/4 x 7 3/4", cover for back opening
Misc. screws, nuts, hook-up wire, paint etc.

Parts behind front panel. Note 1/8-in. felt backing on cone. Metal straps hold A and B batteries in place.

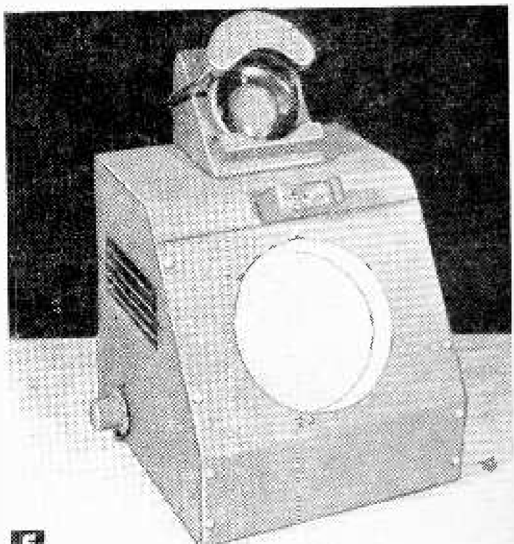

3



4

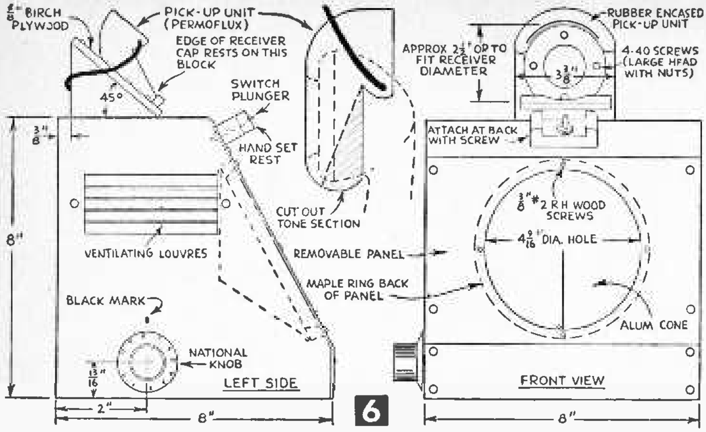
pick-up coil is made especially for picking up telephone conversation without any connections or alteration to the telephone system. It forms the most expensive component of the unit, selling for about $15.00 at electronic supply stores, but since it is a key part, get a good one.

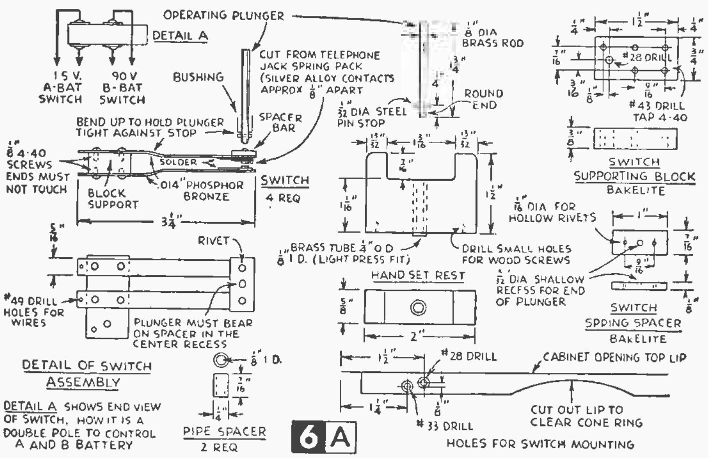
The unit is built around a gray-ripple finish stock cabinet, but an opening needs to be cut in front (Fig. 3). Cut the aluminum cone from .025-in. sheet stock (Fig. 4), and bend up to a cone with a rivet at the edge. Turn the wood ring from maple or other hardwood and mount between the cabinet panel and cone as shown in Fig. 4. The *Permoflux* pick-up unit must be trimmed around its front edge to allow the hand set to be slipped in and out easily (Fig. 6). Bend up the .035-in. sheet aluminum bracket that supports the birch plywood to which the pick-up unit is screwed (Fig. 6B). The *Permoflux* unit should be fitted to the receiver you plan to use it with. The receiver should be pressed into position and come to a stop against the hardwood block at the bottom. The hand set should slip in and out easily, yet be firmly held in position.

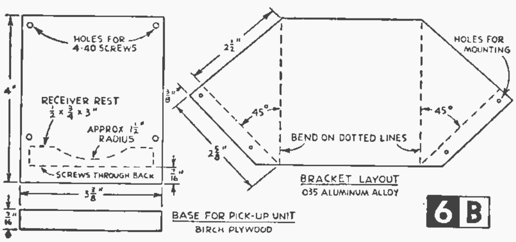

5

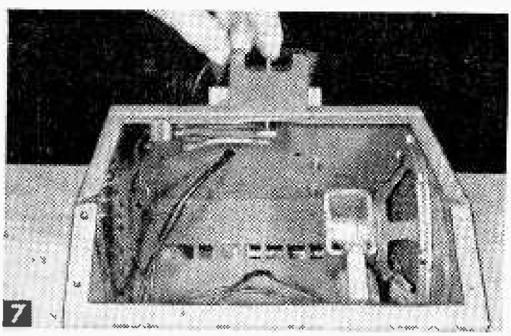
Cone under transmitter is open here, but may be covered with metal grill. Volume control is at left side and louvers help ventilate amplifier.

Build up the leaf-spring switch that automatically switches on the set as shown in Fig. 6A. Silver alloy contacts were borrowed from the spring pack of an old telephone relay and







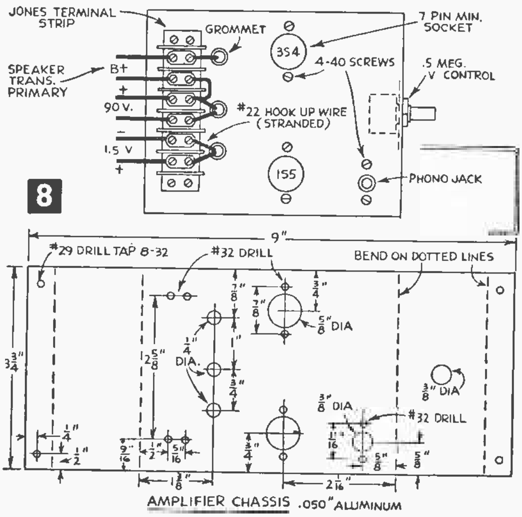


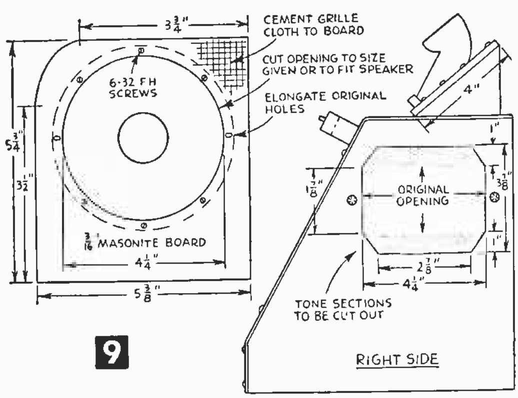
7 Switch plunger and leaf spring. Note how speaker is mounted to Masonite panel at right side. Heavy wire at left is shielded wire from Permoflux pick-up.

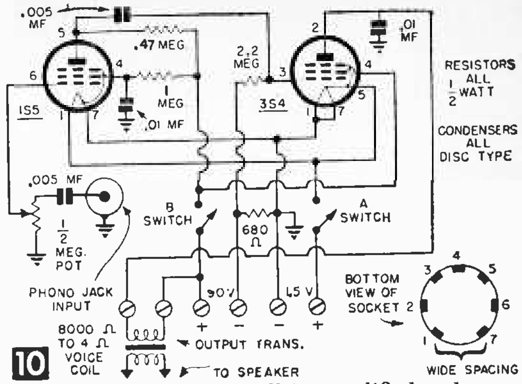
soldered to the ends of the springs. A piece of 1/8-in. *Bakelite* is riveted to the two top springs as a spacer bar. The brass switch plunger passes through a brass bushing in the maple block and rests against this insulated spacer.

The back surface of the aluminum cone is covered with 1/8-in. felt to deaden reflected sound and add to the accoustical value of the cone. The speaker can be seen mounted to its *Masonite* baffle, with the output transformer secured to the speaker frame. The amplifier has been placed to the left rear, where the volume control shaft can project through a hole in the side of the cabinet. The A battery is fixed in a front position with a strap and two bolts, and the B battery is secured to the upper right hand back section with a similar strap. Flexible #22 insulated wire is used for all connections, with standard attachment clips to the B battery and a plug to fit the portable A battery. These snaps make it easy to replace batteries as needed.

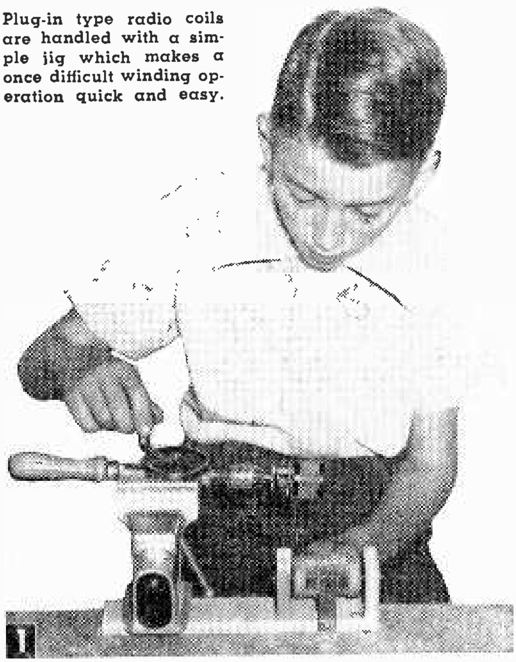
Bend up the chassis from the flat pattern shown in Fig. 8. Layout the holes and set the tube sockets for the two tubes. Wire up the circuit according to the schematic diagram of Fig. 10. Mount the speaker behind the side hole in the cabinet and cover with grille cloth cemented over the opening. The volume control fits into a hole drilled in the left side (as shown in Figs. 5 and 6).







When using the amplifier, answer the telephone in the usual way to establish contact before placing the hand set in position. Then speak normally into the cone opening. The person's voice from the phone will be amplified and come through the side speaker. Adjust the volume carefully, as the cone will pick up an annoying feedback squeal if the speaker volume is adjusted for too loud a volume.



Plug-in type radio coils are handled with a simple jig which makes a once difficult winding operation quick and easy.

Winding Small Coils

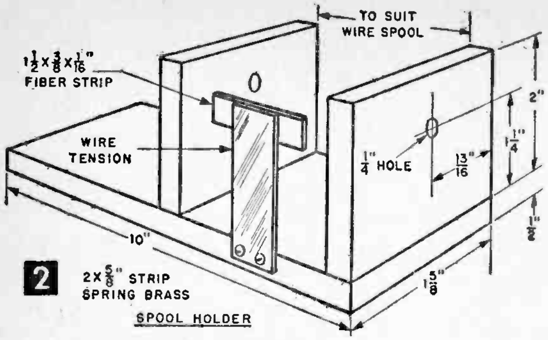
You can "roll your own" coil windings using simple shop tools and following these instructions

WHEN electronic, radio or TV projects call for home-wound coils, you're likely to find yourself in a jungle of snarled magnet wire unless you use some system. A simple coil-winding set-up (Fig. 1) allows you to wind practically any type of coil either on an insulated cylinder or a plug-in coil form. The winding apparatus consists of a vise, hand or breast drill and a home-made spool holder for unreeling the magnet wire as it is wound onto the coil form. The spool holder (Fig. 2) is made from ½-in. pine. Drill ¼-in. holes for the spool supports and use a 20*d* (4 in.) building nail for the spool of magnet wire to rotate on. Spacing of supports was 2⁹⁄₁₆-in. on the original model, but the exact size of wire spool may vary among manufacturers. Check the brand of spool wire offered by your favorite radio parts supplier, and space the vertical supports accordingly.

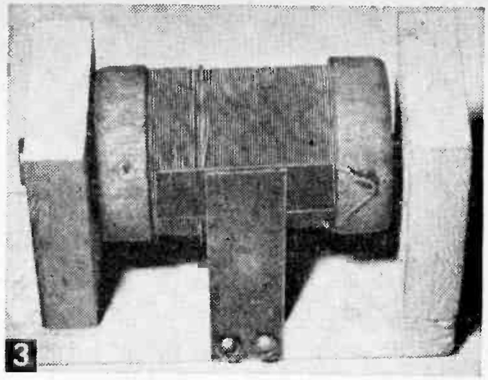
To prevent the spooled magnet wire from getting out of hand while winding a coil, use a simple brake to maintain spool tension as the wire is being removed. This brake is merely a strip of spring brass with a fiber or smooth wooden strip cemented on the end with *Pliobond* or other all-purpose cement. The fiber piece acts as a brake shoe over the entire wire area (Fig. 3). After mounting the brake with two small screws, bend the brass strip inward to provide sufficient pressure against the spool of wire. An ordinary hand or breast drill gripped in the vise jaws drives the coil winder. Fit the drill chuck with one of several jigs which hold the coil form during the winding operation.

For winding coils on paper, plastic, or Bakelite tubing, two wooden cones lock the coil form on a threaded shaft made from a 6 or 8-in. eyebolt with 14-24 or ¼-20 threads. The eye is sawed off, and the bolt inserted in the drill chuck. To mount a tubular coil form, run a nut up on the bolt, followed by one wooden cone. Slip the coil form over the bolt, and follow with the second cone. The coil form is secured by drawing up the wingnut. The wooden cones (Fig. 4) automatically center coil forms from ½ to 1⅛ in. diameter.

Fig. 5 shows how to make a handy jig for wind-

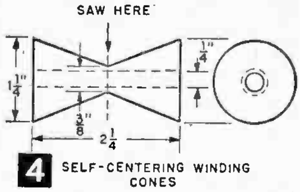


Spring brass leaf and fiber bar keep spooled magnet wire under tension, to simplify winding.

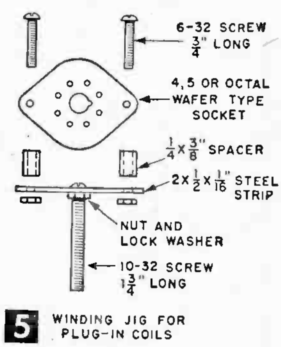


ing plug-in type coils. These coils, frequently used in shortwave receivers, are wound on 4, 5, or octal type bases salvaged from discarded tubes, or on plug-in type coil forms sold by many radio parts suppliers. Ordinarily, such coils are difficult to wind. Secure the jig shaft in the drill chuck and plug in the coil form, and winding the coil is quite simple .

Small plastic bobbins included with motor kits, or bobbins used for winding radio RF chokes, etc. may be wound by whittling a plug of soft wood to fit inside the rectangular or round bobbin. Drill a hole through the center of the plug and use a bolt, washers and nut to make the assembly rigid. The bolt is then inserted in the drill chuck and bobbin wound with the desired number of turns.

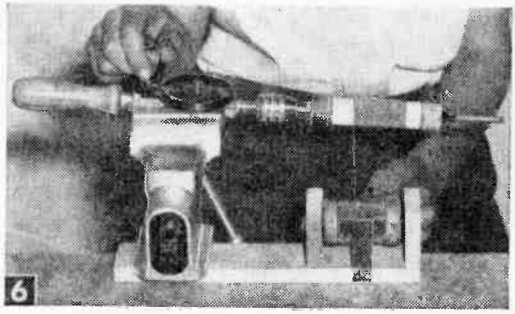


When winding single layer coils, drill a hole in the coil form to secure the end of the magnet wire. A thin coat of coil dope, sold by radio supply houses, may be applied to the form as the wire is being wound, to insure a coil with turns rigidly secured to the form.



Winding Coils from Hank Wire

Figs. 1 and 6 show how wire is guided onto coil form with the thumb and index fingers holding it taut. Wire, in various gages and insulations called for in radio projects, is sold only on spools. However, construction kits may include coil wire in hank form. Motors, electromagnets, etc. may be wound from the hank, by placing the hank over a milk or beverage bottle on the floor directly under your coil winding set-up.



Winding coil on a tubular coil form.

The bottle will cause the wire to come off the hank in spiral fashion as you proceed to wind the electrical coil in question. Of course, the hank could be transferred to an empty wire spool but this additional operation isn't necessary if you exercise a little care.

While coil forms may be purchased in a variety of sizes, the experimenter will find many everyday household items that make ideal coil forms. Plastic pill vials, toothbrush containers, plastic sip straws, cardboard tubing from discarded flashlight cells, roll tissue or wax paper, cosmetic containers—all may be used as coil forms.

"Electronics experimenting is a hobby of mine."

Telethermoscope

for amateur weather stations

Here's a very accurate, remote indicating electrical thermometer for indoor readings of outdoor temperature

By CHARLES A. LAIRD

Telethermoscope indicator located inside house gives accurate reading of outdoor temperature. Three-wire cable shown in insert A connects temperature-sensing bulb, which is located outside, to box housing indicator meters.

BUILT of standard electrical parts readily available, this special type of thermometer is commonly used in science and industry, and many Weather Bureau stations.

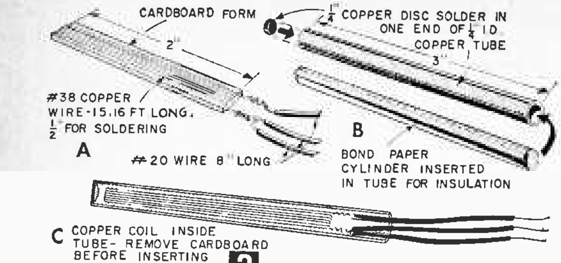
Its operation is based on the principle that the electrical resistance of most metals increases as their temperature increases. For example, if we make up a coil of copper wire of predetermined wire size and length and insert it in a protective tube or "bulb" for use as the temperature-sensing device, and connect this coil to a simple, calibrated resistance bridge to determine the coil's electrical resistance, we have a very accurate method for determining the temperature. The advantage of this type of thermometer is that the coil or sensing device may be placed at a point remote from the indicating meter (Fig. 1).

MATERIALS LIST—TELETHERMOSCOPE

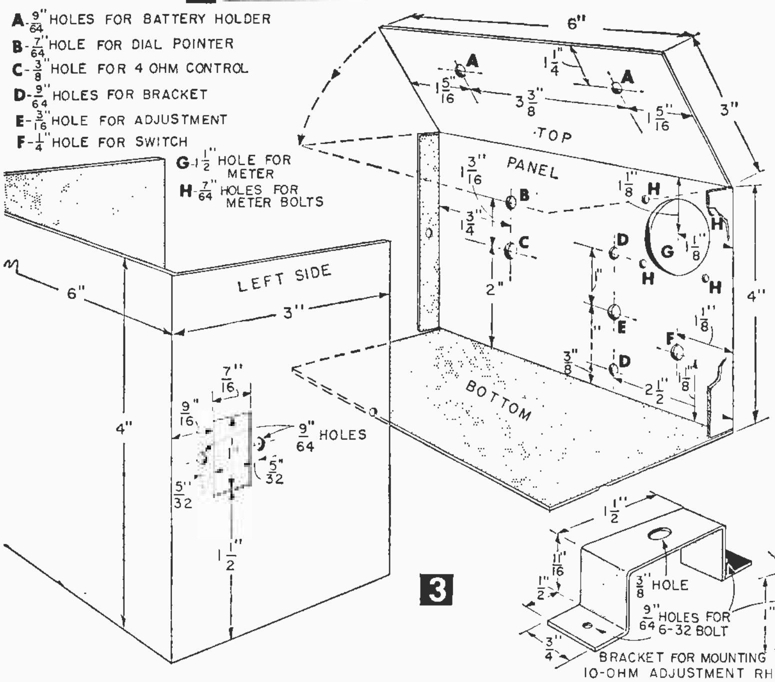
No. Req.	Size and description
1	6 x 4 x 3" metal chassis box to house instrument components
1	0-100 microammeter (Calrad, type MO-38, 1½" sq meter, available from Columbia Electronic Sales, 2251-53 W. Washington Blvd., Los Angeles 18, Calif.) for balance meter (cost, $5.50).
1	10-ohm wire wound control Clarostat, series A10 for adjusting rheostat
1	4-ohm wire wound control Clarostat, series A10 for temperature rheostat
1	3-prong socket, Cinch-Jones S-303-AB for cable connection
1	3-prong plug, Cinch-Jones P-303-CCT
1	push button switch, Switchcraft 95L
1	2¾" radio dial and pointer
2	10-ohm wire wound resistors, Ohmite, 10 watt
2	D-size flashlight battery cells
1	¼" I.D. x 3" long copper tubing for bulb housing 10'
1	Belden No. 8443 3-wire cable (any length may be used as explained in text)
	18 ga. x 1" x 12" aluminum strip for mounting batteries and 10-ohm rheostat
	small terminal strip
16 ft	#38 enameled copper wire
	small disk cut from plastic
4	4-40 x ½" rd. machine screws
6	6-32 x ½" rd. machine screws
2 ft	#18 hookup wire
	drawing paper

Start construction by making the coil first. Cut off a length of #38 enameled copper wire exactly 15.16 ft. (15 ft. 1$^{15}/_{16}$ in.) long plus ½ in. for soldering leads to the ends. Wire tables in physics books show that the electrical resistance of a 15.16 ft. length of #38 copper wire is equal to 10 ohms at 68° F. Actually if a small error is made in measuring the length of wire, it's not too important because we can compensate for this in final calibration of the instrument.

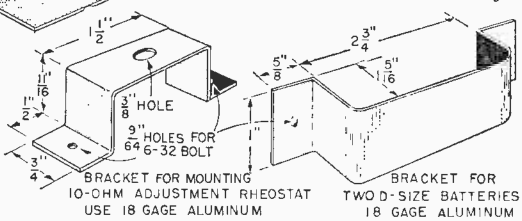
Wind the wire, skein fashion, on a 2-in. length of cardboard as in Fig. 2A. To one end of the wire, solder an 8-in. length of #20 insulated flexible radio hookup wire and to the other end, two lengths of the #20 wire. Use rosin-core solder sparingly. Then cover the splices with short lengths of plastic electrical tape to make certain there will be no short between splices.



2 BULB CONSTRUCTION



3



To make the protective tube or bulb, cut off a 3-in. length of ¼-in. I.D. copper tubing and close one end by pinching and soldering or by soldering on a ¼-in. disc of copper (Fig. 2B). Insert a cylinder of bond paper in the tube for insulation. Now, carefully remove the coil from the cardboard strip and insert it in the tube (Fig. 2C). Give the coil a slight twist to make it easier to insert. Complete the bulb by filling it with melted sealing wax.

Next, lay out and drill the mounting holes in the box (Fig. 3) and make the various brackets for the parts (see Materials List for parts).

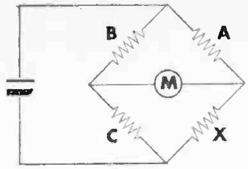
Any microammeter may be used for the bridge balance meter. We used a 0 to 100 miniature-type, microammeter and adjusted it to read as a center zero meter by turning the two hairsprings at the front and back of the meter pivot. This is quite a delicate operation and care should be used. Unless you've had some experience with meters, it's best to use a meter with its zero already in the center of the scale. The purpose of this meter is to indicate a null, or zero, current condition.

Since the 10-ohm rheostat (A2 in Fig. 6) is for initial (and possibly future) adjustment only, mount it on the metal bracket detailed in Figs. 3 and 6 so its shaft will not extend through the chassis box. Then drill a hole through the box in line with the shaft so a screwdriver may be used for initial adjusting. The 4-ohm rheostat (A1 in Fig. 6) is mounted so its shaft extends through the box and is controlled by a standard radio dial. Fasten the two D-size batteries to the box side as in Fig. 7 with the metal strap detailed in Fig. 3. Use a small terminal strip to support one of the 10-ohm resistors.

A Wheatstone bridge circuit (Fig. 4) offers an accurate method for measuring resistance. If we let resistor X represent our temperature bulb, then the formula, $X = AC/B$, applies. If the four resistances are equal, the meter M will show no current. If resistor X increases in value, the meter will show current. We can bring the meter current back to zero by increasing the value of A by a corresponding amount. This is the principle used in our telethermoscope.

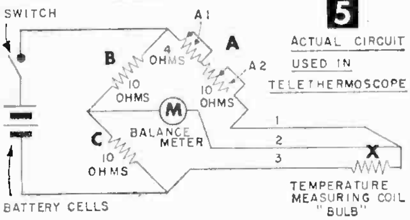
The resistor X in the circuit we are using (Fig. 5) is our coil of copper wire. The resistance A is variable and has a dial calibrated in degrees. Actually, two rheostats are used in leg A of our bridge. A2 is for setting purposes, and A1 has a dial calibrated in degrees F. for direct reading of the bulb temperature. By using three leads between the bulb and the bridge, length of the leads and lead temperature will not affect accuracy of the instrument. The two outside wires (1 and 3 in Fig. 5) go to opposite sides of the bridge, so length and temperature effects will compensate. The center wire (2) goes to the meter and its length and temperature will have no effect on accuracy. A pictorial view of actual hookup is shown in Fig. 6. Use #18 plastic insulated hookup wire and solder all connections.

The dial for the 4-ohm rheostat to be calibrated in terms of temperature is a standard radio dial. Remove the knob from the metal part of the dial (it is held with three screws) and cut



4

BASIC WHEATSTONE BRIDGE CIRCUIT



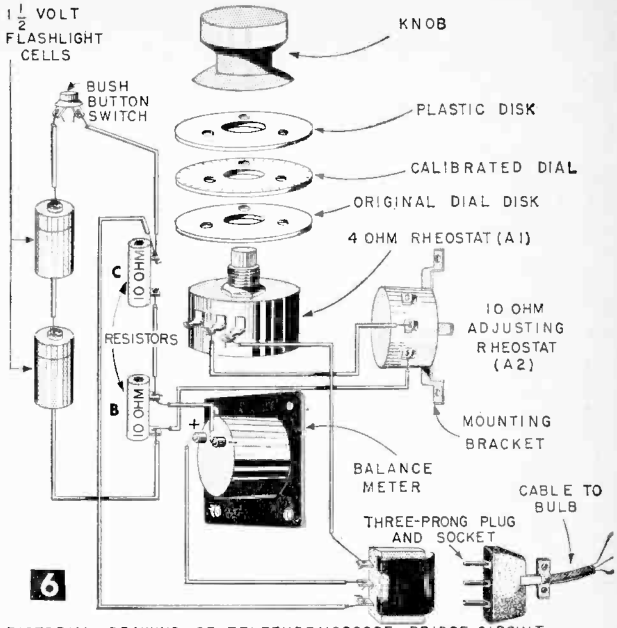
5

ACTUAL CIRCUIT USED IN TELETHERMOSCOPE

a disk from heavy drawing paper, using the metal part as a template. Then mount the paper between the dial knob and the plate. This paper disk will be calibrated in terms of temperature. A disk of transparent plastic can be mounted over the paper to protect it.

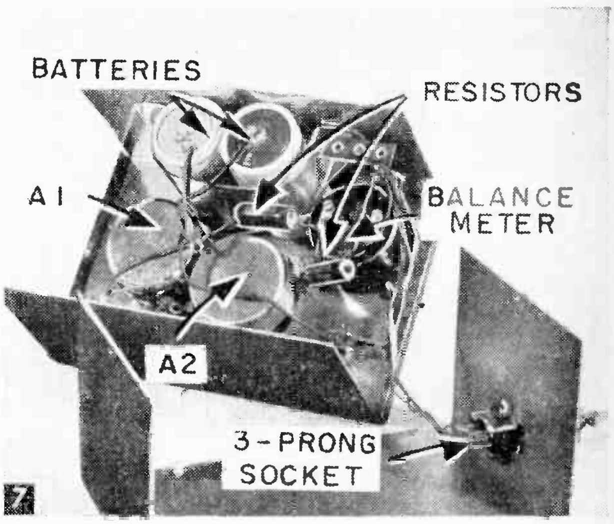
Calibration is not difficult. Use an accurate mercury or alcohol thermometer. Put the bulb and the thermometer in water, warmed (or cooled) to various temperatures, and mark the dial at corresponding points. Stir the water vigorously to assure accuracy. Allow about ½ hour for the bulb temperature to come to equilibrium. Adjust the dial so that the balance meter shows no current. Then mark the dial at that spot. The bulb will vary nearly 4 ohms, covering temperatures between minus 50 and plus 130° F. This will put mid-point on the dial at 40 degrees.

Cool the water in your calibrating bath with ice cubes until it shows 40° F. on your calibrating thermometer. Then adjust the 10-ohm rheostat so that your 40-degree mark will be in the center of the dial. After this, use other calibrating temperatures. One good check point is the 32° F. temperature. Put the bulb in a container of finely crushed ice and leave until no further change takes place. This will be an important check point on your dial.



6

PICTORIAL DRAWING OF TELETHERMOSCOPE BRIDGE CIRCUIT



7

Inside view of indicator box showing placement of components.

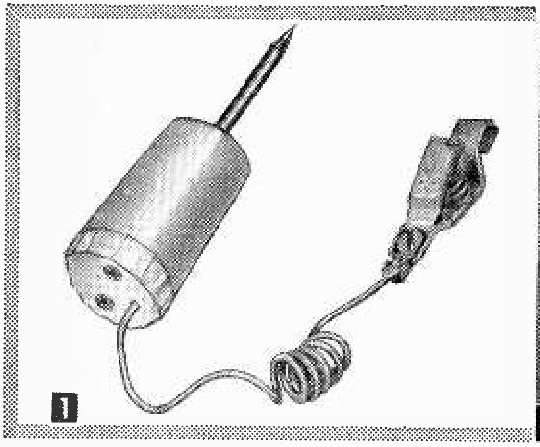
The scale will be linear, so when you have found eight or ten check points, you should be able to lay out the entire scale. The more check points you use, the greater the accuracy. Use black drawing ink for dial markings and figures. The dial in Fig. 1 has a mark for each two degrees.

To get a temperature reading with your telethermoscope, merely press the switch button and adjust the dial until the meter shows zero. The temperature is then read off the dial. Accuracy of the telethermoscope may be checked occasionally by comparing with a standard thermometer. Adjust for correct reading by turning the rheostat, A 2, with a screwdriver. The bulb resistance may tend to drift a slight amount over a long period. The instrument shown here has retained its accuracy for about six months.

The bulb should be exposed on the north side of a building if possible. The indicator (or "bridge") box may be located anywhere in the house—set it on a table or mount it on the wall. Standard Weather Bureau telethermoscopes have their bulbs exposed in a thoroughly ventilated instrument shelter with louvered sides.

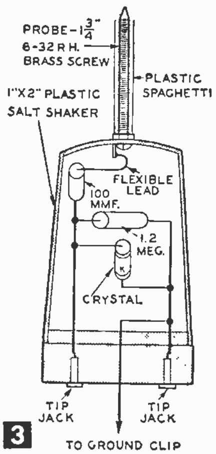
Pocket Signal Tracer

You can build this simple crystal diode testing probe for locating circuit breakdowns in radio sets



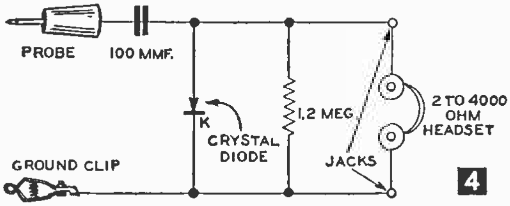
Tracking down the trouble in a radio set by following the signal through the grid and plate of each tube socket. Signal tracer built in a 1x2 in. plastic salt shaker. Alligator clip attaches to the ground or B— circuit of set being checked.

WHEN the simple tests for troubles in a radio set fail, you'll welcome this pocket-size trouble-shooting signal tracer for making a stage-by-stage test to locate the radio's dead section. Operating without any external battery or line voltage, the tracer functions like a crystal radio and is built around a germanium diode. Its small size (this one was built in a salt shaker from a variety store) makes it easy to use. You can also build it into plastic packages for shaving sticks, solid skin lotions or other pharmaceuticals.



MATERIALS LIST—POCKET SIGNAL TRACER

- 1 Small plastic container (salt shaker, etc.)
- 1 Germanium crystal diode (1N34, 1N34A, 1N60, etc.)
- 2 Metal phone tip jacks (ICA)
- 1 Small battery clip
- 1 100 mmf. mica or ceramic capacitor
- 1 1.2-megohm, ½-watt resistor
- 1 1¾ x 6-32 RH brass screw and nut, soldering lug, short length radio spaghetti, and 2 ft. flexible hook-up wire.



The signal tracer is wired as shown in the pictorial plan (Fig. 3) or schematic diagram (Fig. 4). Drill three holes in the base or cap of the plastic container; two ¼ in. holes for the *phone jacks*, and a ⅛ in. hole for the flexible lead to ground (B—) clip. Drill a single hole in the plastic shaker top for mounting the probe.

The probe is an ordinary brass machine screw with a round head (1¾ in. long; size 6-32) with the end ground to a point. A short length of flexible insulated wire is secured to a soldering lug. Slip the lug over the screw and mount in the plastic housing with a 6-32 hex nut. Complete the probe by forcing a 1½ in. length of radio spaghetti over the threads, leaving just the sharp screw tip exposed (Fig. 5).

The pigtail leads furnished with the three components are long enough and rigid to allow direct soldering without use of hook-up wire except for the short flexible probe connection and about 16 in. of flexible lead for the ground clip.

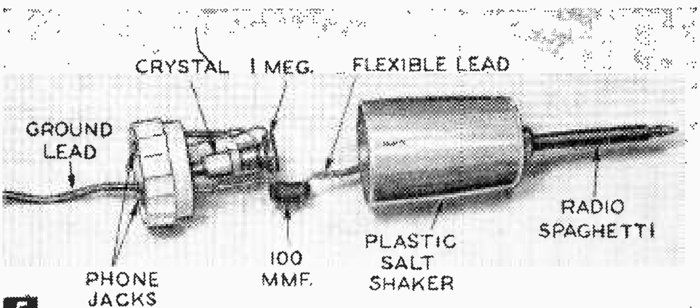
Here's how to use the tracer for tracking down radio set failures when you have completed wiring it. Starting at the radio set's antenna, it will pick up the initial radio frequency (R.F.) signal transmitted from a radio station. From that starting point, you can follow the signal through the intermediate frequency (I.F.), detector and audio stages.

At any point between antenna and final audio output, the circuit breakdown will be indicated when the signal is no longer heard through the headphones attached to the signal tracer. The defective tube, resistor or capacitor will show up between the last gcod stage, and the adjacent stage where no signal is heard.

Fig. 6 shows a schematic diagram of a 5-tube superheterodyne table set employing miniature tubes. Other, older table-model sets will have the same type circuit, but employing the older and larger *GT* octal-base tubes. Except for tube base numbering and positions, signal tracing in either of these popular type sets (and basically in all others) is the same.

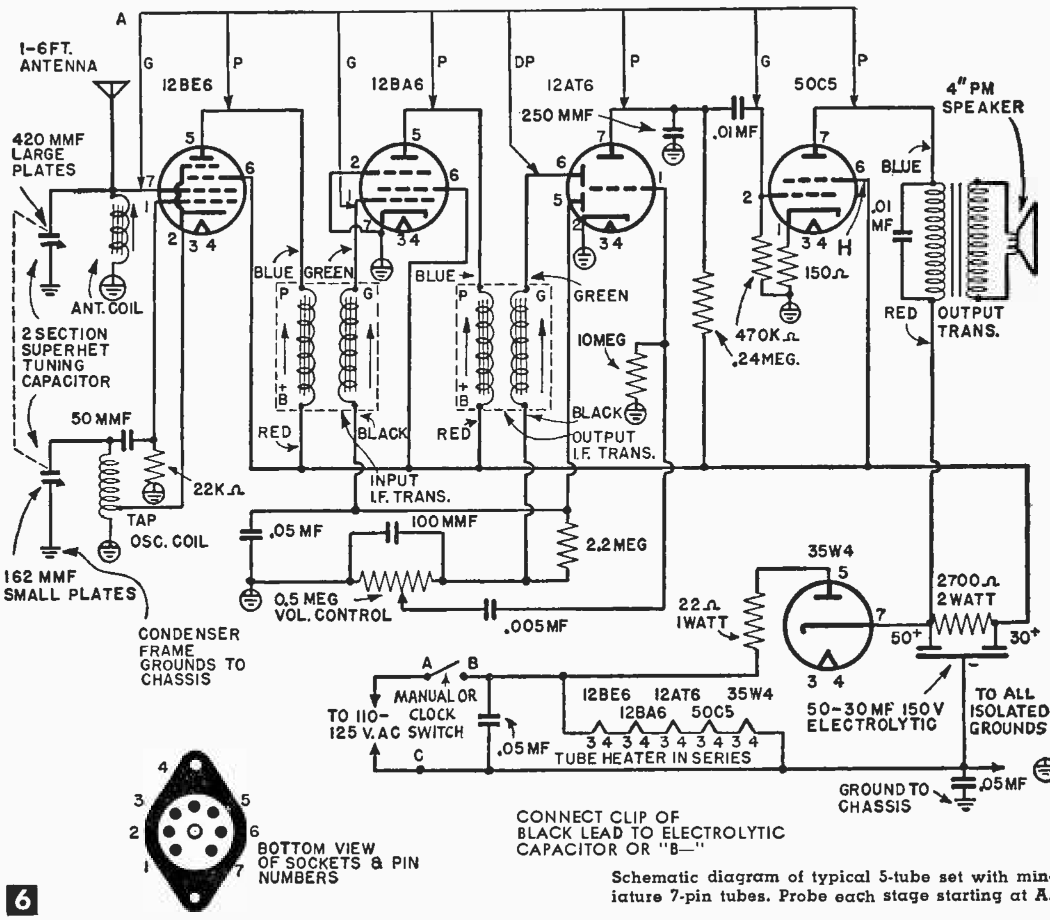
With 2000- or 4000-ohm headphones inserted in signal tracer jacks, attach the *ground* clip to the radio set's B— circuit. The black wire terminal of the cardboard electrolytic capacitor or the can lug of the metal jacketed electrolytic capacitors are connection points for the B— circuit. On sets wired with the chassis "hot," the clip may be attached directly to chassis (Fig. 1).

To locate the defective sec-



5

Exploded view of actual components as built into plastic salt shaker. Flexible lead connects between probe and 100-mmf. coupling capacitor.



Schematic diagram of typical 5-tube set with miniature 7-pin tubes. Probe each stage starting at A.

6

tion of the receiver, first find out if the trouble is not simply a *blown* tube. On popular *ac-dc* sets, one blown tube extinguishes all tubes. If the tubes light up, tune the set so the dial is on the frequency of a nearby station which came in with the most powerful signal when the set was working. Then, starting with the first R.F. or convertor tube if there is no R.F. tube in the circuit, touch the tracer probe to the grid lug of the tube socket. Continue on to the plate of the same tube. Follow through—grid and plate, grid and plate of each tube in set. Assuming tubes are warm and show a visible glow, you will eventually reach a spot where you won't hear a signal.

Suppose you pick up the signal on the *grid* pin of the 12BA6 (or 12SK7GT on a set with *GT* tubes), but nothing when probe is placed on the *plate* lug of same tube socket. The trouble could be due to any of the following: defective tube; open or cold solder joint at cathode, or screen grid, lack of B+ voltage to this tube due to broken lead elsewhere in wiring, open primary winding in I.F. transformer, or defective tube socket.

The signal tracer will not single out the exact component causing set failure. It will, however, localize the source of trouble to a component or connection at the tube where no signal can be picked up off the *grid* or *plate* lug. If, for example, the probe receives a signal off the *plate* lug of the 12AT6 (or 12SQ7GT) detector, but nothing comes through when probe is moved over to *grid* of the 50C5 (or 50L6GT) output tube, look for an open .01 or .02 *mfd.* coupling capacitor.

At the point where the signal is lost, bad capacitors, resistors, open circuits or combinations of these components will prove to be the culprit. Defective resistors are often apparent on sight by their charred appearance. Bad capacitors are frequently identified by wax leakage on chassis. "Cold" soldered joints are also identified in many instances on sight. If wiggling the suspicious wires restores speaker operation, resolder leads.

Defective components do not necessarily exhibit any outward signs of failure. If loose wires are not the cause of failure, replace the resistors or capacitors in the immediate vicinity of breakdown with components known to be good.

This pocket signal tracer may be used with all types of sets. An inexpensive radio tube basing manual will provide identification of the grid (or diode) and plate socket lugs of sets other than that shown here.

D. Vietor

How to Read Color Code on Resistors

STANDARD RETMA COLOR CODE

RESISTORS

All carbon resistors are produced and color-coded under standards set by the RETMA. Under these standards the user is assured of a wide range of values and of a universal color-coding system that permits easy identification of any carbon resistor. To determine the value of a resistor, hold it with the colored bands reading from the left end, as illustrated, and refer to the chart.

BAND A		BAND B		BAND C		BAND D	
Color	Value	Color	Value	Color	Decimal Multiplier	Color	Tolerance
Black	0	Black	0	Black	X 1	None	± 20%
Brown	1	Brown	1	Brown	X 10	Silver	± 10%
Red	2	Red	2	Red	X 100	Gold	± 5%
Orange	3	Orange	3	Orange	X 1,000		
Yellow	4	Yellow	4	Yellow	X 10,000		
Green	5	Green	5	Green	X 100,000		
Blue	6	Blue	6	Blue	X 1 Million		
Violet	7	Violet	7	Violet	X 10 Million		
Grey	8	Grey	8	Gold	÷ 10		
White	9	White	9	Silver	÷ 100		

The first band (A) shows the first figure of the resistor value, the second band (B) shows the second figure, the third band (C) indicates the number of zeros to add. The fourth band (D), which is not included on all resistors, merely indicates tolerance: silver for ± (plus or minus) 10%, gold for ± 5%. If the (D) band is omitted, the tolerance is ± 20%.

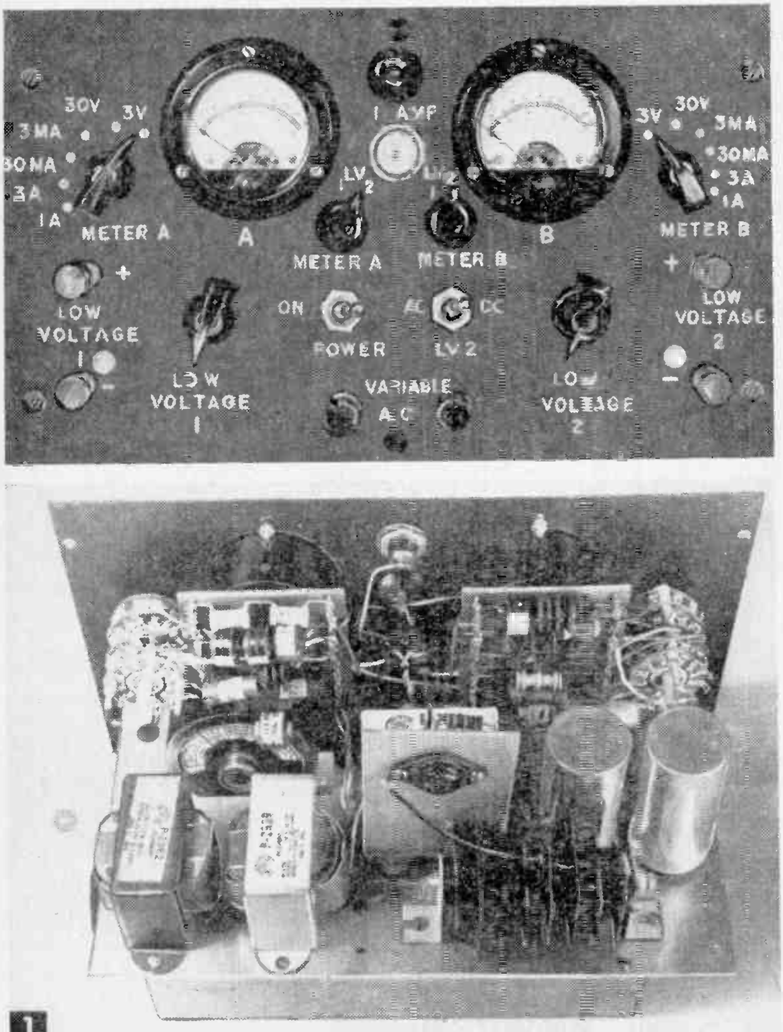
Here is an example: Band A yellow, band B violet, band C yellow, band D silver = (4) (7) (X10,000) (±10%) or 470,000 ohms, ± 10% tolerance.

Note: Molded tubular paper capacitors have same color coding.

Power Supplies for Transistors

To eliminate the expense (and bother) of using batteries when you are experimenting with transistors, build this ac-supplied variable power supply

By W. F. GEPHART



1

Front and back panel views of dual power supply schematicized in Figs. 6 and 7. Note in back panel view the meter resistor mounting and the "heat sink"-mounting of power transistor (center of photo).

THE design of a variable power supply for conventional (pre-transistor) radio work is relatively simple: Usually, a voltage range of 50-500 *v* (1:10 ratio) and a current range to 200 *ma* (1:200 ratio) will do. A versatile transistor power supply, however, need only furnish between 1.5 and 30 *v* (1:20 ratio)—but with currents up to nearly 1 *amp* (1:1000 ratio), and with an extremely low ripple in order to simulate battery operation. Due to the wider variations required, the high currents involved in power transistors, and the need for good filtering, then, several problems arise.

Figure 4A shows a simple power supply for transistor equipment. While it is fairly suitable for powering low-powered devices, it is not satisfactory for bench or experimental work. Even if R_3 were made variable, the voltage output would still be dependent upon the current being drawn, which causes a voltage drop across R_1 and R_2. This type supply is also unsatisfactory because one side of the line voltage is connected to the output.

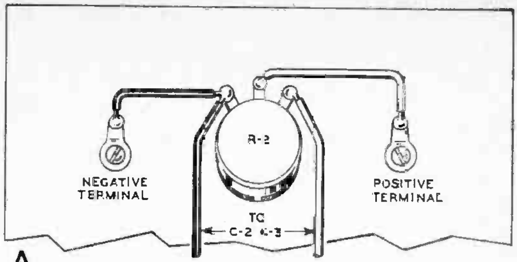
Figure 4B shows a simple bench-type supply. The danger of contact with line voltage is eliminated in this unit by using a transformer, and the lower resistance within the circuit permits greater control of the output voltage with variable resistor R_2. Using a choke (L) instead of a resistance (as in 4A) provides better filtering, but again presents the problem of a varying voltage drop as the current drawn varies. Furthermore, the amount of current that can be drawn is limited by the choke. While chokes capable of handling up to 300 or 400 *ma* are readily available, chokes capable of handling higher currents are bulky, heavy and quite expensive. Also, to minimize bleeder current (and thus minimize voltage drop across the choke with no lead), the resistance R_2 has to be relatively high, yet must be capable of handling full load current, thus presenting problems at high currents. With a value of 2500 ohms, for example, and a full load current of 750 *ma*, R_2 would have to be rated in excess of 1000 watts. This type of bench variable voltage supply can be used, however, up to about 50 *ma* if the components are chosen properly.

Figure 4C shows the circuit to be used for a high-current, well-filtered variable supply. The output is isolated from the line by transformer T_2 and variation in voltage is secured by varying the primary voltage of T_2 with an auto-transformer (T_1). This permits variation on the high-voltage, low-current side, enabling the use of a small auto-transformer. The current-limiting problem introduced by the choke is eliminated by using a power transistor (or two), providing excellent filtering with a small, but relatively constant voltage drop.

Transistors, like pentode tubes, "saturate" beyond certain bias points. That is, beyond these points, variation in input signal will have no effect on the output. If a transistor is biased beyond a certain point, ripple variations included in the *dc* input will not be included in the *dc* output. The same could be done with an ordinary pentode tube, except that ordinary pentodes are not capable of handling the high currents involved. The bias on the transistor is furnished through the resistor-capacitor network of R_1, C_2 and R_2 which provides sufficient filtering for bias purposes. The output current flows through the collector-emitter circuit, and with final filter capacitor C_3, ripple is less than .01%, equal to battery supply for virtually any application.

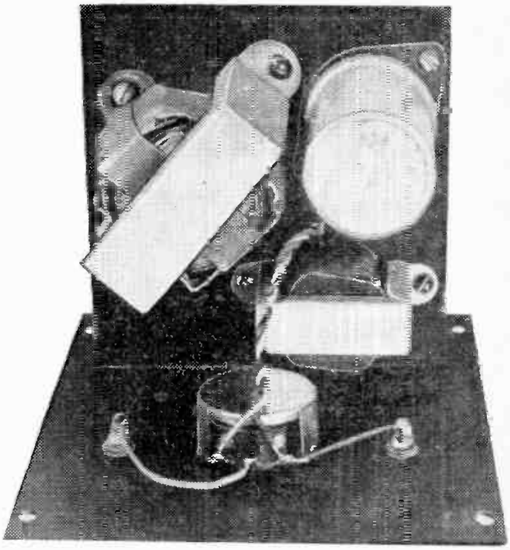
As pointed out, the transistor-filter circuit is only required when current requirements are fairly high, and the circuit in Figure 4B is satisfactory for most low-current applications. If very pure *dc* is required, the filter section of Fig. 4C (consisting of C_1, C_2, C_3, R_1, R_2, and V) can be used with the circuit of Fig. 4B, substituting it for the choke-capacitor filter (L, C_1 and C_2), and still use an output resistance for voltage variation. Filtering action is even better, since the transistor bias is constant in this case.

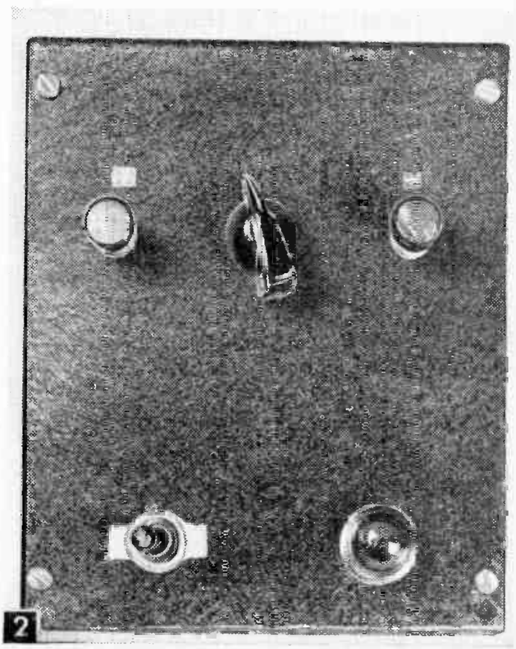
In designing a bench supply, voltage requirements, as well as current requirements, should be considered. Even some low-current circuits use a fairly high (22½ to 30) voltage. Several of the components will involve a voltage drop, and allowance for this should be made when planning the output voltage. In low-current supplies (50 *ma* or less) germanium diodes make excellent rectifiers and have less voltage drop than selenium units. When using chokes, select a happy medium between inductance and resistance, to minimize voltage drop.



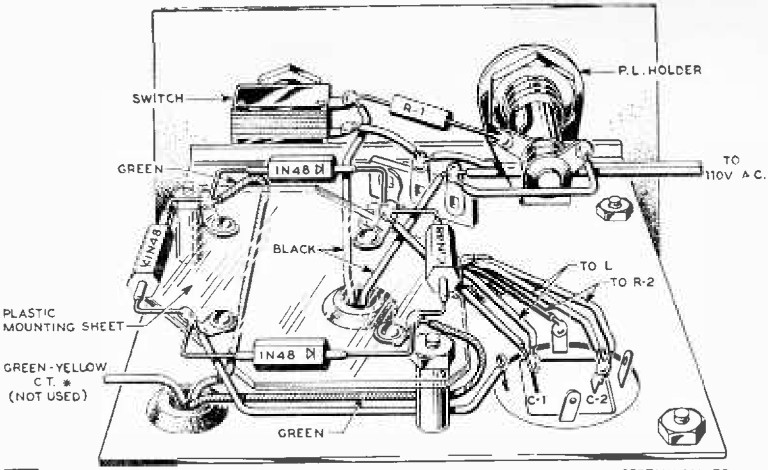
A PICTORIAL

Front and back panel views of power supply schematicized in Fig. 4B, is shown above and below. Under-chassis wiring is shown in Fig. 3.





2



3 PICTORIAL

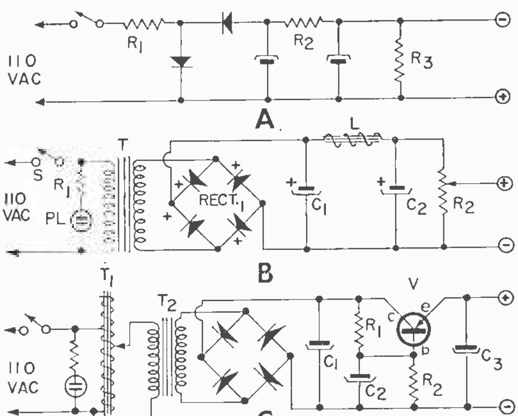
Figures 2, 3, and 5 show the details of a low-current supply using the circuit shown in Fig. 4B. Component values are included in the Materials List, using the nomenclature shown on Fig. 4B. This supply, using the parts listed, will furnish voltage and current as follows:

0-26.5 *v* at no load
0-16.5 *v* at 15 *ma*
0-14.5 *v* at 20 *ma*
0-10.0 *v* at 30 *ma*
0- 5.5 *v* at 50 *ma*

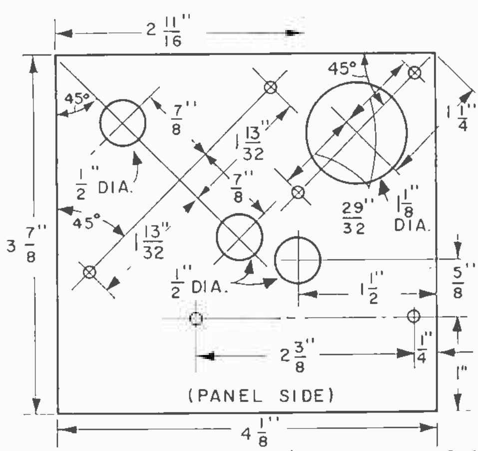
Since even the larger transistor radios draw only 15-20 *ma* at 6-9 *v* this supply will meet most requirements.

The unit shown was placed in a small metal cabinet and equipped with a pilot light, neither of which is necessary, but both of which are recommended (chassis and panel layouts are shown in Fig 5). The diodes were mounted on a piece of plastic raised from the chassis with spacers, although they could have been wired in a bridge circuit using tie points. Some wiring could be eliminated if chassis and cabinet were grounded, but it is recommended that the case be isolated. Due to the varying polarities in transistor equipment, trouble might be encountered if it isn't.

In experimental work, quite often it is necessary to have a separate bias supply, or two isolated supplies for one unit under test. Sometimes, one need requires high current; the other low current; while in other cases, both require low current. Figures 6 and 7 show the complete dual supply, shown in Fig. 1 for bench and experimental work. The unit is made up of one circuit

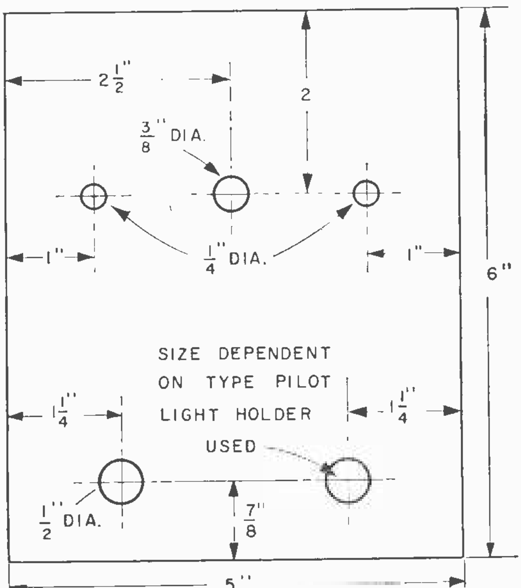


4

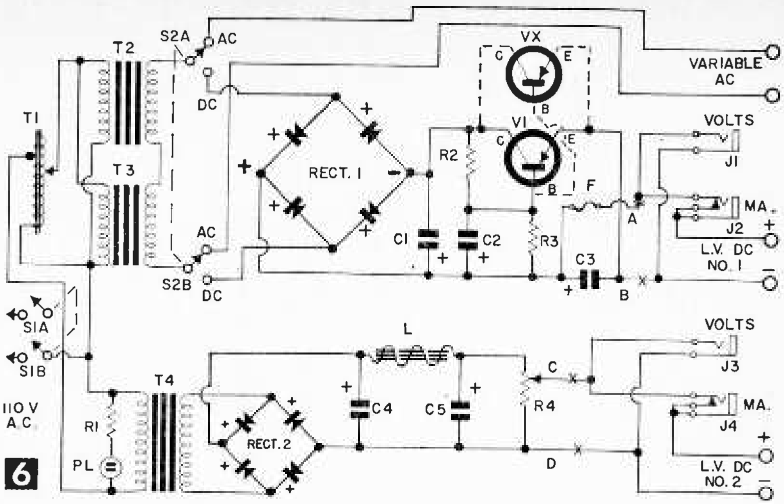


TOP VIEW OF CHASSIS

(CHASSIS ATTACHED TO PANEL ON SPECIFIED CABINET)



5 FRONT VIEW OF PANEL



6

identical with that in Fig. 4B, and one circuit similar to that in Fig. 4C, and has built-in meters and switching circuits. The twin meters can measure voltage *or* current for either supply, or can be switched so that the meters measure voltage *and* current of *either* supply, keeping both circuits isolated from each other.

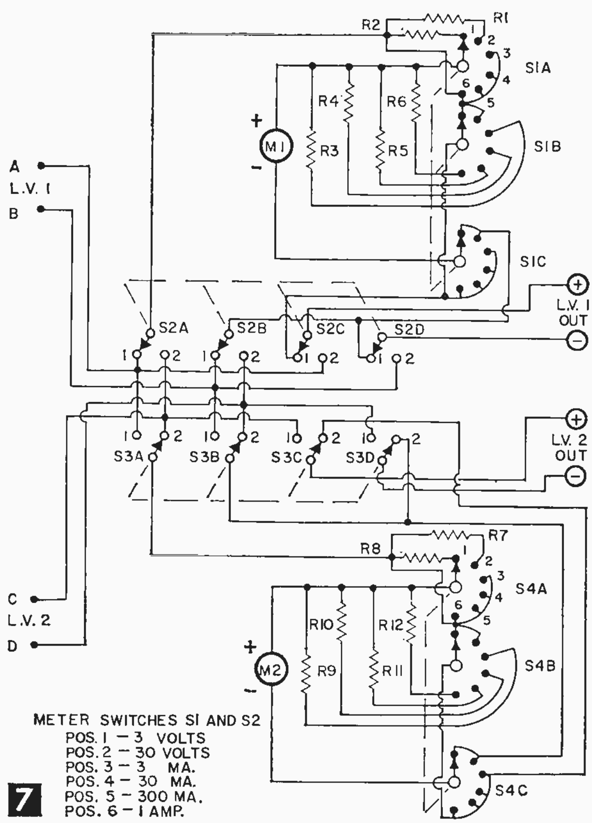
The schematic for this dual supply is shown in Fig. 6. Meter jacks, instead of meters and related switches, are shown, since the elimination of meters, shunts and switches greatly reduces the cost of the unit. If it is desired to build the complete unit on a "progressive" basis, holes for the meters and switches should be drilled in the panel at the time of construction, the switch holes plugged with hole plugs, and the meter jacks mounted in plastic or Bakelite plates mounted in the meter holes. (In any event, the jacks must be insulated from the chassis.) Then later, if it is desired to add the meter circuits, it can be done without drilling into a panel on which components are mounted and wiring completed.

In Fig. 6, a second transistor (Vx) is shown in dotted lines, parallel with V_1. This is required only if the desired output current is to exceed 700 *ma* and if used, should be mounted on a "heat sink" (as is V_1). This "heat sink" (which is common to the collector) should be insulated from the chassis, to keep the chassis and cabinet isolated. Also, if Vx is used, the value of R_3 should be reduced to approximately half of the value given in the Materials List.

In the high-current supply, an auto-transformer, two filament transformers, and a germanium rectifier provide the *dc* voltage. While a high-current selenium rectifier would be somewhat cheaper, the voltage drop would require another filament transformer, and stability would not be as good at low voltages and current.

The high-current supply, using the parts specified, furnishes in excess of 30 *v* (transistor limit) with no load, and slightly over 19 *v* at 700 *ma* (full load). If current in excess of 700 *ma* is desired, the larger rectifier mentioned in the Materials List, as well as the second transistor Vx, should be used. Under those conditions, loads to about 1.1 amperes would be permissible.

In Fig. 6, S_2 switches the transformer output to a set of binding posts, since it was felt that there would sometimes be a need for variable *ac* between 0 and 50 *v*. Fig. 7 shows the dual meter circuits used. The input leads of these circuits are connected to points "A", "B", "C" & "D" in Fig. 6, and the jacks cut out at the points marked "X". The values of the shunt resistors used are not furnished, since they will depend on the meters used. In the unit shown, the meters were surplus 0-500 microammeters, although 0-1 *ma* meters would do just as well.



7

MATERIALS LIST—TRANSISTOR POWER SUPPLIES

Shown in Figures 2, 3, 4B, and 5

R1	56,000 ohms, 1/2 watt*
R2	10,000 ohm potentiometer
C1, C2	100-100 mf. 50 volt (Cornell-Dublier B0085 or Mallory WP202.5)
T	25 volt filament transformer (Merit P-2962)
L	4.5 hy, 50 ma., 200 ohm choke (Merit C-2977)
Rect.	Four 1N48 diodes, bridge-connected
PL	NE-51 neon bulb
	Small cabinet with chassis (Bud C-1796), pilot light holder, binding posts, knob, miscellaneous hardware

Components shown in Figs. 1 and 6

R1	56,000 ohm, 1/2 watt*
R2	470 ohms, 1 watt
R3	1200 ohms, 1 watt
R4	10,000 ohm potentiometer
C1	500 mf. 50 volt (Cornell-Dublier 5005)
C2	250 mf. 50 volt (Cornell-Dublier 2505, Sprague TVA-1312, Mallory TC-50025)
C3	50 mf. 50 volt
T1	Auto-transformer, 0-130 volts @ 1.25 amp. (Superior Type 10, Standard Electric 100BU)
T2, T4	25 volt filament transformer (Merit P-2962)
T3	12.6 volt filament transformer (Merit P-2959)
L	4.5 hy, 50 ma., 200 ohm choke (Merit C-2977)
Rect. 1	70 volt, .7 amp. Germanium Bridge (General Electric 4AJ211AB1AC1) Note: If higher current desired, use 70 VAC 1.4 amp. (General Electric 4AJ211AB1AC2)
Rect. 2	Four 1N48 diodes, bridge-connected
S1	DPST toggle
S2	DPDT toggle
PL	NE-51 neon bulb
J1, J3	Open circuit jacks
J2, J4	Closed circuit jacks
Cabinet	(Bud CC-1092), aluminum for chassis, binding posts, knobs, miscellaneous hardware
	* Not required if included in pilot light holder such as Dialco series 952208 or 95408X.

Components shown in Fig. 7

R1 through R12	See text
M1, M2	See text
S1, S4	3 pole. 6 pos. rotary switch (Centralab 1421, Mallory 1335L) Note: Mallory 3236J can be used if 20° spacing is acceptable
S2, S3	4 pole, 2 position rotary switch (Mallory 3242J)

The most accurate means of determining shunt and dropping resistor values is to use an accurate resistance decade, a variable voltage source, and an accurate voltmeter and milliameter. In this method, voltage-dropping resistances are selected by taking a known voltage, feeding it into the proposed meter through the decade, and adjusting the decade for the desired reading. Current shunts are determined in a similar manner, by establishing a known current through a load, placing the proposed meter in the circuit (with the decade connected across its terminals), and adjusting the decade for the desired reading.

If equipment is not available, required resistances can be determined by calculations, using the following formulas:

For voltage series resistance:

$$R_s = \frac{E_r}{I_m} - R_m$$

R_s—Series resistance required (ohms)
E_r—Desired full-scale range (volts)
I_m—Full scale range of meter (amperes)
R_m—Internal resistance of meter (ohms)

For current shunt resistances:

$$R_s = \frac{I_m R_m}{I_r - I_m}$$

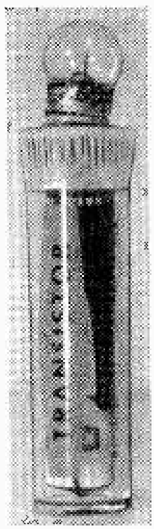
R_s—Shunt resistance required (ohms)
I_m—Full scale range of meter (amperes)
R_m—Internal resistance of meter (ohms)
I_r—Desired full scale range (amperes)

In the latter formula, at high current values, I_m may be disregarded in the formula as being insignificant.

The meter ranges on the low-current supply (No. 2) need not have as high current ranges as the No. 1 meter. The meter selector switches (S_2 and S_3 in Fig. 7) permit voltage reading from *either* output, but current readings only on the associated circuit. For example, with both S_2 and S_3 on Position 1, meter M_1 will read *either* the voltage *or* current of output 1, and meter M_2 will *only* read voltage of output 1.

In the unit shown in Fig. 1, the meter resistors were mounted on terminal boards fastened to the meter terminals, saving space and wiring. (A few of the components pictured in Fig. 1 are not exactly those specified in the Materials List.)

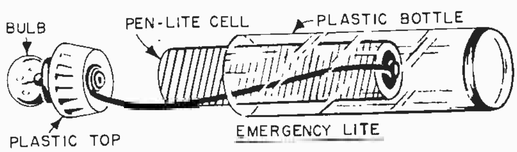
Emergency Lite



An investment of about a quarter and five minutes of your time converts a small plastic bottle into a pocket-size emergency light. The bottle doesn't cost you a cent. If you're a transistor experimenter, you can use one of the bottles in which General Electric transistors are packaged (this same kind of bottle is frequently used by pharmacists as a pill box). In addition to the bottle you need only a flashlight bulb and a small pen-lite battery.

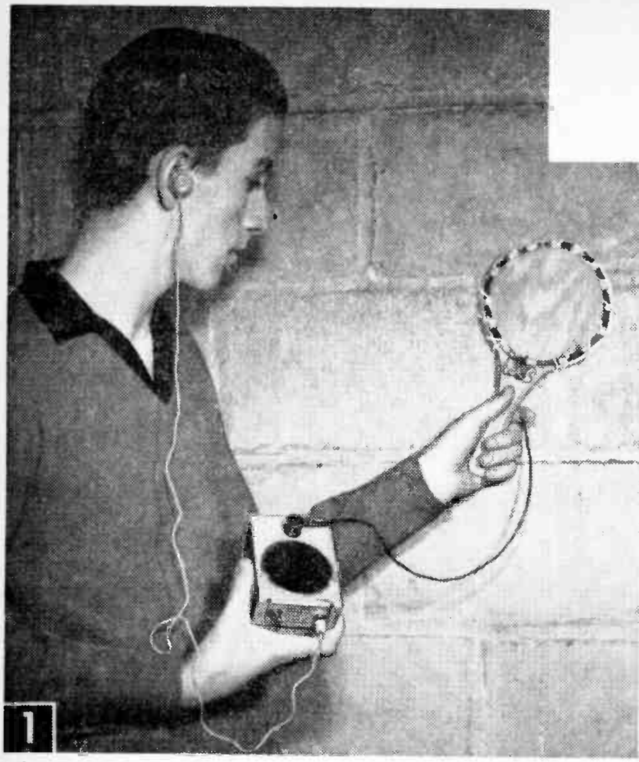
To make the emergency lite, ream a hole in the bottle top just large enough to allow the bulb to be screwed into it. Solder a piece of thin insulated wire to the shell of the bulb. I used #28, silk-covered magnet wire. Solder the other end of the wire to the center terminal of the battery. Insert the battery and bottle top, with bulb, into the bottle with the center battery terminal down.

To turn the light On, push the bottle top on tight. To turn it Off, loosen the top slightly.—Forrest H. Frantz.



EMERGENCY LITE

One-Transistor



1

Our transistorized metal detector can be held in the hand or easily fitted with a clip for attaching to your belt. Probe coil passed over wall signals when hidden metal object is present.

Track down hard-to-find metal objects under walls, floors and paving with this pocket-size low frequency detector

By THOMAS A. BLANCHARD

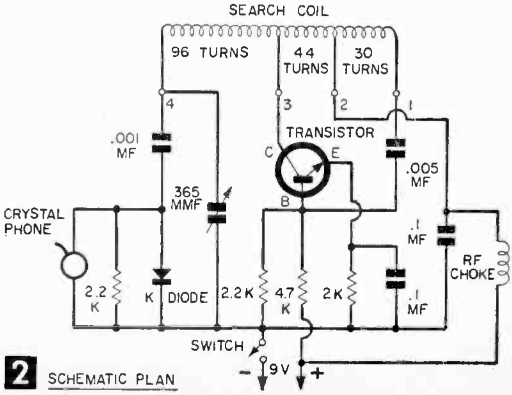
WHILE you may never locate buried treasure with this little metal detector, unless the walls of your house contain a cache left behind by a former occupant, you are certain to use it often to track down buried "headaches." By running the detector's search coil over plaster, stone, brick or wood walls, ceilings or floors (Fig. 1), such concealed objects as water, steam and gas pipes can readily be traced. This applies equally well in the case of electrical conduit, BX cable, lath nails in 2x4 studs where wood lath and plaster were used, steel lath and braces. Outdoors, the detector will find manhole covers, water and gas shut-off valves that have been covered over by earth up to a 12-in. depth, cement or asphalt.

This transistorized metal detector is similar in operation to our vacuum-tube gadget (see p. 116, *Home Electrical Handbook,* Vol. 3, published by Science and Mechanics, price 50¢). However, there are several distinct advantages over the other type: our new unit is considerably smaller, much more stable, requires fewer components, and uses just one small, long-life transistor battery.

The transistorized Hartley oscillator consists of a 74-turn loop, 5¼ in. in dia. and tapped at the 30th turn. Direct-coupled to the collector end of the oscillator coil is a 96-turn loop which, in conjunction with a crystal earphone shunted with a 1N34A germanium diode, serves as the detector circuit. A miniature 365 *mmf.* variable capacitor tunes the circuit in the more stable long wave frequencies of 150 to approximately 455KC.

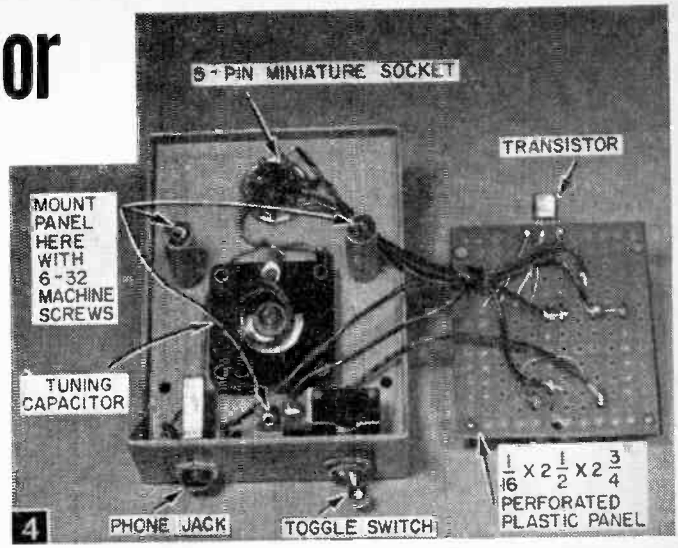
The metal detector can be assembled in any radio utility box measuring 2¼x3x4 in. or more. If you use a government surplus Signal Corps BC-366 Jack Box (Figs. 1, 4 and 5), remove all its original components so just the aluminum die cast box is left. Fit phone jack, toggle switch and variable capacitor into ⅜-in. holes already in the box (Fig. 4). Enlarge a fourth ⅜-in. hole to ⅝ in. and fit with a 5-pin miniature cable socket to which the search coil can be attached or detached from at will.

On a 2½x2¾-in. piece of perforated phenolic plastic mount three "flea clips" for securing the transistor, along with diode, r.f. choke, capacitors and resistors (for wiring details see Figs. 2 and 3). Thread the pigtail leads through the perforations in the plastic panel to provide a rigid components assembly. Mount with 6-32 machine screws through three built-in studs (Figs. 4 and 5). If you use a regular utility box, however, one multi-lug tie strip will be sufficient for securing the small components.



2 SCHEMATIC PLAN

Metal Detector

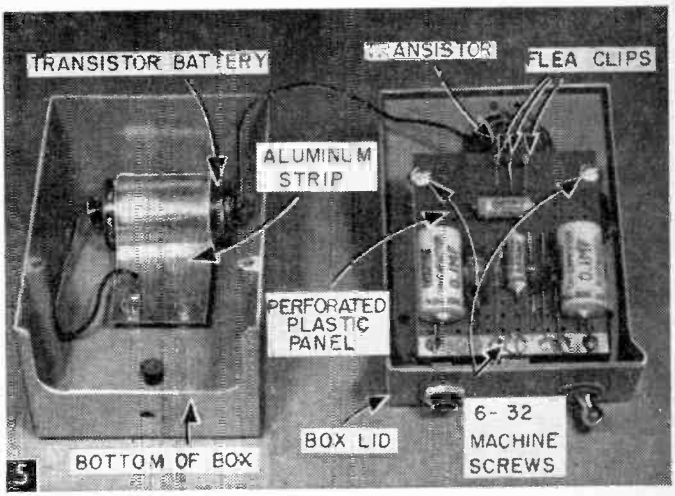


Aluminum box lid is fitted with cable connector socket, phone jack, miniature tuning capaciter, and toggle switch.

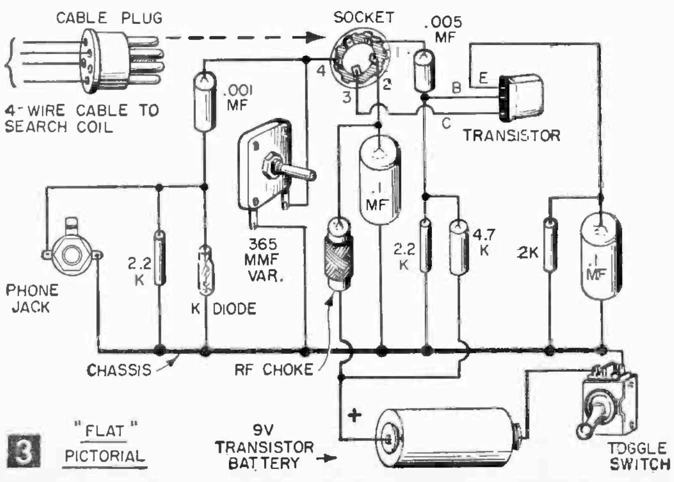
To make the search coil, plot a 4½-in. square on a piece of wood about 6 in. square. In each corner of inner square drive a long finishing nail. Attach the end of the #28 d.c.c. magnet wire to one of the nails, then wind 30 turns of wire around the nails and form a small loop at the 30th turn for the first tap (Term. #2). Before continuing, bind these turns together with a strip of plastic tape between the nails. Continue on with 44 turns and again form a loop, marking it Term. #3. Bind these turns with tape, and add the final 96-turn winding.

Pull out one of the finishing nails, freeing the coil windings, then bind all three windings together with ½-in. tape. For clarity in our photographs we do not show the coil completely taped, but the builder should do so to insure turns remaining rigidly in place.

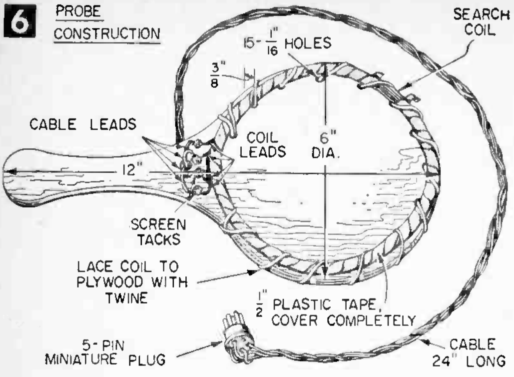
From a 6x12-in. piece of ¼-in. plywood, fashion a probe with the paddle portion being a 6-in. circle (Fig. 6). All around paddle, ⅜ in. from edge, drill fifteen $\frac{1}{16}$-in. lacing holes. At the top of the handle, drive four pure copper screen tacks into the plywood to serve as tie points for the coil and cable leads. For the cable to the search coil, use four 2-ft. lengths of stranded plastic insulated hookup wire. You should have no trouble in making the proper connection to the miniature cable plug and socket, as both items have molded-in numbers both top and bottom.



Cast-in studs in BC-336 box are used to support perforated plastic wiring board to which small components are rigidly attached. A strip of aluminum secures 9-volt battery in box bottom.



Although the search coil was wound in a square shape, it is easily reshaped into a circle. Shaping may be done before the outer protective covering of tape is added. Lace the coil to the plywood paddle with twine, finally connecting coil and cable leads to the tie points. *Be sure these connections are correct.*



6 PROBE CONSTRUCTION

MATERIAL LIST—1-TRANSISTOR METAL DETECTOR

No. Req.	Description
1	Signal Corps BC-366 "Jack Box" or radio utility box 2¼ x 3 x 4" or larger
1	1/16 x 2½ x 2¾" perforated plastic plate for BC-366 box
1	standard or miniature phone jack
1	5-pin miniature plug (Amphenol 71-5S)
1	5-pin miniature socket (Amphenol 78-S5S)
1	365 mmf. miniature variable capacitor (Lafayette MS-215)
1	bar knob for above
1	transistor socket or 3 "flea clips"
1	S.P.S.T. toggle switch
1	¼ lb. spool #28 d.c.c. magnet wire (2½ oz. or 255 ft. used for search coil)
1	RCA #VS300 9v. transistor battery or equiv.
1 pr	battery snap connectors
1	2.5 or 5 millihenries R.F. choke (Nat'l R-100)
1	general purpose germanium diode (1N34A)
1	N-P-N R.F. transistor (Sylvania 2N233, GE 2N170 etc.)

RESISTORS (all ½ watt)		CAPACITORS	
2	2.2K (2200) ohm	2	0.1 mfd. paper tubular
1	2K (2000) ohm	1	.005 mfd. paper tubular
1	4.7K (4700) ohm	1	.001 mfd. paper tubular

Misc: Hookup wire, hardware as required; miniature crystal earphone (Lafayette MS-111); dial optional

Note that we have used a cheap midget crystal earphone with the metal detector rather than the magnetic headphones specified for the majority of transistor circuits. The crystal phone is non-inductive and will not adversely influence the function of the search coil. You may be able to use a high resistance magnetic earphone by disconnecting the 2.2K resistor shunted across the phone jack. However, a crystal earphone can be purchased for about $1, so experimentation with a magnetic phone is unnecessary.

When connecting the phone jack, carefully observe soldering lugs. One lug is riveted to the threaded mounting sleeve and is the grounded connection. The remaining lug connects to insulated plug tip contact to which .001 *mfd.* capacitor connects (Fig. 3). Reversing jack connections will create a short-circuit across phone, making detector inoperative.

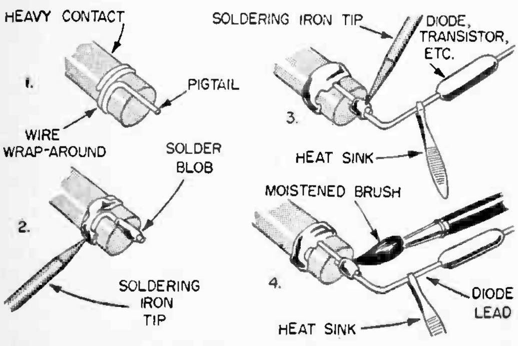
Using the Detector. With search coil connected and switch *on,* a series of oscillator tones will be heard as the variable capacitor knob is rotated. A high-pitched tone will be heard with knob at zero; as you advance the control the tones will become lower and finally break off.

For silent operation, set the dial to the point where low tones cease. Now move the probe toward a metal object and suddenly you will hear a "cry-baby" tone similar to that produced when a phone number is incorrectly dialed. When the probe is moved away the tone will stop.

Several points will be found in rotating the tuning knob where especially high, crisp whistles are heard. In this case, as the probe approaches a concealed metal object the pitch of the steady tone will change abruptly. While you may find the steady tone a more sensitive detection method, it may prove uncomfortable to your ear.

Safe Soldering of Transistor Leads to Heavy Contacts

• A transistor lead can be soldered to a relatively massive terminal post or lug without damage to the diode or transistor. To do this, wrap a small diameter hookup wire around the post or lug as in Fig. 1, leaving a pigtail for soldering to the lead from the diode. Solder the wrap-around (see Fig. 2), leaving a small drop or blob of solder hanging down from the pigtail. Apply the tip of the soldering iron to the top of the pigtail (Fig. 3), and reheat just enough to melt the solder. Bring the diode or transistor lead, which has been inspected and tinned if corroded, to it rapidly just as the solder melts, using a heat sink (such as pliers, hemostat or tweezers). Move the iron tip to rapidly flow the solder blob onto the transistor or diode terminal or lead.



Now apply a previously moistened brush to the pigtail and lead (Fig. 4), moving it back and forth. Water will rapidly cool the lead. Remoisten the brush and apply it to the pliers or other heat sink. Allow some moisture on the diode lead as well as the large terminal.

Phono Turntable Repair

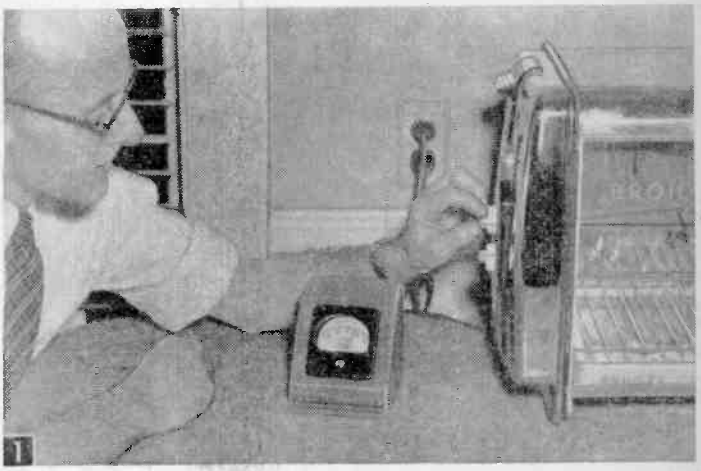
• Poor reproduction from a phonograph having the rim-drive type turntable mechanism is usually caused by slippage of the rubber-tired drive wheel. To renew the grip of the rubber tire, sand it lightly with sandpaper. A non-slip dial compound (such as General Cement's *Non-Slip,* 2 oz. approx. 38¢) applied to the wheel will also cure slippage.—John A. Comstock.

Is your TV set giving sub-par performance?

Build a Meter to Check on Line Voltage

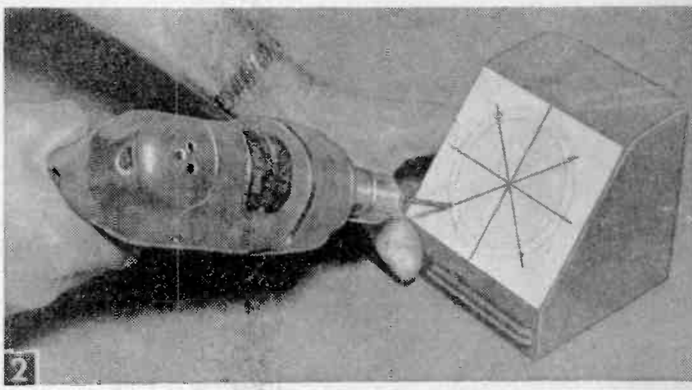
HOW can you tell if the line voltage of your house current is lower than it should be? Very simply, merely plug the instrument described in this article into any wall outlet and get an immediate reading of the voltage. You will have good reason to suspect low voltage, if your electric lights are not delivering their full candlepower brilliancy; if your electrical appliances are not working at peak efficiency or, which is more noticeable, you get a reduced coverage on the screen of your television set.

There are two possible reasons for low voltage. If the low voltage symptoms are noticeable only during the evening hours when the current drain in the surrounding neighborhood is greatest, it usually indicates that the trouble is in the lines or pole transformer outside of your home which, of course, is beyond your control. When this is discovered, notify your power company and their representatives will investigate, and rectify the trouble. Most power companies try to keep their voltage as near 120 volts as possible. However, the voltage will vary somewhat depending upon the distance your home is from the pole distribution transformer, the type of customer load and the number of customers served from an individual transformer.

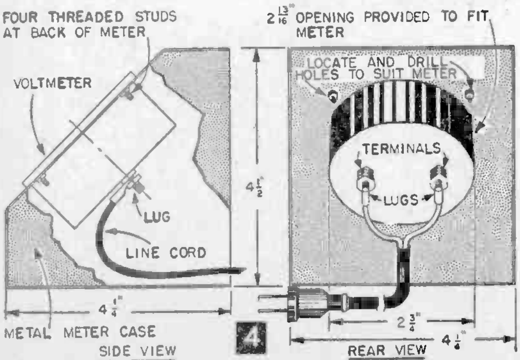


Using the voltmeter to check the drop in voltage in a circuit to which a 1320 watt broiler has been connected.

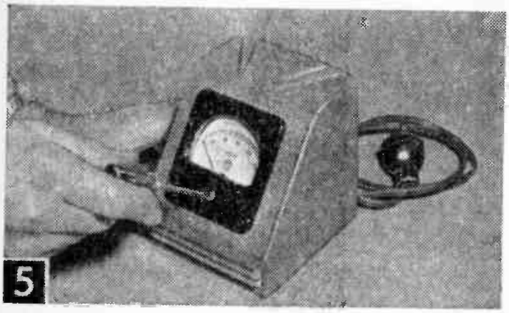
The open space in the back of the case is convenient for storing the cord when not in use.



Drilling meter-mounting holes located with the aid of a cardboard template taped to face of case.



The other reason for low voltage is due to inadequate house wiring, for which the home owner is responsible. This is voltage drop developed on branch circuits when appliances are plugged in.



Using a small screwdriver to adjust the pointer to the zero position.

MATERIALS LIST

1 A.C. 0-150 panel type, rectangular voltmeter. Simpson model 57, Triplett model 337-S or other make. 3" size. (Lafayette or Allied Radio)
1 sloping panel meter case with 2 13/16 in. opening. ICA #3996. (Lafayette or Allied Radio)
3 ft plastic or rubber parallel lamp cord
1 rubber attachment plug cap
2 solder type terminal lugs with 1/4" ring opening
4 nuts and washers to fit meter mounting screws
Lafayette Radio, 165-08 Liberty Avenue, Jamaica, N. Y.
Allied Radio, 110 N. Western Avenue, Chicago 80, Ill.

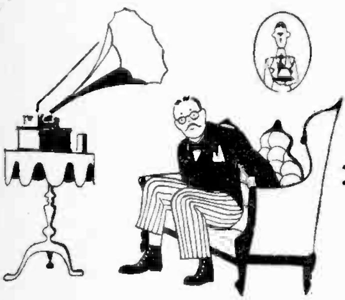
For example, a test was made using a 1320 watt broiler in a house wired about 25 years ago with #14 wire circuits having both lights and appliance wall receptacle outlets on the same circuit. The meter (Fig. 1) was first plugged in and the line voltage found to be 120. The broiler was then plugged into the same circuit and the meter registered a drop to 109 volts. When the test was repeated with the light on, a noticeable drop in light value was seen. Today the National Electrical Code demands that separate circuits without light outlets and wired with #12 wire, fused at 20 amperes be provided in rooms where heavy-duty appliances are normally used. When the same test was conducted on a properly wired appliance circuit, the voltage drop was only 3 volts or a drop from 120 to 117 which is normal.

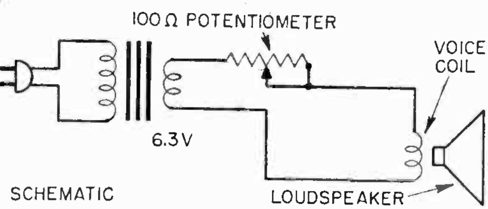
To build this voltage tester, first obtain the parts given in the materials list. Then lay out and drill the holes to clear the four attachment screws located at the back of the instrument (Fig. 4), by taking center-to-center measurements of the screw spacing. Lay out this information and a circle the size of the meter on a piece of thin cardboard and attach it to the case with *Scotch* tape (Fig. 2). Be sure to center the circle with the opening in the case. The drill should be of a size to provide a little extra clearance for the screws so that the meter can be centered with respect to the opening.

Solder two terminal lugs to a 3 ft. length of cord equipped with a plug cap at one end and connect the lugs to the meter terminal posts. The cord and plug can be coiled up neatly in the meter case through the open back as in Fig. 3 when not in use. Adjust the pointer on the meter to zero by turning the screw as in Fig. 5 and your meter is then ready for use. If at any time the pointer is found off the zero mark simply re-adjust it.

This tester was designed for use on all ordinary circuits with a voltage not over 150 or the standard 115-120 lighting and appliance circuits. It should never be connected where the voltage exceeds this maximum value or the meter will immediately be ruined. Such outlets do exist in some homes, such as 240 volt supply for air conditioners and similar heavy duty equipment. If it were necessary to make tests at these outlets, a unit would have to be constructed which contained a meter with a 0-300 volt scale.—Harold P. Strand.

"Working-in" a Speaker

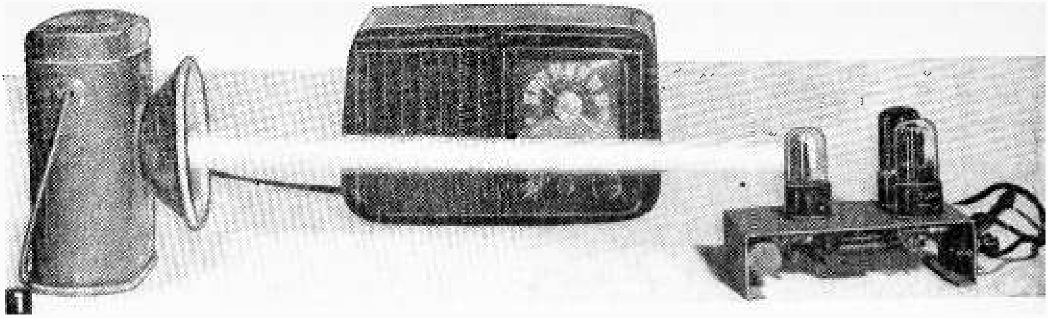




TO IMPROVE the bass response of an otherwise good loudspeaker, try softening up the edge suspension to permit greater and easier cone vibration. To do this, connect the voice coil in series with a 6.3 volt filament winding, using a current-limiting rheostat, as shown in the diagram. Any 6.3 volt filament winding will do, either as available in any convenient piece of radio apparatus, or using a separate filament transformer (as shown).

Place the speaker where a rather loud 60-cycle (50-cycle in Canada) buzz will not irritate you, and apply power, using the entire 100 ohms in series at first. Then gradually reduce the series resistor until the cone is vigorously vibrating at its maximum safe amplitude. (Use judgment here as it is possible to rip the cone out entirely). Allow it to vibrate thus for five or six hours.

Now reconnect the speaker to your hi-fi amplifier. The improvement in bass reproduction will amaze you.—C. F. Rockey



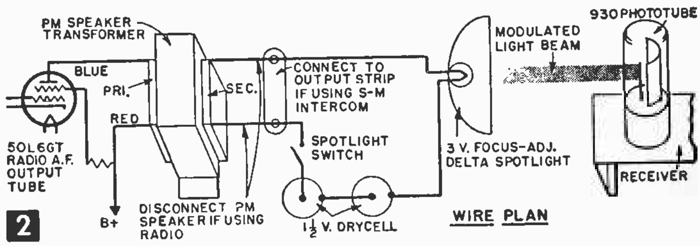
Program from radio is converted to light beam and sent via Delta lantern to photo-elecric receiver at right. Proper spotlight or light source will transmit close to ¼-mile. Beam is painted in here to clearly indicate action.

Talking on a Light Beam

Radio experimenters can now build this simple transmitter, which broadcasts over a light beam through an ordinary radio receiver

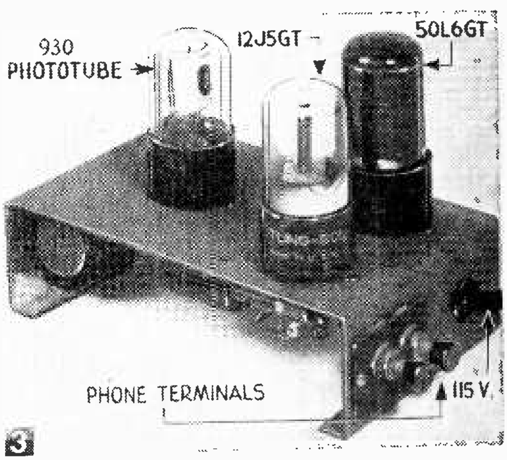
By THOMAS A. BLANCHARD

AMAZING as the feat of talking over a light beam may seem, the idea is not new. For some 25 years movie sound reproduction in your local theater has been accomplished with a phototube and light beam. Running along the edge of the film is a narrow "sound track." The track contains little zig-zag streaks of varying lengths, or a ribbon-like strip varying from opaque to nearly transparent. As the sound track passes between light beam (exciter lamp) and photocell, the light striking the phototube literally "flutters." This "flutter" is the modulating medium—whereby a flickering light stream is converted into voice or music!



This is the same idea employed in this radio experimenter's model. However, modulation is accomplished entirely by electrical principles whereas movies are mechanically modulated, as by film. You'll find this light beam transmitter easy to construct, since a small table radio may be incorporated in its design (Fig. 1). In order to convert the sound that usually comes out the speaker to a modulated light beam, you need only disconnect the speaker and install a concentrated spotlight in series with the set's output transformer (Fig. 2).

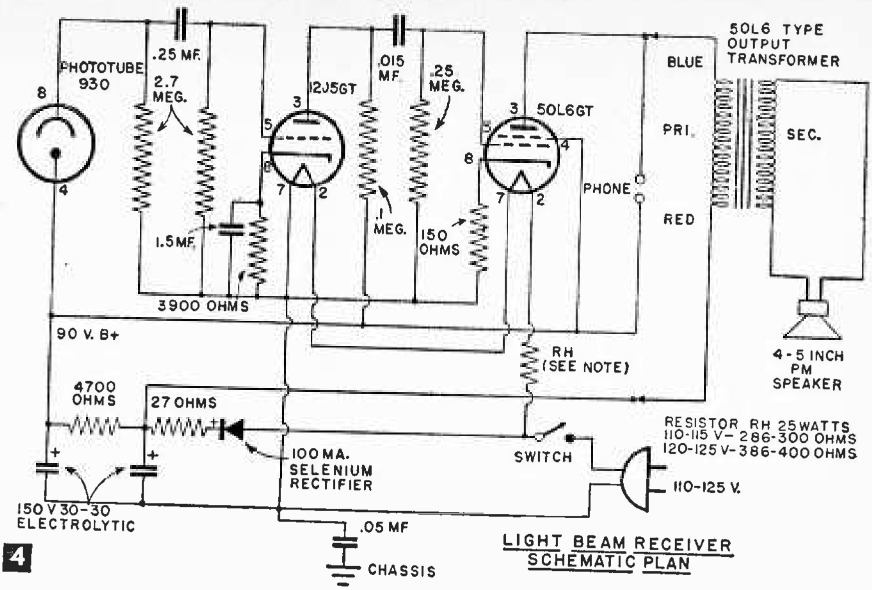
The two uncovered copper wires from the output transformer are disconnected from the PM speaker cone. Solder two extension leads to these wires so that the secondary of the radio transformer may be wired in series with a *battery* operated light source (an *ac* light source will not



Light beam receiver is assembled on simple two-fold metal chassis for easy wiring.

work!). With spotlight switch closed, and radio tuned to a station, the bulb will flicker madly. Now when this beam is aimed on the phototube in the *light beam receiver*, you will hear the program from the radio set—*via light beam!*

The *ac* impulse from the output transformer primary adds to or subtracts from the 3-volt battery voltage, which causes the bulb's light output to vary at the same frequency as the applied signal (or, in other words, the impulse bucks the reactance effect of the secondary winding, causing light modulation). The radio output transformer operates like an ultra-high-speed rheostat in the spotlight circuit, causing the light intensity to vary faster than the eye can see these changes. To transmit your voice over the radio, attach a mike and preamplifier into the radio phono connection. Better yet, you can use a home broadcaster mike (modulated oscillator type) available from radio supply houses.



4 LIGHT BEAM RECEIVER SCHEMATIC PLAN

MATERIALS LIST—LIGHT BEAM RECEIVER

- 1 pc. #14 or 14 gage aluminum or c.r. steel, 3½" x 9"
- 1 type 930 RCA phototube
- 1 type 12J5GT RCA triode tube
- 1 type 50L6GT RCA pentode tube
- 1 4-5" PM speaker and output transformer (optional)
- 1 Delta spotlight (3 or 1½ v. model)
- 1 100 ma. selenium rectifier
- 1 pair phone terminals
- 3 octal tube sockets
- 1 length fixture cord, plug and switch

RESISTORS

- 2 2.7 megohm, ½ watt
- 1 0.1 megohm, ½ watt
- 1 0.25 or 0.27 megohm, ½ watt
- 1 4700 ohm, 1 watt
- 1 27 ohm, 1 watt
- 1 3900 ohm, 1 watt
- 1 150 ohm, 1 watt
- 1 25 watt wire-wound resistor 300 to 400 ohms (see text)

CAPACITORS

- 1 30-30 or 40-40 mfd., 150 w.v. electrolytic
- 1 1.5 (or 2) mfd., 200 w.v. paper capacitor
- 1 .25 mfd., 200 w.v. paper capacitor
- 1 .05 mfd., 200 w.v. paper capacitor
- 1 .015 (or .02) mfd., 200 w.v. paper capacitor

Miscellaneous hardware as needed

You may find that you need to modify the secondary winding of the output transformer. For example, if the light intensity is too bright with no noticeable "flutter," more turns of #26 magnet wire should be added. On the other hand, if spotlight is too dim, remove some of the turns from secondary winding.

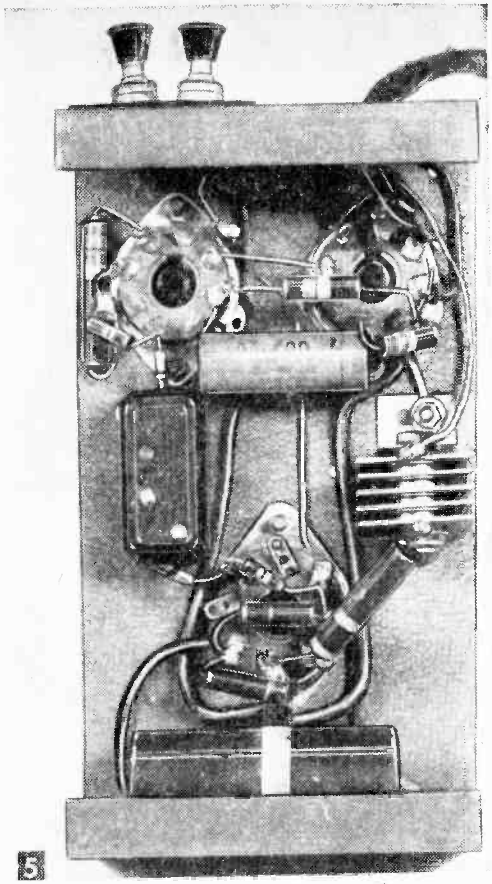
Rather than mutilate the set's transformer (which is often clamped to the PM speaker frame) it is best to buy a separate transformer (they cost little) for the 50L6-tube. To add or subtract secondary turns, simply remove the mounting strap, lifting the "E" lamination out of the core. You'll find the secondary winding directly under the outer paper insulation. If this insulation is carefully cut with razor blade, it may be replaced with a strip of Scotch tape after alterations.

The range of this light beam transmitter depends on the light source's efficiency. By employing optics rather than parabolic metal reflectors alone, you can improve both the range and concentration. For long-range use, the receiver will respond better if an optical condensing lens is placed in front of the phototube (a Boy Scout's "burning" lens is excellent for this purpose). Position and focus the lens so the concentrated light from distant electric lantern is concentrated in the center of phototube's cathode and anode elements. You can enclose the phototube amplifier in wood or metal box to keep out stray light.

Building the Light Beam Receiver

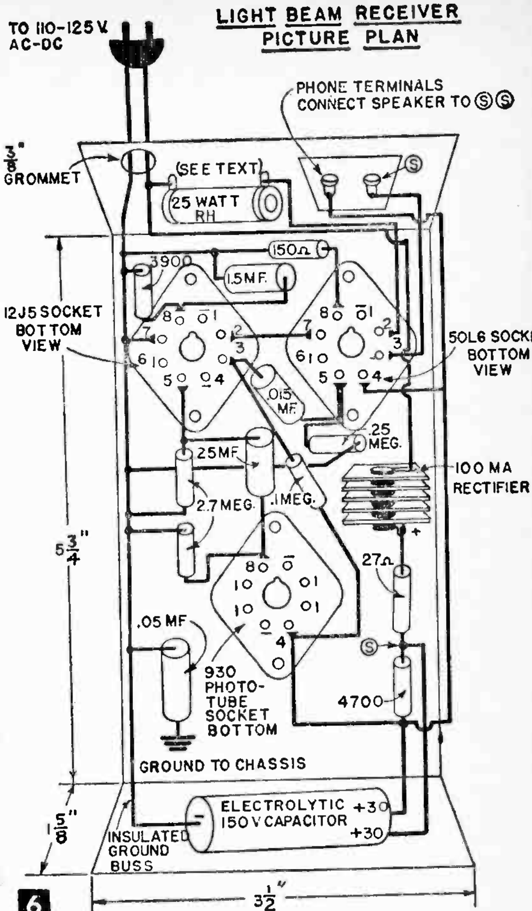
The *light beam receiver* (Figs. 3 through 6) uses only standard radio components and its circuit (Figs. 4 and 6) follows the same basic design used for movie sound reproducers, except that it uses tubes designed for operating on low plate voltages. Thus the *receiver* needs no power transformers of any kind.

As shown in Fig. 6 the receiver chassis is just 9 in. long x 3½ in. wide aluminum or steel. Each end is bent up 1⅝ in. to form the amplifier foundation. Ample room is available so that socket and mounting holes need not follow any precise



5

Bottom view of light beam receiver.



6

layout. Assemble the receiver components shown in the materials list, and wire and solder carefully using only rosin core solder. Only pins #4 and #8 are used on octal phototube socket. (Fig. 6).

The 12J5GT socket has no connections on pins #1, #4 and #6, while on the 50L6GT, pins #1 and #6 are blank. While it is common practice in *ac-dc* type circuits to return all grounds directly to the chassis, this is dangerous unless the metal chassis is completely enclosed in a plastic housing so that it is impossible for the chassis to be touched. To avoid this danger, use a heavy piece of tinned copper wire, isolated from the chassis, for all negative junctions. A .05 mf. capacitor is used to harmlessly ground the chassis to the isolated copper buss wire (note left side of Fig. 6). To make the copper buss wire rigid, you may solder it to pins #1 of the 12J5, 50L6 and 930 phototube sockets. This will provide a convenient zig-zag route to which the various resistors and capacitors may be terminated. For editorial clarity, this buss has been shown in a straight line and reader may adhere to the Fig. 6 diagram.

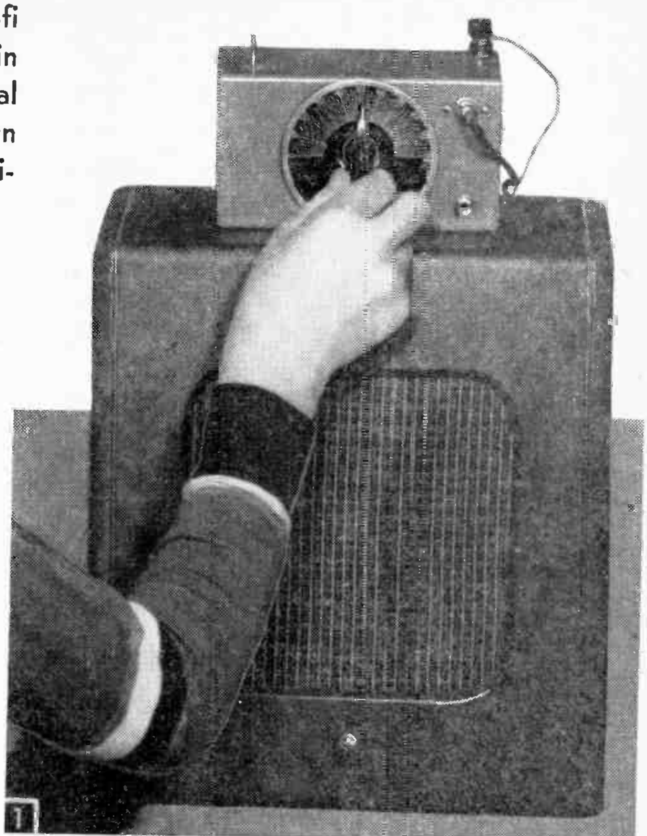
Since the Light Beam Receiver derives both its *ac* tube heater (filament) and plate-screen grid voltages (rectified *dc* 90 v.) right from the power line, certain consideration must be given to the line-drop resistor ("RH" in Figs. 4 and 6) although any moderate increase of the rectified *dc* potential is not important. Check with your local power company as to the "peak" line voltage delivered to your home. If this peak is never in excess of 115 volts (any cycle), the value of RH may be 286 to 300 ohms. If, however, the "peak" is 125 volts, the line drop resistor must be higher, or 386 to 400 ohms. If the 25-watt resistor RH is not high enough to handle peaks, burned out tubes will result. If in doubt, use the largest resistance, since the light beam receiver will still operate on a reduced "heater" voltage although the warm-up time will be somewhat increased.

The receiver, correctly wired, will provide moderate loudspeaker volume and excellent earphone reception. Speaker transformer is connected to the "phone" terminal (S) and to B plus between 27 and 4700 resistors marked (S) in Fig. 6. For greater volume, you can try connecting phone terminals to a separate amplifier. Don't attempt to increase range of transmitter with, say, a 6 volt battery and an auto spotlight bulb. Any but "flashlight-type" bulbs are of the coil-filament type, and residual glow causes them to react too slowly to the output transformer's modulating action to be useful here.

WAVE-POWERED TUNER

It's surprising how much hi-fi performance you can obtain from a very fine 1924 crystal circuit, updated with modern hi-Q components and semi-conductors

By THOMAS BLANCHARD

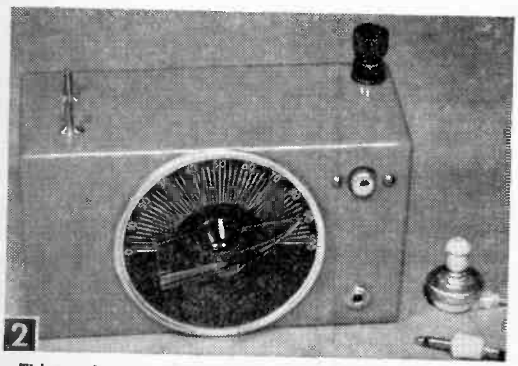


Connected to any amplifier, the wave-powered tuner provides bell-clear reception free of static and power line noise.

THIS tiny wave-powered fidelity tuner is a streamlined version of an antique 1924 receiver, which sold for $75 when a dollar was worth a dollar. The original set was housed in a 7 x 7 x 18-in. walnut cabinet with a hard rubber panel and a pair of 4-in. tuning dials. It had a hand-adjusted catswhisker and galena crystal detector.

Whereas the antique set employed two separate tuning capacitors with coils wound on forms the size of oatmeal boxes, this modern receiver-tuner (Fig. 1) employs miniature hi-Q coils, with ferrite slugs, and a 2-gang tuner which was unknown in 1924. One section of the tuning capacitor serves to tune the input ferrite antenna coil which receives the radio signal from the ether. This is known as a *wave trap.*

Because receivers which employ simple semiconductor detectors are not very selective, the wave trap serves to pre-tune the incoming signal before it reaches the R. F. coil and its tuning capacitor. Thus, two tuned circuits not only provide good selectivity, but provide a stronger signal than an ordinary wave-powered circuit.



This modern version of a 1924 crystal radio is an excellent hi-fi receptor. Lower jack provides for earphone reception, while phono jack allows connection to any record amplifier.

Most of you already know, of course, that the crystal diode detector makes the finest hi-fi tuner, and is 95 to 100% static-free. It is especially useful in areas where regular sets pick up power line interference. The circuit shown here provides for the use of a miniature earphone, for personal listening, as well as an output jack so that the signal can be fed into the crystal pickup phono jack of your radio or to your hi-fi record amplifier.

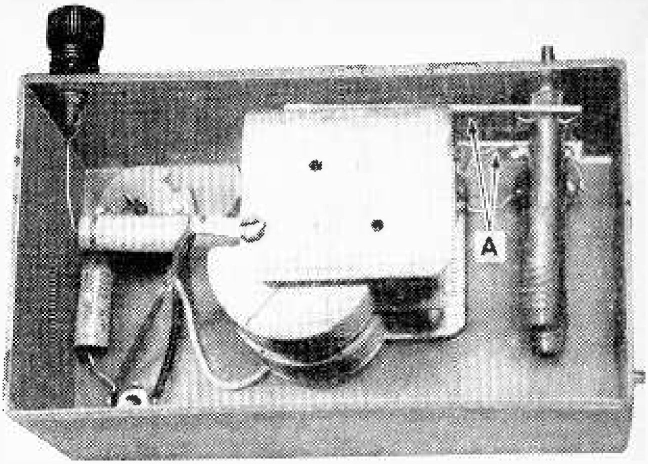
We built this tuner-receiver in a 2¼ x 2⅞ x 5⅛-in. plastic box. But any larger non-metallic container will serve equally well. If you are electronics-minded, you'll also find that you don't have to follow the Fig. 5 parts layout slavishly, as long as you make the correct connects, your tuner will perform properly.

Since various mounting holes are provided on the frame of the 2-gang 350- or 370 *mmf* tuner, it was possible to mount the ferrite antenna coils

MATERIALS LIST—RECEIVER-TUNER

1 plastic or wood box or cabinet large enough to hold components
1 2-gang variable capacitor, 350 or 370 mmf
1 bar knob and dial plate
1 miniature phone jack
1 phono jack
1 length single conductor shielded phono cable
2 phono plugs
2 ferrite slug-tuned antenna coils (Miller, Variloop, Loopstick, etc.).
1 germanium general purpose diode detector
2 .002 or .0022 mfd paper or ceramic capacitors
1 39,000 to 50,000 ohm ½-watt resistor "R" (see text)
1 binding post

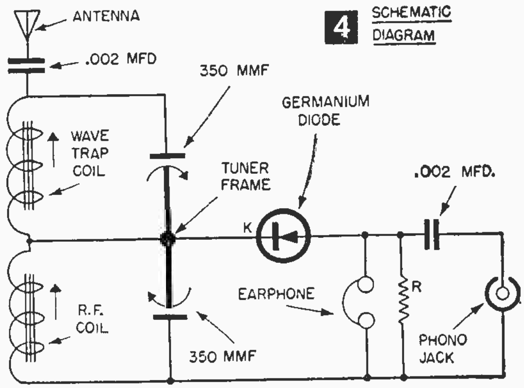
to the capacitor frame using the metal mounting strap supplied by most coil manufacturers. Coils and tuner in this way become a single, easily handled unit requiring a minimum of wiring.



3 Arrangement of components in small plastic box. Coil mounting straps (A) have been secured to frame of 2-gang tuning capacitor.

With the small plastic cabinet we used, space did not allow clearance of the ferrite slug adjustment screws. So a pair of ⅜-in. dia. holes was made with a burring reamer in the top of the box. If you use a larger cabinet, screws need not protrude. But in order to permit proper set alignment, after wiring has been completed, these screws must be accessible.

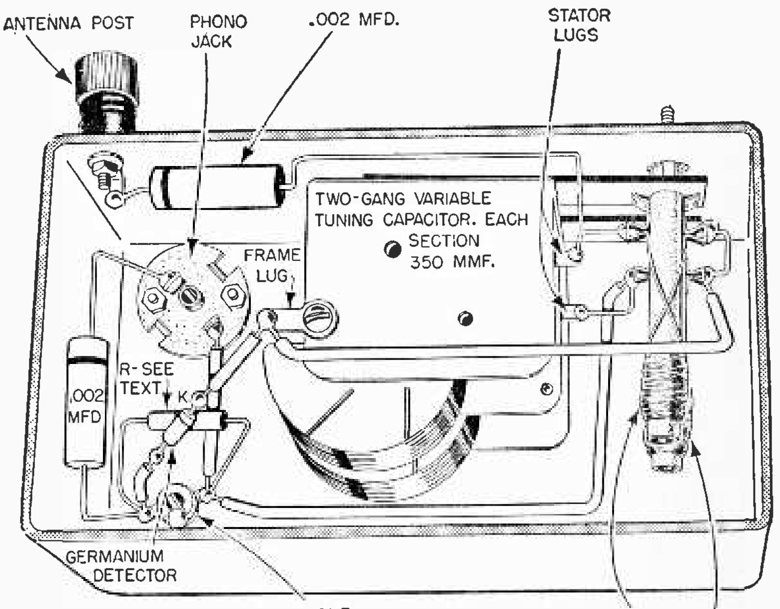
The "heart" of our tuner-receiver is the semiconductor detector. Any inexpensive general purpose type germanium diode will work here, as a crystal detector. However, some units are "hotter" than others even though of the same type number and make. If you have several diodes on hand, try each one in the circuit. Pick the one that provides the strongest signal.



4 SCHEMATIC DIAGRAM

The tuner output is connected directly to a miniature earphone jack, then through a .002 *mfd* capacitor to a phonograph pickup jack. A length of single conductor shielded cord is fitted with pin plugs on each end. One plug connects to the tuner and the other to the input jack of any amplifier. If the amplifier is a simple *ac-dc* type, and the signal comes through distorted, reverse the line cord plug in the outlet to establish proper polarity.

Load resistance "R" is a ½-watt unit with a value of 39,000 to 50,000 ohms. In fact, varying this value by means of a small 100,000 ohm potentiometer provides an interesting "loudness" control. However, the employment of the resistence "R" across the output is mostly theoret-



5 PICTORIAL DIAGRAM

6

Coil slug screws extend above cabinet allowing for easy alignment. Here tuner is used with miniature earphone as a personal set.

ical. You will need to add it only if the signal when fed through an amplifier is distorted. It is not needed when the earphone is used with the set.

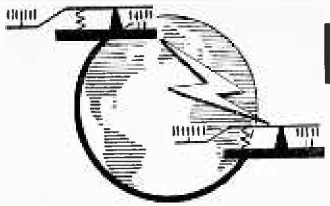
Except when used with an earphone, a ground connection is not necessary. Indeed, little increase in signal was noted with a ground; therefore none has been employed. When the tuner is used with an amplifier, the power line supplies necessary grounding through the shielded cable coupling.

As a safety measure, the antenna is coupled to the set through a .002 *mfd* capacitor. With a phono amplifier, the tuner provides excellent reception of nearby stations with a piece of wire as short as 3 feet. A length of wire fitted with a small battery clip may be attached to various metallic objects around the home if a stronger signal is desired. Or make a conventional outdoor antenna connection if you're trying to pull in distant stations.

How to Align Tuner. The slug screws on the ferrite antenna coils must be properly adjusted to insure the set's tuning the entire broadcast band, and providing maximum trap efficiency. Start by tuning to a station near 1600 *kc* where plates of tuner will be almost fully open. Turn the R. F. coil's slug screw until signal is strongest. Next, without changing dial setting, turn trap coil slug until signal reaches its final peak.

Now rotate the tuning dial to another station near 550 *kc* (plates meshed). The tuner will cover the entire broadcast band when the R. F. slug has been correctly adjusted. The ideal way to "peak" the set is to tune to a very weak station once the R. F. range is satisfactory. Now slowly turn the trap coil slug until the weak signal is loudest. Your tuner will now track with maximum selectivity from 1600 through 550 *kc*.

"I installed a new voltage regulator. The wife said I was nuts but I figure what the heck—"



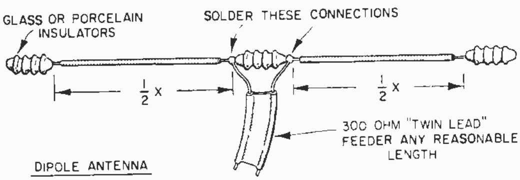
Low Power DX

Follow these eight simple principles, and get in on this most exciting of electronic sports

By C. F. ROCKEY, W9SCH/W9EDC

DO you like to stand beside a stream and try to out-think the wily trout? Or perhaps you enjoy matching wits with a deer. If you do, then you're a natural for the electronic equivalent of these sports—*low power DX*.

Many new hams gain the impression that expensive equipment, a rural hilltop location, and the luck of a veteran gambler are necessary to make foreign contacts. This is categorically untrue. Many long distance contacts are made every day with simple equipment, from urban residential locations just like yours.



MATERIAL: ANY COPPER WIRE HEAVIER THAN NO 18, B AND S GAGE. MAY BE INSULATED IF DESIRED

TOTAL LENGTH FOR VARIOUS DX BANDS:

BAND	TOTAL LENGTH, FT
28 MC	16
21 MC	22
14 MC	33

1 A

How, then, does one start? First, we'll assume that you are a *licensed* amateur operator, or soon will become one, and that you are in a position to set up a simple station. All right, *first*, get your *General* class license as soon as possible. The restrictions imposed upon Novice-class operators are so confining as to discourage DX operation. (Although some Novices *do* make foreign contacts.) Learn your code and theory and take that test next week.

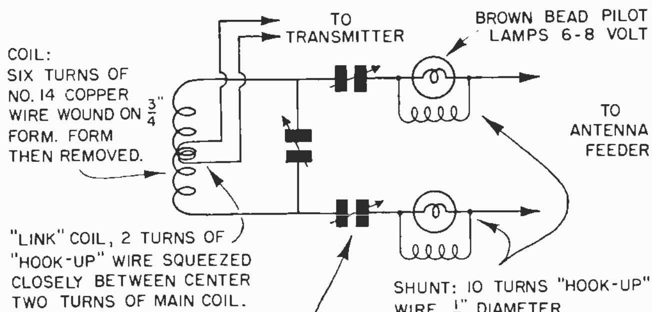
Second, plan your equipment to operate on one of the *DX bands*, 14 or 21 megacycles. While the 28-megacycle band is also good for long range contacts, the powerful 'phone stations all but monopolize it. So, as of now, it is not recommended.

Third, plan to do most of your serious long-distance work on radiotelegraph (CW). Reputable calculations indicate that about 50 times more power is required to produce a radiophone signal than is needed to produce a CW signal of the same magnitude.

Fourth, plan to spend plenty of time and work on your antenna system. Of all the technical factors involved in long-distance communication everyone agrees that the antenna system is far and away the *most important*. If you are rich, or can otherwise arrange it, a rotary directive array, otherwise called a "rotary beam" is probably the best available DX antenna. Descriptions, prices, and specifications for *good* beam antennas can be found in any amateur jobber's catalog, but unless you plan to spend upwards of $150 on such a beam (with rotator and accessories, of course), better not try this approach. Many a home-built or flimsy beam antenna ends up in the neighbor's elms during the first thundergust.

Suppose you do not have $150 to spend. Must you then concede defeat? Never! Experience proves that a plain piece of copper wire, fed with a few watts of high-frequency power, will produce a signal anywhere on this planet—if the wire is in the *right place*.

What is the "right" place? Books on electromagnetic theory develop neat formulas for the radiation distribution of theoretical antennas in free space and over an infinitely-conductive plane surface. These are elegant, but your backyard and mine are made of dirt, and dirt is not infinitely-conductive. Furthermore our "free space" is filled with gutter pipes, 'phone wires and power lines. The wonderful formulas are therefore useless to us. (The writer wore out a good slide rule and chased many an electromagnetic vector down a rathole before he learned this for himself.) What, then, shall we do? Here's *one* answer:



ALL CAPACITORS: ANY WELL-INSULATED VARIABLE CAPACITORS HAVING AT LEAST 250 MMF MAXIMUM CAPACITANCE. (BUD: MC 1860)

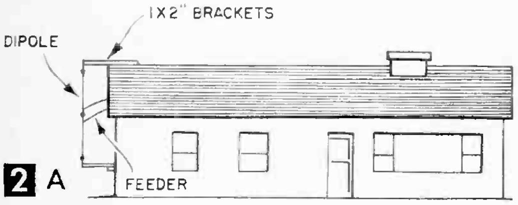
ANTENNA TUNER

(IN EVENT NONE IS PROVIDED IN TRANSMITTER. TUNES ANTENNA AND REDUCES TV INTERFERENCE.)

1 B

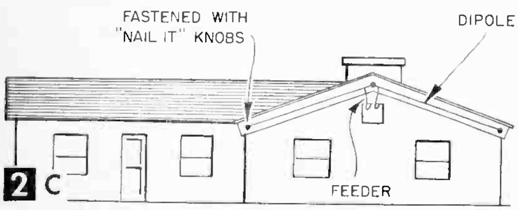
Make yourself a half-wave dipole antenna (see Fig. 1) for the band you're interested in. It will be 22 ft. long, overall, for 21 megacycles and 33 ft. long for 14 megacycles. (Forget the odd inches; they don't matter.) Feed it as you prefer. The writer likes a tuned transmission line at the center. (With tuned feeders, the 33-footer can be used on the 21 mc. and 28 mc. bands also.)

When you have your antenna, try hanging it in various available positions about your real



2 A

estate (see Fig. 2). If it doesn't quite fit somewhere, you may bend it, with discretion, but do not double it back upon itself. *Somewhere* on *your* property is a place where such an antenna will work. Try the highest and clearest spot first and call a few foreign stations. If you do not raise them after several days of trying, move your dipole somewhere else, and try again. (Did you catch a rainbow trout in the first stream you tried?) Unscientific? Yes, but it's the only answer. When you find the right spot, *then* you



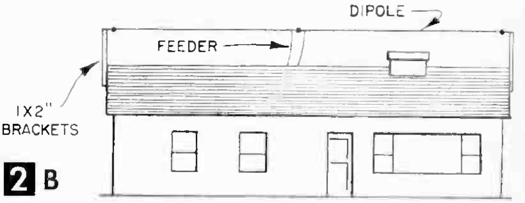
2 C

may speculate as to the whys and wherefores.

Fifth, provide yourself with a good receiver. The attributes of a good receiver are: 1) *reliability*—freedom from bad connections and hand capacity; 2) *stability*—ability to tune in and hold a signal despite reasonable mechanical shock, and over a reasonable period of time; 3) *sensitivity*—the ability to bring weak signals up to an audible level. A good practical test (on 14, 21, and 28 mc. bands) is to alternately connect and disconnect the antenna. If the noise level does not markedly increase when the antenna is connected, your receiver will hardly do well on weak foreign signals; 4) *quietness and convenience*—Your receiver should produce no sound except a smooth, quiet, hiss when the antenna is disconnected. If it hums, crackles, grunts or makes similar noises, it needs internal attention. Also it should have a non-slip, smooth-acting, tuning mechanism if you are to tune in the weak ones on the nose.

A receiver need not be expensive; indeed, a properly built two-tuber will qualify easily on all four counts. On the other hand, many a chrome-trimmed cabinet full of tubes shows up most miserably. It's not how loud the signals are, but how well the *weak* ones come through that counts. Of course, the features of a truly fine receiver are well worth the cost, if you can afford it. Oh, yes, for best results, use your transmitting antenna for receiving also.

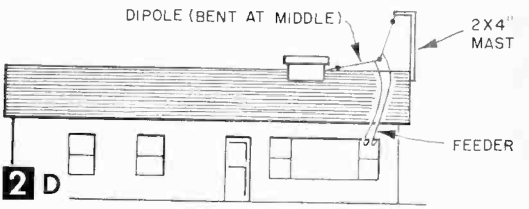
Sixth, use a good variable frequency oscillator, often called a V.F.O., with your transmitter. Most



2 B

foreign operators do not tune more than a few kilocycles from their own frequency, when listening for answers to their CQ calls. If you're "rock bound," with a crystal-controlled transmitter, you have to wait for a station near your crystal frequency before you stand much of a chance for contact. Of course, you can buy a "raft" of crystals, but this becomes too expensive for most amateurs. Good V.F.O.'s may be built from kits or, if you have ingenuity plus a "junk-box," you can often build a better one by yourself from scratch. See the specialized amateur handbooks for circuits and suggestions.

Seventh, adjust your transmitter to produce a *steady, clean, reliable* signal. If one or more tubes overheat, bad connections exist, or you have to "give it a kick" to make it work, you'll miss many



2 D

good DX chances and you *may* get into trouble with the F.C.C.

The power is inconsequential; both experience and mathematics prove that a one-watt transmitter may have world-wide range. Indeed, the lower the power the greater the challenge to the true ham sportsman. You can get all the fish you want in any lake with a stick of dynamite. Similarly, you can contact all continents in one afternoon with a 1000-watt, "store bought" transmitter but this is "commercial radio," not sport. The writer recommends an input power ranging from

---

To operate *any* radio transmitter without a license in the U.S.A. is punishable by a maximum fine of $10,000 and/or two years in prison.

---

30 to 100 watts as being adequate and sporting.

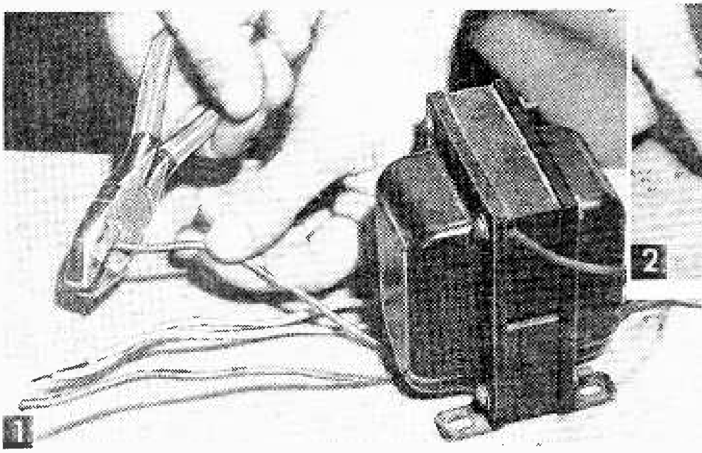
Eighth (and last), operate intelligently:

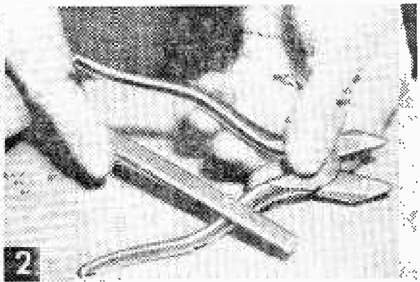
a) *Never* call "CQ DX." Instead answer the foreigner's CQ for best results. Listen *first*, then call.

b) Look for DX at the proper time. You must be on hand when the ionosphere is right, if you want results.

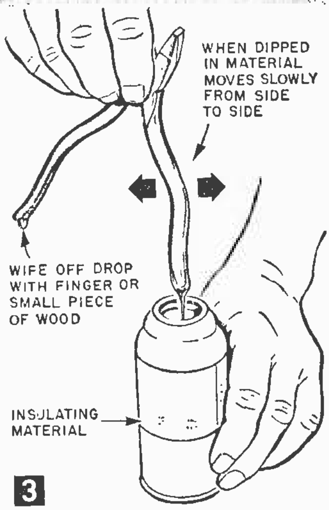
c) Be a gentleman. Other hams judge your country by the way its hams behave on the air. Know and obey the regulations at all times, both in spirit and letter, be brief, but polite.

d) Don't give up! Try another day, a different antenna arrangement, a different operating approach. Others make foreign contacts; so can you. Get your hook in, the fishin's fine!





There is little chance of receiving a shock through these insulated plier handles. The glass-smooth coating has high dielectric strength and will stand the usual hard usage. It is chemically inert and resists acids, alkalies and petroleum products.



Insulating Your Tool Handles

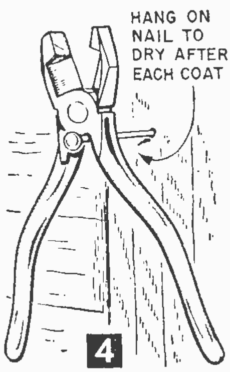


Fig. 2. Sharp edges will take only a thin coating, so use a file to round all edges.
Fig. 3. Dip plier handles into the material one at a time, move handle slowly from side to side to avoid air bubbles and then slowly withdraw.
Fig. 4. Hang the pliers on a convenient nail for drying after each coat.

IN the interests of safety, electrical workers and experimenters should always use pliers, screwdrivers and other tools with well-insulated handles to avoid the possibility of shock when working on live wires and equipment (Fig. 1). You can easily insulate your tool handles by dipping them in an insulating material such as *Rub-R-Ize* (made by Rubber Magic, Inc., Dept. M, 4312 Third Ave., Brooklyn 32, N. Y.) or *Insl-X E-33* (made by The Insl-X Co., Inc., Dept. SM, Water Street and Broadway, Ossining, New York).

First file or grind off any sharp edges and rough spots on the part of the tool to be coated (Fig. 2). Then thoroughly clean the surface with a clean cloth and a grease solvent like carbon tetrachloride. Careful of the fumes! Dip the tool handle into the material to the desired depth moving it from side to side to avoid forming air bubbles. Then remove it very slowly (Fig. 3). The large drop which forms on the end as it drains can be wiped off with your finger or a small piece of wood.

Hang the tool up to dry for one hour on a suitable support (Fig. 4), then apply the remaining coats in the same manner. Three dips should make the tool safe to use on voltages up to 230 volts. For higher voltages, apply more coats. Always allow an hour between coats, and 24 hours' drying time after the last coat. When the material is dry, remove excess with a sharp knife.

For coating fixed objects or those too large to be dipped, the material can be applied with a brush. It then can be used for coating panelboards, coating terminals after making connections and also metal parts adjacent to wires that might require insulation. Wires formed into small cables can be held in place effectively by this material and thus avoid the possibility of fractured insulation. You can also use it to coat nuts and bolts so that they will remain tight permanently.—H P. STRAND.

Lab Reports and Construction Hints

Anyone constructing or repairing electronic equipment as a hobby, or professionally, *must* have a means of checking the equipment. There are many different types of electronic test equipment depending upon the application, but there is a basic piece of equipment that is a must on any test bench—a voltmeter for measuring *ac* and *dc* voltages combined with an ohmmeter for checking circuit continuity and values of resistance.

This basic piece of test equipment can be in the form of a multimeter or it can be a vacuum-tube voltmeter. If a multimeter (VOM), it must have a *dc* sensitivity of at least 20,000 ohms per volt to keep circuit loading at a minimum and an *ac* sensitivity of at least 5,000 ohms per volt. These minimum sensitivity limits are necessary to keep circuit loading low, but even with them there will be many situations where loading is excessive and readings obtained by a VOM are meaningless or there is no reading at all. And though the VOM does offer the advantages of being entirely self-contained and of requiring no external power source (and also, usually, of having several ranges for making *dc* current measurements), such a meter—even in kit form—will cost at least $30. Thus, the widespread use of the vacuum-tube voltmeter (VTVM).

Instrument accuracy of no better than ±10%, sometimes ±15%, is usually sufficient when repairing amplifiers, radios, and television sets. Absolute or true voltage values are not as important in such applications as knowing whether a certain voltage

Front panel views of the completed Knight-Kit 83Y125 VTVM kit (left) and Heathkit V-7A VTVM kit (opposite page).

Heathkit Model V-7A VTVM

HEATHKIT

All of the parts supplied in the Heathkit (see Fig. 2) were well packaged, the kit was complete in all important details (though solder was not supplied), and a detailed instruction manual was included. Parts supplied were all of good quality, and though the circuit board wiring appeared tarnished, it soldered readily during the construction. (At one point, for the job, instructions specify a 25 to 50-watt soldering iron, and at another point a 60- or 100-watt iron or soldering gun is specified. Never, however, use larger than a 50-watt iron when making connections to the circuit board assembly.)

Switches had a ball-type detent which gave them a smooth easily operated action. The meter scales on the V-7A *could* be made more legible if the markings were made slightly heavier and given alternate pairs of scales in red and black, opposite ends of the ohmmeter scales are hidden by the case and it is necessary to read the meter from one side or the other at these extremes.

The V-7A VTVM has a clever dial lamp arrangement in the top edge of the clear plastic meter case, but the red dial lamp has low brilliance and you have to look closely to determine whether the instrument is Off or On.

The range switch is, in some respects, the heart of the instrument. Careful workmanship on it will insure maximum instrument reliability. It is the most difficult part of the instrument to assemble, but the "jig" shown in Fig. 3 greatly simplifies the job.

Take a scrap piece of ¾-in. plywood and cut it to roughly 4¼ x 8¼ in. with a ¼-in. hole drilled at an approximate angle of 60° through its center. Mount the precision resistors with a minimum amount of bending and pulling of their leads, wrapping the leads around the switch terminals so that leads are not under tension when mounting is completed. Position resistors so they do not touch each other or any part of the range switch or the shaft through the center of the switch. Rotate the shaft to be sure of clearance in all positions. It is also wise to position the resistors so the values can be easily read.

Don't race with the clock when constructing your VTVM kit—to do so may result in a wiring

on Two Vacuum-Tube Voltmeter Kits

Knight-Kit Model 83Y125 VTVM

By MILO A. ADLER

The ideal instrument to provide these desirable features, then, is a vacuum-tube voltmeter (VTVM). Most vacuum-tube voltmeters do not have *dc* current ranges, but this is not a serious shortcoming since *dc* current readings are not commonly taken or used when testing or repairing electronic equipment of the type commonly found in the home.

The most economical method by which to obtain a VTVM is to purchase it in kit form and construct it yourself. Kits are available at a price far below the aggregate cost of individual components and they have a "professional" appearance when completed. Moreover, they are lower in cost than a 20,000-ohms-per-volt VOM kit.

Questions such as "Which kit shall I buy?" "Is the completed kit unit any good?" and "Will the kit be too hard for me to build?" obviously enter the mind of every prospective VTVM kit buyer.

To answer these questions, a Heathkit Model V-7A vacuum-tube voltmeter kit and a Knight-Kit Model 83Y125 vacuum-tube voltmeter kit were obtained and assembled according to the instructions supplied with them. The completed units were then subjected to rigorous tests with precision laboratory test equipment. Here are the results obtained, along with some construction tips.

has increased or decreased as a result of an adjustment or a parts replacement. Being able to measure voltages without upsetting an electronic circuit is also far more important than knowing exact voltage.

error which could ruin a valuable circuit component and take many hours of tedious circuit tracing to find. The instrument will work the first time you turn it on—provided, you start at the front of the instruction manual accompanying the kit and follow its instructions to the letter. *Don't* skip the introduction, some very important information is given in this portion of the manual.

The 1% precision resistors supplied in the Heathkit were covered with impregnated paper tubing for protection. These resistors are manufactured by placing a thin conductive film on the outer surface of a glass or ceramic core. This film is then cut in a spiral pattern until the desired resistance is obtained. Since such a film is easily damaged by scratching, some sort of protective covering is required. Precision resistors of the highest quality are protected with a thick coating of insulating varnish or equivalent plastic material. This type of coating is unaffected by moisture. A paper covering provides the necessary protection, but it is not impervious to moisture.

As a test, four of the paper-covered resistors from the kit were placed in a humidity chamber along with "coated" resistors of the same ratings. Humidity was maintained between 85% and 90% at all times, temperature was raised from 68°F to 104°F over a two-hour period, held constant at 104°F for six hours, then allowed to drop to 68°F. This temperature fluctuation was automatically repeated twice every day for three days. Resistance values were measured before the test was started, at the end of each day, and again after the resistors had been out of the humidity chamber for three days.

A 900,000-ohm, 1-watt, paper-covered resistor changed in value by more than 33%. A 900,000-ohm, ½-watt, paper-covered resistor changed in value 52%. A 90,000-ohm, ½-watt, paper-covered resistor changed 3.22%, and the remaining paper-covered, 9,000-ohm resistor changed only 1.3%. The four coated resistors changed less than 0.5% each. All resistors (paper-covered included) were within 1% of their marked values after the three-day drying out period.

This was a severe test—a *most* severe test, perhaps unduly so—but it does show that the high-value paper-covered resistors can change radically in resistance under high humidity and temperature conditions. And such radical changes can affect instrument calibration and accuracy.

Components supplied by the manufacturer of the Heathkit V-7A kit.

Two solutions to this problem are open to the V-7A kit builder. One would be to purchase a replacement set of "coated" 1% precision resistors and substitute them for those supplied with the kit. (To do this, however, voids the kit's guarantee.) The other solution would be to carefully slide the paper tubing on each precision resistor so that the tube is still around each resistor but does not touch both ends. It will still protect the resistor from physical damage, but cannot cause a change in resistance. Do this before final calibration and installation in the cabinet.

Circuit Board. Check tube socket position on the circuit board carefully before bending the lugs down and soldering to the foil pattern. Socket lugs are longer than they need be and there is some danger of a short circuit at the outer end of some of them. This danger can be eliminated by bending the outer end of the lugs upward from the circuit board or by cutting off the surplus length.

When preparing the eight-wire, color-coded cable, be sure not to cut the wires too short (save the wires that are cut off to use when wiring the balance of the voltmeter). Hook-up wire of only one color is supplied in the kit. By using wires of several different colors, you will simplify any possible trouble shooting and will also be aided in checking the wiring in your completed unit.

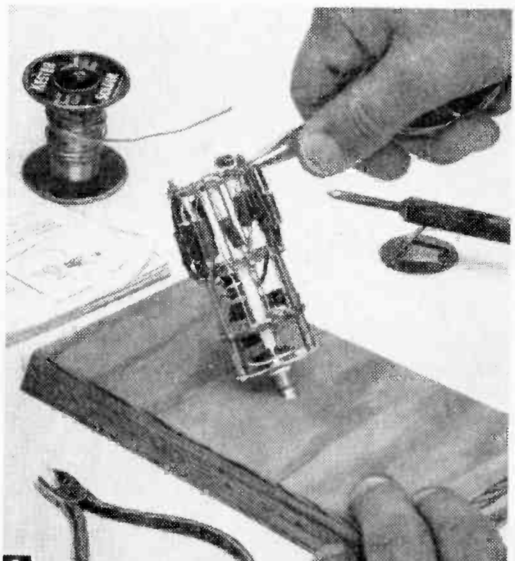
After all parts have been mounted on the circuit board (as shown in Figure 4) clean off the foil side of the board to remove all traces of the rosin soldering flux. Do this by wiping off the board with a cloth dipped in acetone or alcohol. Don't use an excessive amount of acetone, however, or the printing on the opposite side of the board will be removed by it.

After the foil side of the board has been cleaned thoroughly, cover the entire side of the board with an insulating varnish or equivalent plastic coating to protect and preserve the circuit-board wiring. Pressurized spray-cans that provide a crystal clear acrylic insulating coating can be obtained from radio parts distributors at a nominal price. Do not spray the switches, since contacts within them would be coated and erratic switch action would result.

The phosphor bronze battery holder spring is somewhat difficult to mount and you will have to make several attempts before succeeding. (This portion of the VTVM assembly could have been simplified if the spring supplied had a slightly different shape to provide room for the mounting nut and lockwasher.) The battery is also somewhat difficult to install. However, the battery is firmly held in place and the battery contacts are tight, both desirable features.

The battery should not be installed in the VTVM or used in any manner until the final *dc* calibration is complete. Calibration accuracy for the *dc* ranges depends upon the terminal voltage of the battery. If the battery has been previously used, or has been accidentally shorted for just a moment, the terminal voltage could permanently drop.

Final assembly of the instrument can be accomplished without forcing any of the components. The meter and the circuit board are both rugged, but unnecessary force could permanently damage either or both. Tighten the four meter mounting screws just enough to hold the meter without coming loose under normal operating conditions. Over-tightening them could result in a cracked or broken meter case. The inside of the completed VTVM should look like Fig. 6.



Installing last resistor on Range Switch. Switch is held secure for mounting of resistors by wooden jig.

Calibration. Provide a support that will hold the panel upright in the normal operating position. Make this support out of wood so that the panel is insulated, if on a metal surface, and use an insulated screwdriver.

Do not touch the metal panel when calibrating the *ac* ranges.

When setting the meter movement to mechanical zero, rotate the adjusting screw clockwise until the meter pointer is moving down-scale toward zero, stopping when you reach zero. If you go beyond, keep rotating the screw clockwise and again approach zero from the high side of the scale. This is the correct way to adjust to zero any meter movement of this type.

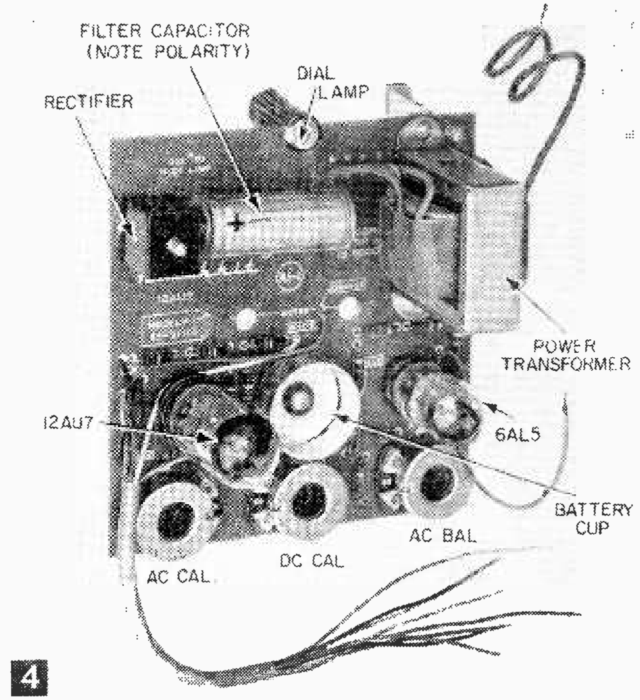
When the instrument is operating you should be able to set the meter to zero with the ZERO ADJ. control set to the approximate center of the control adjustment range. If this adjustment can be obtained only with the control at or near one end, the two triode sections of the 12AU7 are probably unbalanced. The tube is not defective and the VTVM can be calibrated and used with good results, but if you have a selection of 12AU7 tubes, pick one that will permit setting the meter to center scale with the Selector Switch in either the D.C.– or the D.C.+ position. This will make the VTVM slightly easier to use and there is also less chance of the tube drifting out of the adjustment range of the ZERO ADJ. control.

Make a rough initial calibration, install the VTVM cabinet, reconnect power, and leave the instrument on for at least 100 continuous hours. This may seem like a long time, but using two different sets of tubes there was noticeable drifting of characteristics in the test model until the tubes had aged for at least four days and nights.

When making the final calibration, the VTVM should be thoroughly warmed up and—if at all possible—a second voltmeter with accurate or known calibration should be used as a reference, especially when calibrating the *ac* ranges. Your VTVM should then be adjusted to give the correct reading as determined by the reference voltmeter when connected to the same voltage source. If possible, check several scales and adjust the meter for a compromise calibration that gives the best accuracy on all ranges checked. Do not include the 1.5- and 5-volt *ac* ranges as they may have some inaccuracies that cannot be avoided. (This will be explained later.)

If a reference voltmeter is not available, use the calibration procedure given in the instruction manual. This procedure is accurate for the *dc* ranges since battery voltage will probably be within 1% of 1.55 *v*. Accuracy of the *ac* calibration will depend upon how close the line voltage is to 117 *v* at the time you calibrate your unit. The line voltage could very easily be 5% to 10% from 117 *v*, which would automatically introduce a corresponding error in your calibration.

The three wires supplied for the voltmeter test leads are only 3 ft. long. This makes it necessary to have the meter very close to the points to which it is connected. Cables that are at least 4 ft. long will make the V-7A much easier to use.



Completed V-7A circuit board ready for final assembly.

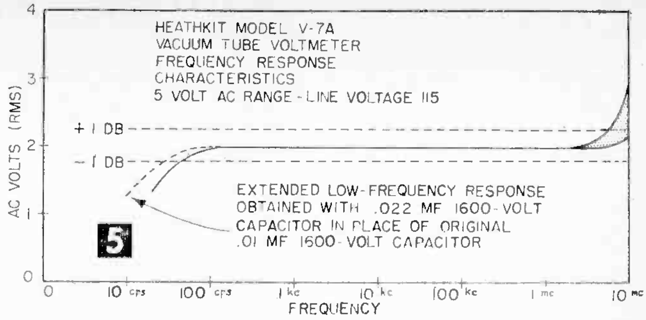
The special "test prod wire" for the COMMON and the A.C. OHMS leads, as well as the shielded type RG-58U cable for the D.C. lead, is relatively inexpensive and can be obtained from any radio parts distributor. If you make up a new set of longer cables, check the *dc* calibration of the VTVM with the new cable. Heat from soldering the 1-megohm resistor in the *dc* probe may cause the resistor to change value, affecting calibration.

Check-out. The completed V-7A VTVM model was calibrated exactly according to the instruction manual directions. Instrument accuracy was then checked by means of laboratory equipment having a *dc* accuracy within 0.1% and an *ac* accuracy within 0.25%.

The *dc* readings were all low, with none any lower than 2% with respect to full scale. This means that the *dc* portion of the unit can be recalibrated to provide a between-scale accuracy of ±0.8% of full scale. A tracking error of ±1% of full scale was found between equally spaced readings taken from one end of a scale to the other. This means that the over-all *dc* accuracy of the V-7A model was ±1.8% with respect to full scale. Your VTVM may not be as accurate as this, it may be more accurate.

Error between the D.C.— and D.C.+ positions of the function selector switch was negligible.

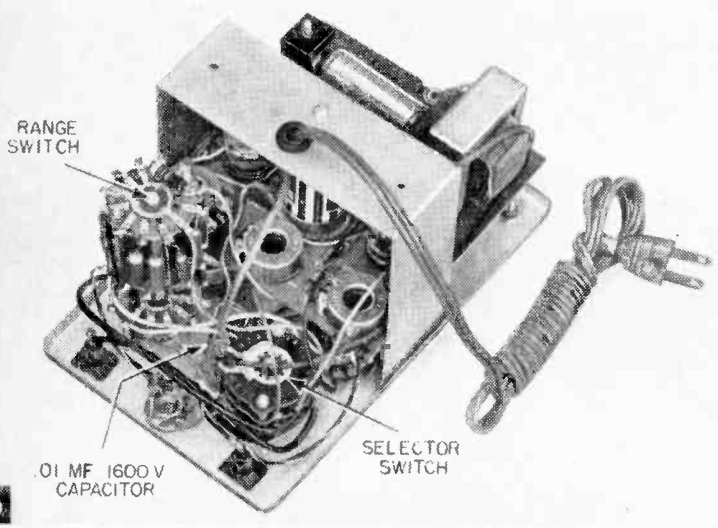
Line voltage was increased to 125 *v* and decreased to 105 *v*. The ZERO ADJ. control was readjusted each time line voltage was changed. Maximum error introduced by this extreme test was only approximately ±3%. There are no published specifications for this test, but the results obtained were far better than expected. Rarely do line voltages vary this much in any given location and it is therefore permissible to neglect any possible error due to line voltage fluctuations when using the V-7A VTVM.



5

The V-7A VTVM model passed the *dc* accuracy test easily, since published specifications are ±3% of full scale and ±1.8% was obtained (±5% and up to ±10% is usually considered good for all except special-type, laboratory meters).

Accuracy of *ac* calibration was then checked at a frequency of 400 *cps* and was found to be within ±6.3% of full scale on the upper five ranges. Good accuracy cannot be expected on the 1.5 *v ac* range (as will be explained later). The instruction manual contains the kit manufacturer's explanation for the error on the 1.5 volt *ac* scale and states that the error may be as high as ±15% of full scale. The error between the upper five *ac* ranges was not more than ±3.3% with respect to full scale. There was, however, an additional ±3% tracking error with respect to full scale, resulting in the over-all accuracy of ±6.3% of full scale, still well within reasonable limits, but not quite meeting specifications for *ac* accuracy of ±5.0% of full scale. The *ac* line voltage was very close to 117 *v* when the V-7A VTVM model was calibrated.



6

Completed V-7A VTVM ready for installation in unit's cabinet.

Frequency response of the 5 *v ac* range was then checked; results obtained are shown in the graph of Fig. 5. The equipment used to make the frequency response measurements has an accuracy of better than ±1%.

High-frequency response varied depending upon the position of the test leads, but usually fell within the shaded area at the upper end of the graph, Fig. 5. The frequency response obtained was much better than expected and was within ±1 *db* from approximately 45 *cps* to 5.5 *mc*.

In most cases, voltmeters of this type are seldom used at frequencies above approximately 20 *kc* which means that the high frequency response of the model was excellent. The approximate error of 6% at power line frequencies seemed excessive, but it was very easily reduced to a satisfactory level by replacing the 0.01 *mfd*, 1600-*v* capacitor between Selector Switch terminal S12 and Range Switch terminal R6 with a 0.022 *mfd*, 1600-*v* capacitor. Frequency response was lowered by almost an octave and the error at 60 *cps* was reduced to approximately 2.5%. The improved low-frequency response is shown by the dotted line on the low frequency end of the response curve in Fig. 5. Anyone building the V7A kit should make this parts substitution during assembly. (Unfortunately, the Heath Co. informs us that to do so will void the guarantee; you'll have to decide whether it's worth it to you or not. There is room for a Sprague "Black Beauty" 0.022 *mfd*, 1600-v capacitor in place of the original .01 *mfd*, 1600-*v* capacitor.)

The ohmmeter ranges were checked and the results obtained were:

CORRECT VALUE IN OHMS	V-7A INDICATION	ERROR IN OHMS	ERROR PERCENT
10	9.3	0.7	−7%
100	93	7	−7%
1,000	920	80	−8%
10,000	9,400	600	−6%
100,000	94,000	6,000	−6%
1,000,000	950,000	50,000	−5%
10,000,000	9,600,000	400,000	−4%

Students of mathematics and of electronics may be confused by two statements that appear in the instruction manual supplied with the kit. One statement is in the form of a chart which shows adjacent voltage ranges as being 10 decibels apart. If you wish to neglect a 0.5 *db* error this statement is correct. Two scales of any voltmeter are 10 *db* apart when the ratio between the two readings obtained with the meter needle in any position is 3.16 or 0.316 to 1. Under these conditions, 9.5 on the 15 *v* scale or 95 on the 150-*v* scale will be opposite 30 on the 50-*v* scale.

The scales in the V-7A voltmeter, however, are arranged so that 9 on the 15-*v* scale is opposite 30 on the 50-*v* scale. This is a ratio of 3.33 or 0.3, which can be expressed as 10.5 *db*. When going from the 50-*v* scale to the 150-*v* scale, 30 will be opposite 90 which is a ratio of 3.0 or 0.33. This ratio can be expressed as 9.5 *db*. Alternate scales are 20 *db* apart (as stated in the instruction manual). A corrected chart to take the place of the one in the manual would be:

VOLTAGE SCALE	DECIBEL SCALE	DIFFERENCE
0-1.5 VOLTS	READ DB DIRECTLY	
		10.5 DB
0-5 VOLTS	ADD 10.5 DB TO READING	
		9.5 DB
0-15 VOLTS	ADD 20.0 DB TO READING	
		10.5 DB
0-50 VOLTS	ADD 30.5 DB TO READING	
		9.5 DB
0-150 VOLTS	ADD 40.0 DB TO READING	
		10.5 DB
0-500 VOLTS	ADD 50.5 DB TO READING	
		9.5 DB
0-1500 VOLTS	ADD 60.0 DB TO READING	

The second questionable statement is in the circuit description where the 6AL5 is said to act as a full-wave rectifier for *ac* voltage measurements. The 6AL5 is actually connected in a half-wave, voltage-doubler circuit. Such a voltage-double circuit is used to obtain high sensitivity in order to provide a 1.5 *v* range for *ac* voltage measurements.

In order for the voltmeter to be accurate on all *ac* ranges, the *dc* output from the 6AL5 rectifier must be directly proportional to the *ac* input voltage. This linearity is possible with diode rectifiers only when the input voltage has an amplitude of at least 1 to 1.5 *v*. When the *ac* input signal is less than approximately 1.5 *v*, a diode rectifier acts like a "square law detector" with output proportional to the square of the input signal amplitude. The voltage doubler circuit only amplifies this error. Because of this, the 1.5 *v* *ac* range of the V-7A VTVM cannot be expected to be accurate. In fact, this error will also be noted on the low end of the 5-*v* range. This is *not* faulty design, even though errors as high as 20% with respect to the actual voltage may be present in the 1.5 *v* range of a particular V-7A model. The circuit provides optimum performance at a low price, combined with construction simplicity. Many commercially built VTVM's costing several times the price of the V-7A have the same error on their 1.5- and 5-*v* *ac* scales. The 1.5-*v* *ac* range is still extremely useful for making relative measurements. Exact values are usually not necessary on these scales.

The V-7A VTVM can be used in any convenient location. Just remember that the common black test lead is connected to the aluminum cabinet. If you connect this lead to the hot side of the power line (as in an *ac-dc* receiver) and the cabinet is grounded—something has to give. The rubber feet on the cabinet are not adequate to give good insulation. In doubtful locations, sit the VTVM on a piece of dry wood, a piece of flat plastic, or a magazine.

Anyone with the ability to read and understand simple, well-written instructions can complete the Heathkit V-7A vacuum-tube voltmeter kit. The instructions are complete, without error, and are easy to follow. Some soldering experience and knowledge of the resistor color code will be helpful, as will enough previous electronic experience to be able to identify electronic components since all small parts are mixed together in one bag when received.

The completed instrument will be rugged and dependable and more than adequate for servicing "home-type" electronic equipment. You can say "I made it" with justifiable pride, and you can use it with confidence.

All parts supplied in Allied Radio's 83Y125 kit are shown in Fig. 7. The completed Knight-Kit VTVM (see page 123) was assembled from these components with a few simple tools, a soldering iron, and a few hours of spare time in only a few evenings. Instructions supplied with the kit are extremely complete and can be followed by even the greenest beginner. The resistors in the kit are supplied mounted on cards with their corresponding circuit designations, eliminating the need for using the color code to identify resistors, and thus greatly reducing the possibility of a wiring error resulting from the selection of a wrong part. The

Components furnished with the Knight-Kit 83Y125 VTVM kit. Note card-mounted resistors.

83Y125 kit is supplied with hook-up wires of different colors, cut to length. More than enough solder to complete the kit is furnished and enough cable is provided to make the test leads a full 4 ft. long.

All components furnished were of good quality; circuit-board wiring had a bright copper color and soldered easily. The circuit board was made of a translucent material, permitting viewing of the wiring or the component mounting position from either side of the board. An inspection lamp held on the opposite side of the board will show the wiring and components in silhouette, greatly simplifying possible troubleshooting. Most commercially built equipment has translucent circuit boards for this reason.

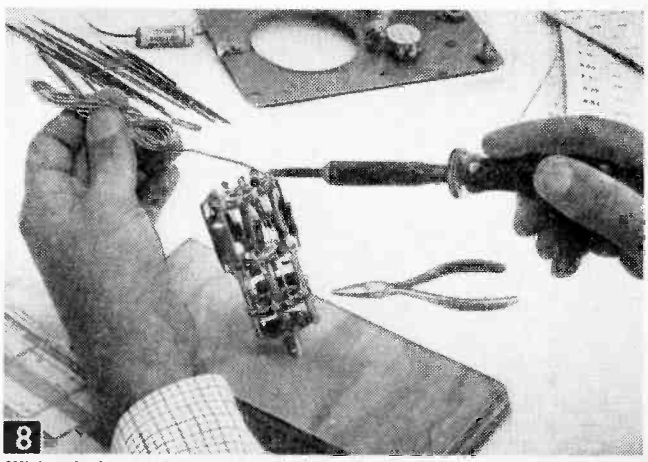
When you first unpack your VTVM kit, put the 1.5 *v.* battery aside and leave it there until final calibration has been completed. The battery terminal voltage may change if the battery is used in the ohmmeter circuit or accidentally shorted, even if only momentarily. Calibration accuracy of the *dc* voltage ranges is based on the assumption that the terminal voltage of this battery is 1.55 *v*. Any newly purchased, unused battery of the same type should have this terminal voltage.

The two switches supplied in the 83Y125 VTVM kit were more than adequate from an electrical viewpoint, but were stiff to turn. This can be attributed to the fact that the switches did not have a ball-type detent. *Sparse* lubrication with a light grease (even petroleum jelly) will keep friction at a minimum, however, and the stiffness will disappear somewhat in time.

All but one of the precision resistors supplied with this Knight-Kit had a varnish or plastic coating and were therefore not only protected from physical damage but made impervious to moisture, also. One resistor had only impregnated-paper protection. Tests made on precision resistors with impregnated paper protection (see Heathkit test results) showed that resistance values could change under high humidity and temperature conditions. You can eliminate such possible sources of inaccuracy by purchasing "coated" type 1% resistors as replacements, or you can partially slide the cardboard off the resistor. Slide the tube just far enough to clear the metal cap on one end of the resistor.

Pin jacks of the type supplied in the 83Y125 kit will, in time, lose their gripping power and the test leads will pull out of the jack under normal use. This can be somewhat prevented by using banana jacks. Also, the fiber washers used to insulate the pin jacks do not *look* like they would be capable of withstanding 1500 *v* under high humidity conditions (it is only fair to add, however, that the manufacturer states that they have never had a breakdown of these jacks). One way of eliminating the tip jacks would be to solder the test leads directly into the instrument. Put grommets in the panel holes and connect the test leads inside the panel. If you use the pin jacks as supplied, however, follow the installation instructions carefully to avoid the possibility of a short circuit.

The 83Y125 VTVM has a regular jeweled dial lamp that gives a positive indication when the VTVM is turned on, and meter scales have been planned for maximum visibility. Optical confusion is avoided by having alternate pairs of scales in black and red. The dial markings on the meter face are all clearly visible from the front of the instrument without any portion of the scales being hidden by the meter case. In addition, the lines and figures are dark enough and wide enough to be legible from several feet away, yet they are not so wide that they prevent accurate readings.



Wiring in last resistor on Range Switch with aid of scrap plywood jig.

Assembly instructions have been prepared with the beginner in mind.

The steps are presented in sequence designed to eliminate as many of the possible construction errors as possible.

In the instructions, you are instructed to insert the tubes in the sockets during construction of the circuit board. This apparently is done to prevent the beginner from accidentally filling the socket full of solder which would prevent insertion of the tube at a later time. The possibility of damaging the tubes, however, makes this procedure seem unwise. If you apply heat and solder only at the joint between the socket terminal and the circuit board wiring you cannot run solder into the socket.

Assembly of the Range Switch is somewhat of a construction headache—three hands are needed. In an attempt to help the builder, the instruction manual says to mount the switch on the front panel for wiring. There is considerable danger of scratching the front panel if you do this. Also, the switch is not held at a convenient angle.

Instead of using the panel, drill a ¼-in. hole at an angle of approximately 60° through the center of a ¾ x 5 x 9-in. thick piece of scrap wood and insert the shaft of the switch into the hole for support. The switch can then be easily worked on as shown in Fig. 8. The soldering iron shown in Fig. 8 is a Drake, 35-watt, "Pee Wee" Model 360, and is ideal for wiring the entire VTVM. The tip temperature can be controlled by sliding the tip in or out of the iron.

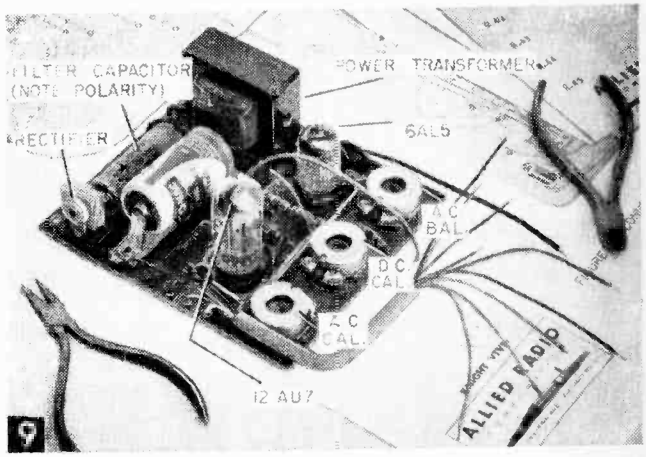
Mount the resistors on the Range Switch without excessive bending and pulling on the leads. The leads must not be under tension after the resistor is mounted. Position the resistors so they do not touch each other or any part of the Range Switch or the shaft through the center of the switch. Rotate the shaft to be sure of clearance in all positions. Position the resistors so the values can be easily read.

When preparing the nine-wire color coded cable be sure not to cut the wires too short—a little long is far better than too short.

After all parts have been mounted on the circuit board as shown in Fig. 9, clean off the foil side of the board to remove all traces of soldering flux by wiping it off with a clean cloth dipped lightly in acetone or alcohol. The two tubes and the battery are shown in place in Fig. 9 but you are urged not to install these parts until later.

Covering the foil side of the board with an insulating varnish or equivalent plastic coating will increase instrument dependability and life. Pressurized spray-cans are available through radio parts distributors.

As instructed in the manual, when mounting the circuit board, cut one spacer to a length of 1¼ in. and leave the other three their original length of 1⅜ in. Use the shortened spacer over the meter mounting screw on which the line cord cable clamp is mounted (see Fig. 10), thus preventing unnecessary strain on the circuit board, and also making an electrical contact between the front panel and the circuit board wiring. If you have sprayed your circuit board with an insulated coating be sure to remove enough of the coating to insure a good contact for the shortened spacer. An ink eraser will remove the coating without damaging the foil on the circuit board.



Completed circuit board ready for mounting.

The instructions with the kit say to coat the foil pattern with solder in the contact area of the shortened spacer.

You can crack or break your meter case by overtightening the four mounting nuts for the meter. Tighten the nuts just enough to hold the meter firmly in place.

To calibrate the instrument, first provide a support that will hold the panel upright in the normal operating position. Make the support out of dry wood so that the panel is insulated if on a metal surface and use an insulated screwdriver. Do not touch the metal panel when calibrating the *ac* ranges.

Set the meter movement to zero by rotating the adjusting screw clockwise until the meter pointer is moving downscale toward zero and stop when you reach zero. If you overshoot, keep rotating clockwise and again approach the zero from the high side of the scale and stop on zero without overshoot.

When the instrument is operating you should be able to set the meter to zero with the ZERO ADJ. control set to the approximate center of the control adjustment range. If this setting can be obained only with the control at or near one end, the two triode sections of the 12AU7 are probably unbalanced. The tube is *not* defective and the meter can be calibrated and used with good results. If you have a selection of 12AU7 tubes, pick one that will permit setting the meter to center scale with the Selector Switch in either the D.C.− or the D.C.+ position.

Make a rough initial calibration, install instrument in cabinet, reconnect power, and turn the VTVM on for at least 100 continuous hours to stabilize tube characteristics. (If and when you replace tubes, do this also. All new tubes should be "aged" thus whenever used in such applications.)

When making the final calibration, the instrument should be thoroughly warmed up and—if at all possible—a second voltmeter with a known or accurate calibration should be used as a reference. Your VTVM should then be adjusted to give the correct reading as determined by the reference voltmeter when connected to the same voltage source. If possible, check several scales and adjust the meter for a compromise calibration that gives the best accuracy on all the ranges checked. You should not include the 1.5- and 5-*v* *ac* ranges as they may have some inaccuracies that cannot be avoided.

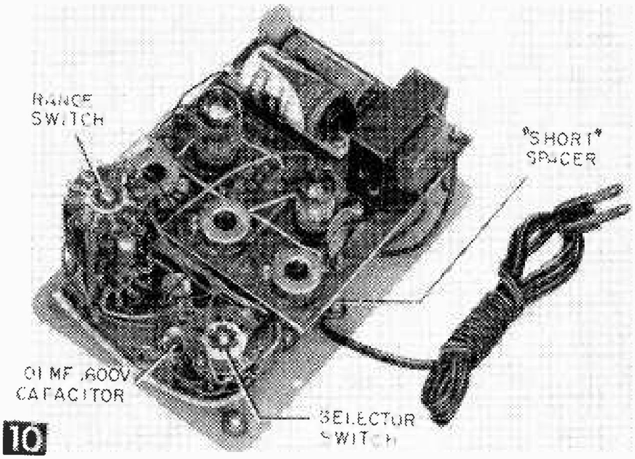
If a reference voltmeter is not available, use the calibration procedure given in the instruction manual. The procedure in the manual is accurate for the *dc* ranges since the battery voltage will probably be within 1% of 1.55 volts. The accuracy of the *ac* calibration will depend upon how close the line voltage is to 117 *v* at the time you calibrate your VTVM. This voltage could very easily be ±5% or ±10% from 117 *v* at the time, automatically introducing a corresponding error in your voltmeter *ac* calibration.

Do *not* attempt calibration of the 83Y125 VTVM kit *ac* voltage ranges by measuring the secondary voltage of the power transformer in the manner described in the manual as this may introduce additional calibration error. The transformer in the model tested 6 *v* when the line voltage was set exactly to 117 *v*. This represents an error of 2% with respect to full scale, or nearly 5% below 6.3 volts.

The completed 83Y125 VTVM kit was calibrated by following the instruction manual, with the exception that the *ac* ranges were calibrated by measuring the power line voltage which was assumed to be 117 volts. Instrument accuracy was then checked by means of laboratory equipment having a *dc* accuracy within 0.1% and an *ac* accuracy within 0.25%.

The *dc* readings were all high, but none were any higher than 1% with respect to full scale. This means that the *dc* portion of the VTVM can be recalibrated to provide a between-scale accuracy of ±0.5% of full scale. However, a tracking error of 1% with respect to full scale was found between equally spaced readings taken from one end of a scale to the other. This means that the maximum over-all *dc* accuracy of the test model was ±1.5% with respect to full scale. Error between the D.C.− and the D.C.+ positions of the function Selector Switch was found to be negligible.

Line voltage was increased to 125 *v* and decreased to 105 *v*. The ZERO ADJ. control was readjusted after each change and the VTVM became stable as indicated by a steady position of the meter pointer. The maximum error introduced by this extreme test was only approximately ±2%. No published specifications for this test exist, but results obtained were far better than expected—and since line voltages rarely vary this much, it is permissible to neglect any error due to line voltage fluctuations when using your Knight-Kit 83Y125 VTVM. The 83Y125 VTVM model easily passed the *dc* accuracy test since published specifications are ±3% of full scale and an over-all accuracy of ±1.5% was obtained by test.

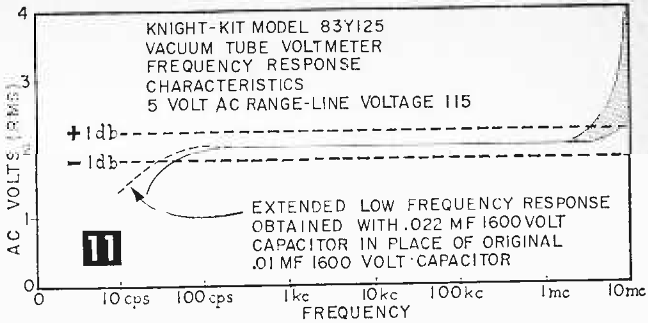


Completed 83Y125 VTVM ready for cabinet installation. Unit is compact, yet all components—except dial lamp—are accessible.

The accuracy of the *ac* calibration was checked at a frequency of 400 cps *and* was found to be ±5.5% of full scale on the upper five ranges. The error between any two of the upper five *ac* ranges was not more than ±2.5% with respect to full scale. There was also a ±3% tracking error with respect to full scale, resulting in an over-all *ac* accuracy of ±5.5%, but this is still, more than adequate.

Results obtained when the frequency response of the 5-volt *ac* range was checked are shown in the graph of Fig. 11. High-frequency response varied, depending upon the position of the test leads, but usually fell within the shaded area at the upper end of the graph. The response obtained was much wider than expected and was within ±1 *db* from approximately 40 *cps* to 4 *mc*.

In most applications, voltmeters of this type are seldom used at frequencies above approximately 20 kc which means that the high frequency response is much higher than necessary. Though the approximate error of 6% at the power line frequency of 60 *cps* seems excessive, it can be very easily reduced by replacing the .01 *mfd*, 1600-*v* capacitor between terminal 9 of the Selector Switch and terminal 6 of the Range Switch with a .022 *mfd*, 1600-*v* capacitor. With this change, frequency response was lowered by nearly an octave and the error at 60 *cps* was reduced to approximately 2%. This is shown by the dotted line on the low frequency end of the response curve in Fig. 11. You are urged to make this parts substitution during construction. There is room for a Sprague "Black Beauty" 0.022 *mfd*, 1600-*v* capacitor in place of the capacitor supplied with the kit.



Ohmmeter ranges were checked with these results:

CORRECT VALUE IN OHMS	83Y125 INDICATION	ERROR IN OHMS	ERROR PERCENT
10	10.1	0.1	−1.0%
100	101	1	−1.0%
1,000	1,005	5	−0.5%
10,000	10,000	0.0	NONE
100,000	101,000	1,000	−1.0%
1,000,000	1,010,000	10,000	−1.0%
10,000,000	10,200,000	200,000	−2.0%

As with the Heathkit, two statements appearing in the instruction manual may confuse students of mathematics and electronics. One statement is in the form of a chart showing adjacent voltage ranges as being 10 *db* apart. This chart is correct only if you wish to neglect a .5 *db* error. Two scales of any voltmeter are 10 *db* apart when the ratio between the two readings obtained with the meter needle in any position is 3.16 or 0.316 to 1. Under these conditions, 9.5 on the 15-*v* scale or 95 on the 150-*v* scale will be opposite 30 on the 50-*v* scale.

The scales in the 83Y125 VTVM are arranged so that 9 on the 15-*v* scale is opposite 30 on the 50-*v* scale. This is a ratio of 3.33 or 0.30, which can be expressed as 9.5 *db*. Alternate scales are 20 *db* apart as stated in the instruction manual. A corrected chart to take place of the one in the manual is:

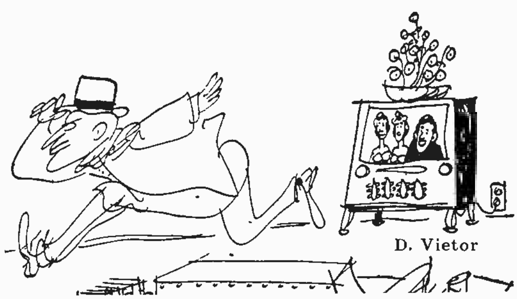
VOLTAGE SCALE	DECIBEL SCALE	DIFFERENCE
0-1.5 VOLTS	READ DB DIRECTLY	
		10.5 DB
0-5 VOLTS	ADD 10.5 DB TO READING	
		9.5 DB
0-15 VOLTS	ADD 20.0 DB TO READING	
		10.5 DB
0-50 VOLTS	ADD 30.5 DB TO READING	
		9.5 DB
0-150 VOLTS	ADD 40.0 DB TO READING	
		10.5 DB
0-500 VOLTS	ADD 50.5 DB TO READING	
		9.5 DB
0-1500 VOLTS	ADD 60.0 DB TO READING	

The second confusing statement is in the circuit description where the 6AL5 tube is said to act as a full-wave rectifier for *ac* voltage measurements. For a discussion of this, see the Heathkit test report discussion of a similar statement in Heathkit's instruction manual.

The Knight-Kit 83Y125 VTVM can be used in any convenient location. Just remember that the common black test lead is connected to the steel cabinet. If you connect this lead to the hot side of the power line as in an *ac-dc* receiver and the VTVM cabinet is grounded—poof! there goes a fuse. Sit the VTVM on an insulated surface (a dry piece of wood or a ¼-in. piece of plastic or even a copy of the *Radio-TV Experimenter*) when making connections to the power line for voltage measurement purposes. Be sure the *ac* power is disconnected from the device to which you connect your VTVM leads when you make the actual connections. Do *not* touch the VTVM cabinet or the common test lead after connecting the device under test to the power line. Remember—if in doubt, insulate.

The Knight-Kit 83Y125 VTVM has a 2.2-ohm resistor in series with the parallel connected tube heaters. This resistor adds to instrument stability, reliability, and accuracy. Tube life is extended by the reduced heater voltage, tube performance will be more consistent over a longer period of time because of it, and the VTVM remains in calibration longer.

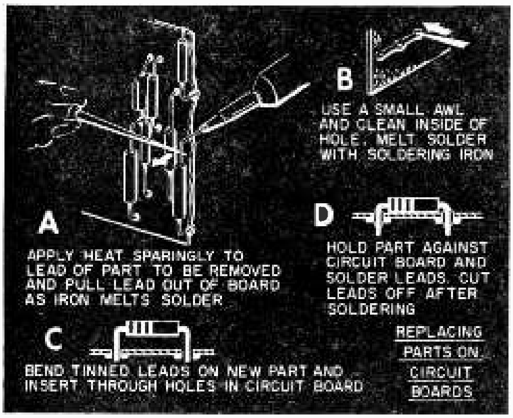
Any serious beginner with the ability to read the extremely simple instructions can complete the 83Y125 kit. It is complete in every detail, including detailed, illustrated instructions on how to solder. Absolutely nothing extra is required other than tools. The completed instrument will be more than adequate for servicing electronic equipment found in the average home and the instrument is rugged.



". . . and, while they last, these two beautiful mnphrph are included with every box of Trucut blades!"

Repairing Circuit Boards

By MILO A. ADLER



MANY home receivers for AM, FM, and TV, as well as numerous electronic construction kits utilize a circuit board for much of their wiring. The circuit board is a sheet of insulating material on which parts are mounted and connected by means of wires that are nothing but thin copper foil bonded to the circuit board. The bond between the etched wires and the circuit board will last indefinitely under normal use. But excessive heat or pressure can break the bond, and occasionally a circuit component will fail and cause a short circuit which can then burn out the copper coil wiring.

There is no mystery about the repair of these circuit boards. Repair is simple.

First, the soldering iron used should be no larger than 50 watts and all soldering operations should be performed as quickly as possible. Rosin flux can be used but such flux should be completely removed following the soldering operation. Use a cloth (or a short stiff brush with fiber or hair bristles) moistened with acetone or alcohol to wipe the flux off of the board.

Second, when mounting components, bend their leads so that they slide easily through the mounting holes. Press components firmly against the circuit board before soldering on the reverse side. Apply the soldering iron to the lead of the part, rather than to the etched wiring itself. Tin component leads before mounting to reduce the possibility of damage from heat as the joint is made. Cut off excess lead length after soldering.

Third, cover all newly soldered connections on the circuit board with a good insulating varnish or equivalent preparation. Pressurized cans containing acrylic spray-on plastic insulation are available from radio parts distributors and are ideal for this purpose. Do not, however, allow this insulation to enter controls or get on switch contacts.

A broken or burned-out section of a foil-type wire can be repaired or replaced by soldering a length of copper wire *over* the damaged section. Overlap the wire onto the undamaged portion of the foil for about ½ in. if possible. Use pre-tinned wire with a dia. less than the width of the foil wire. A short section of wire from a capacitor or resistor lead is ideal for use for this method of repair.

Sometimes, the foil wires of a circuit board will partially raise up off the board. Cement such wires in place with a quick-drying acetate base cement such as *Duco* which has good insulating qualities when dry.

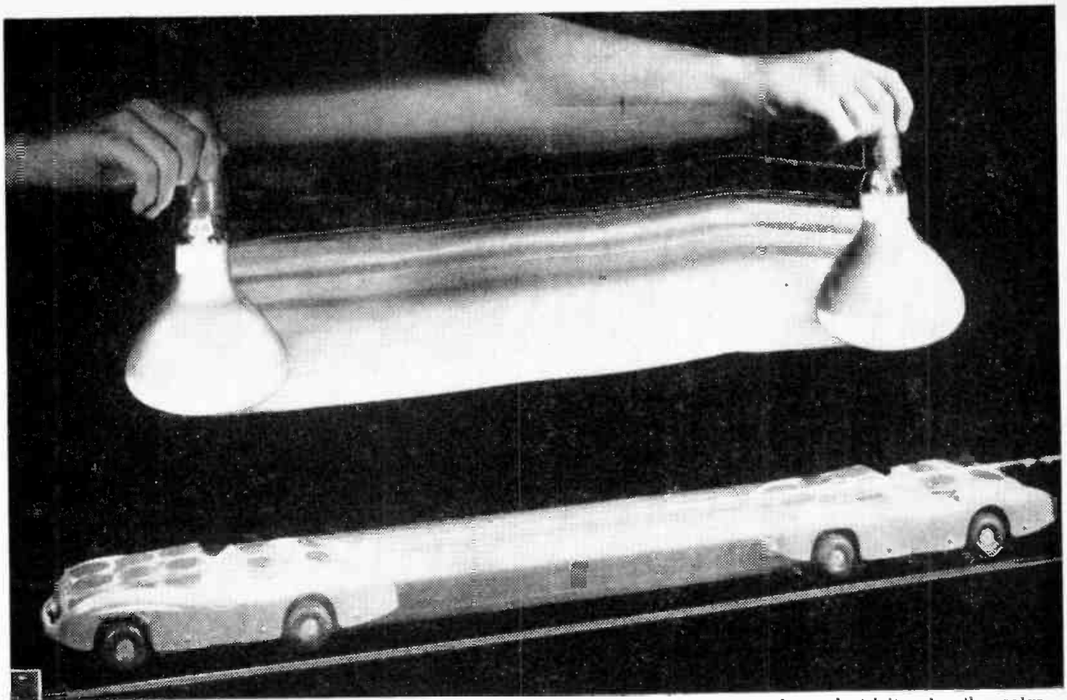
Components are usually soldered to small round tabs on the foil side of the board. Should one of these tabs become loose or broken, repair it immediately. Hold component on opposite side of board, apply soldering iron to melt solder, and press and hold the tab against board with any convenient tool until the solder sets (after removal of soldering iron). A tab can be replaced by forming a small loop in the end of a short, bare wire and then soldering the loop to the foil wires in place of the missing tab.

Components can be replaced by simply unsoldering and discarding the defective component (apply heat sparingly to lead and pull from board as iron melts solder), cleaning the mounting holes, and soldering in the replacement. Clean out holes by melting the solder and thrusting a small awl through the hole while the solder is still melted.

Tube sockets can be replaced by prying the socket up by each socket pin in succession and momentarily melting the solder on the reverse side of the board. You will have to go around the socket several times before the socket is free of the board. (Some sockets are mounted in such a manner, however, that each terminal can be loosened from the circuit board in only one operation.) Clean socket mounting holes with an awl, insert new socket, press firmly in place, and solder.

REPAIR REMINDERS

- **DO NOT push or pull on attaching wires in a way that will raise the foil wiring from the board.**
- **DO NOT use a soldering iron larger than 50 watts.**
- **DO clean holes to receive wire leads without force.**
- **DO pre-tin wire leads so connections can be soldered quickly.**
- **DO clean off rosin flux residue after soldering.**
- **DO NOT use any type of paste or acid soldering flux.**

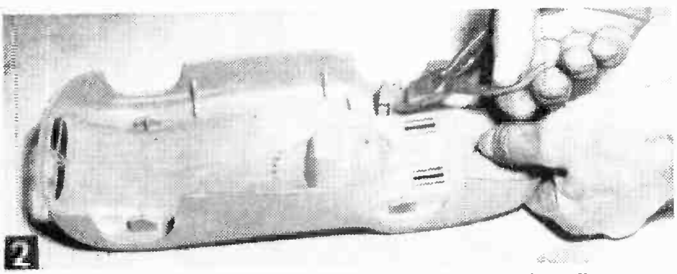


Light from 300-watt, reflector-type bulb used as a substitute for sun, is converted to electricity—by the solar cells on top of the car and used to drive electric motor to propel the car.

Solar Powered Car

New low-cost, silicon cell sun batteries supply all the current needed to power this electric-motor driven toy car

By HAROLD P. STRAND



Clip off original axle supports with a diagonal cutting pliers.

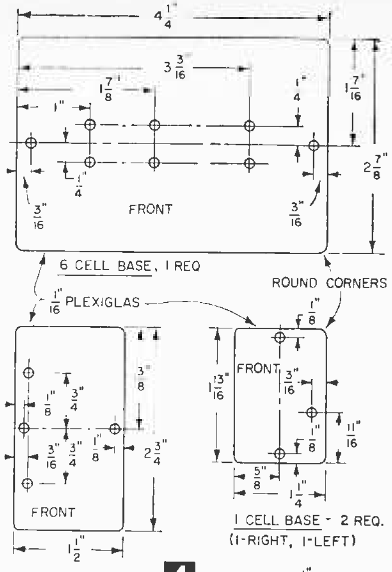
WHEN one considers the rapid advancement of scientific discoveries and developments in recent years it is not too difficult to imagine this little solar powered car as the vanguard of the future full-size car.

When sunlight, or light from a 300-watt electric-light bulb, strikes the silicon solar cells mounted on top of the toy car (Fig. 1), 11-13% of the light received is converted into electricity which powers a tiny electric motor. The motor drives the rear wheels through a gear train made of discarded clock gears. Theoretically this little car should operate indefinitely without replacing or recharging any batteries. All that's required is the free energy from the sun.

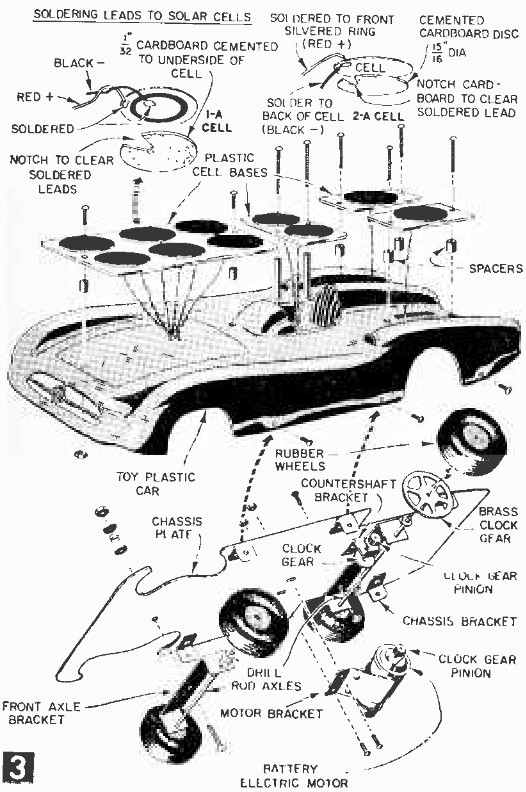
Solar Battery. After purchasing the parts called for in the Materials List, prepare the toy car for the installation of the solar cells by removing the wheels and axles and cutting off the plastic axle supports as in Fig. 2. Set the car body aside for the present and start soldering wire leads to the solar cells. On the 1-A cells, a silvered ring will be found around the underside edge of the cells and a silvered circle at the center. The ring is the positive or plus side and the center circle the negative pole of the cell. Use twenty 4-5-in. lengths of #28 gage Alpha red and black plastic covered wire for the leads. Bare the ends ⅛ in. and tin with solder. Then solder the red leads to the ring and the black leads to the center circle of the cells as in Fig. 3A. If the 2-A cells are used, solder the black lead to the back of the cell and the red lead to the silver ring on the front of the cell as in Fig. 3B. Since the cells are sensitive to heat,

MATERIALS LIST—SOLAR-POWERED CAR

Amount	Description
1	toy plastic car, U. S. Plastic Company make, Mercedes Race car model, blue finish, Approx. 11" long, 4" wide. Try toy stores or write to Standard Toy Co., 777 Washington St., Dorchester, Mass., $0.79 each plus $1.00 handling and postage in U.S.
1	battery electric motor, Aristo-Rev #2 model. Hobby shops or write to Crosby Hobby Center, 1704-A Massachusetts Ave., Cambridge, Mass., $3.50 P.P. in U.S.
10	Hoffman silicon solar cells, Type 1-A, $3.50 each P.P. in U.S. Durrell Distributors, Inc., 222 Mystic Avenue, Medford, Mass. If 1-A cells are not available, use type 2-A cells.
1	30-foot spool of #28 Alpha #407-A plastic covered sub-miniature wire, black. About 39¢ a spool at electronic supply houses.
1	30-foot spool of #28 Alpha #407-A plastic covered sub-miniature wire, red.
4	rubber wheels for models commonly sold in hobby shops. Perfect #64, 1½". 39¢ a pair.
2 pcs	drill rod .098-.100" dia. about 4" long. Cut to length for axles. Sold in hobby shops in 3-ft. lengths.
1 pc	half-hard or harder aluminum alloy about .035-.040" x 4" x 10" for chassis plate.
1 pc	soft aluminum about .040" x ½" x 7" for chassis brackets.
1 pc	soft sheet aluminum about .035-.040" x 1⅜" x 6" for motor bracket.
2 pcs	sheet brass about .035" x ⅝" x 4½" for axle brackets.
1 pc	sheet brass about .035" x 5/16" x 2" for countershaft bracket.
1	brass clock gear about 1 3/16" diameter, 52 teeth, with hub which can be bored out to fit tightly on rear axle.
1	brass or steel clock gear pinion, 10 teeth to match teeth on large gear mounted on axle.
1	brass clock gear about ⅝" dia., 32 teeth with hub which can be bored out to fit tightly on countershaft.
1	brass or steel clock gear pinion, 12 teeth, to match teeth on ⅝" dia. gear.
1 pc	steel drill rod about .080" dia. x ⅝". Countershaft. Clock gears can usually be picked up at clock repair shops.
1 pc	clear Lucite or Plexiglas 1/16" x 3" x 8" for solar cell bases.
1 pc	⅛" I.D. x 4" long Bakelite, fiber or aluminum tubing for cell base spacers.
14	4-40 x ¼" rh. screws with nuts and washers.
7	4-40 x ⅝" rh. screws with nuts and washers.
2	4-40 x 1¼" rh. screws with nuts and washers. Pliobond cement, spaghetti tubing, etc.



4 ALL HOLES, 1/8" DIA.



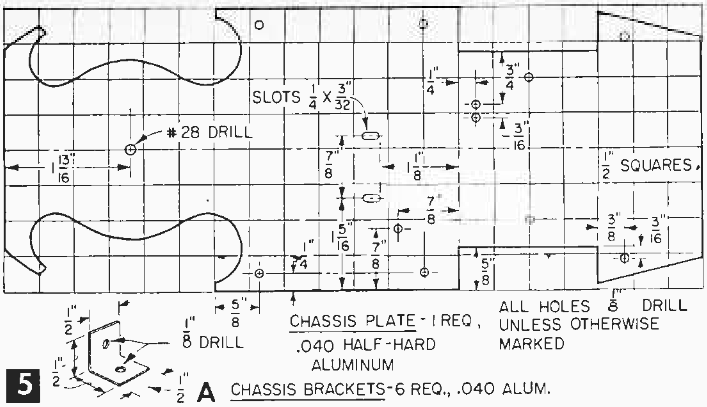
3

use an Ungar soldering pencil at full heat and apply to cell just long enough to have the solder flow. Then quickly remove and cool cell by blowing on it. Extreme care must be used when handling these cells since they are very brittle and break easily. Twist leads together to identify wires from each cell.

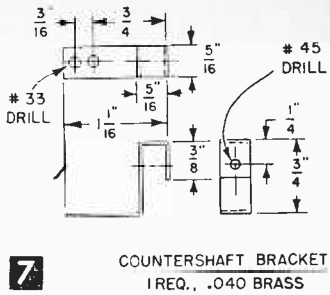
Make the battery cell bases of clear plastic as in Fig. 4, and cut 10 discs from 1/32-in. thick cardboard the same diameter as the cells (Fig. 3A). Then make V-shaped cutouts in the discs to provide clearance for the soldered leads and fasten the discs to the underside of the cells with Pliobond cement. Continue assembly of solar battery by running cell leads through holes in plastic bases and cementing cells to bases. Mount the assembled batteries to the top of the car body with 4-40 screws and tubular spacers as in Fig. 3. Insert cell leads through holes drilled in car body.

Car Chassis. Lay out the chassis plate from dimensions given in Fig. 5 directly on the aluminum it is to be cut from. This material can be cut with a household scissors. Make the mounting brackets (Fig. 5A), from the same material and bolt them to the chassis plate as in Fig. 3.

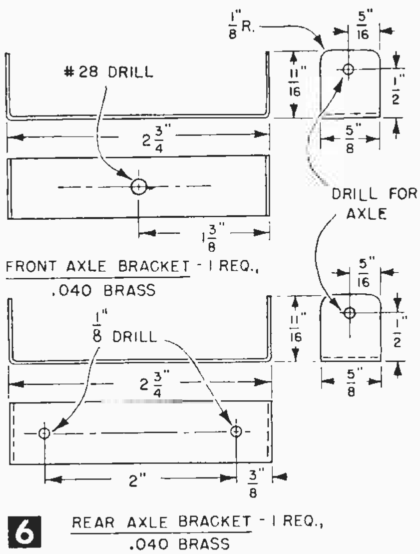
Since different wheels are to be put on the car, new axles and axle brackets are needed. Make the brackets as in Fig. 6 and determine the size of the drill for boring the axle holes by measuring the axles. The axles should turn freely but without excessive looseness. If the drill rod you purchase for the axles is hardened, it cannot be cut with a hacksaw, so grind off the length needed by holding it against the corner of an abrasive wheel. Then dress the ends square. Redrill the wheels for a press-fit on the axles. Carefully center these holes.



5 CHASSIS PLATE - 1 REQ., .040 HALF-HARD ALUMINUM
CHASSIS BRACKETS-6 REQ., .040 ALUM.

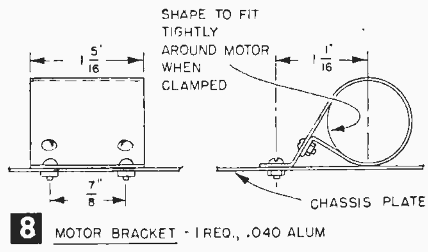


7 COUNTERSHAFT BRACKET 1 REQ., .040 BRASS



FRONT AXLE BRACKET - 1 REQ., .040 BRASS

6 REAR AXLE BRACKET - 1 REQ., .040 BRASS



8 MOTOR BRACKET - 1 REQ., .040 ALUM

Assemble the wheels and axle on the axle brackets using several very small washers (available at hobby shops) between the wheels and brackets to keep the tires from rubbing against the brackets. Before pressing the left rear wheel on the axle, redrill a 52 tooth, 1-3/16-in. dia. brass clock gear for a press fit with the axle and assemble with a washer between axle bracket and gear. Use several washers between the gear and wheel to hold the tire about 1/32 in. from the gear. Then fasten the rear axle assembly to the chassis with two 4-40 screws and the front axle assembly with one screw. Use a small lock washer between two plain washers to provide tension on this screw so that the front axle can be set to have the car run in a circle. Use two nuts locked together or peen the end of this screw to prevent loosening.

The countershaft (Fig. 3) is next, and for this you will need a 10-tooth pinion gear that will mesh with the 52-tooth gear on the rear axle and a 32-tooth, 5/8-in. dia. gear to mesh with a 12-tooth pinion on the motor shaft. Old spring-wound alarm clocks are the best source for these gears. Make the countershaft bracket as in Fig. 7. Drill the 10- and 32-tooth gears for a press-fit on a 5/8-in. length of .080-in. dia. drill rod. If the holes in the gears are larger than .080 in., use a heavier drill rod for a countershaft. Assemble the gears on each side of the bracket as in Fig. 3.

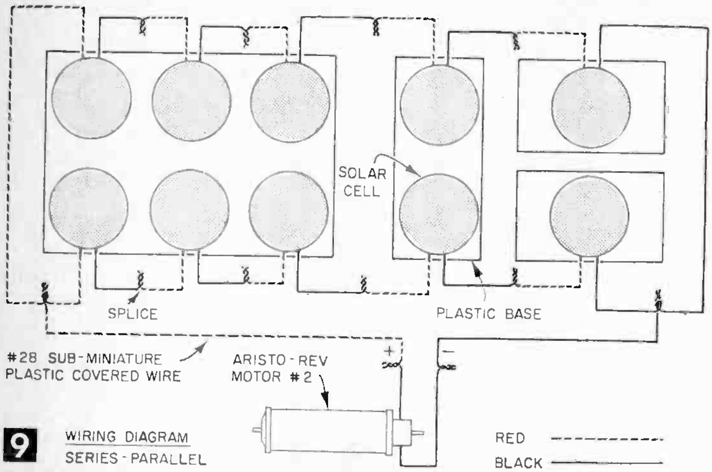
Then, holding the bracket on the chassis plate with the 10-tooth pinion engaged with the gear on the rear axle, mark and drill mounting holes in the chassis plate. Elongate these holes in the plate slightly so that the countershaft bracket can be adjusted to prevent the gears from binding.

Next, redrill the 12-tooth pinion gear for a press-fit on the motor shaft and force it on the end of the motor shaft opposite the commutator. Make up the motor mounting bracket as in Fig. 8. Then, after fastening the motor in the bracket, hold it on the chassis plate with the motor pinion gear engaged with the large countershaft gear and mark the location of the mounting bolt holes. Drill and elongate these holes for gear adjustment as you did for the countershaft. When assembling the motor to the chassis plate, adjust both the motor and countershaft brackets so that when the rear wheels are spun with your finger the entire gear train and motor continues to spin for about 5 seconds.

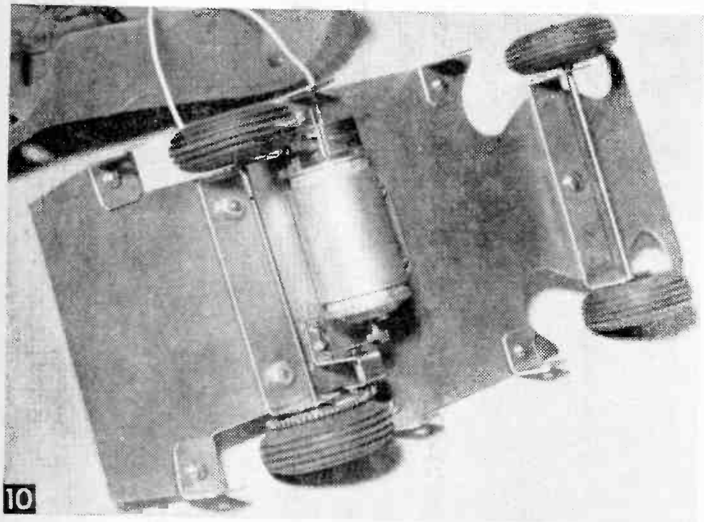
Insert the motor leads through a hole drilled in the chassis plate and prepare to hook up and solder the battery leads to one another and the motor. The solar cells are to be connected in *series-parallel,* with two groups of 5 cells each connected in series and then the two groups connected in parallel. Join the red lead to the black lead of another cell and so on to make up the two groups of 5 cells as in Fig. 9. Actually, you do not have to worry about lining up the leads to get 5 cells in a row on each side of the car. The 5 cells may be picked at random. After connecting the red and black leads together, you will have one red and black lead left over in each group. Connect these two reds together and splice on a red lead to go to the motor. Do the same with the two black leads.

Now, before permanently connecting these leads to the motor, make a test for motor rotation (Fig. 10). With bright sunshine or a 300-watt bulb shining on the solar cells, temporarily connect the leads to the motor and check to see if the rear wheels are turning in a forward direction. If not, simply reverse the leads. Then solder the connections and insulate all of the connections by slipping short lengths of spaghetti over them as in Fig. 11. Finally, assemble the chassis to the plastic car body with 4-40 screws through the 6 chassis brackets to complete the project.

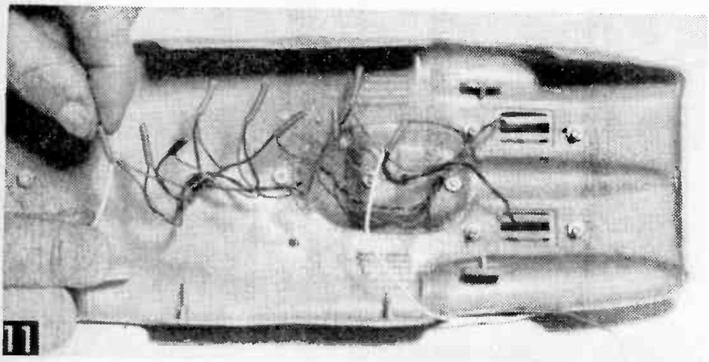
This little car should be operated on a smooth and level surface to reduce starting resistance to a minimum. All d-c motors require an excessive amount of current at the initial start because the armature is at rest and its resistance so low as to be practically a short circuit for the battery. With a solar battery, this results in a severe voltage drop at the starting period and with no reserve energy as you might have with a dry cell, car starting is handicapped to begin with and cannot overcome obstacles under the wheels. Once the car has started, however, the back e.m.f. developed in the armature results in a drop in the current requirements and the car runs along very well.



9 WIRING DIAGRAM SERIES-PARALLEL



10 Underside view of completed chassis. Test rotation of motor before assembling chassis to body.



11 Insulate soldered lead splices with short lengths of spaghetti tubing which must be forced over wires.

Extending Radio Battery Life

MANY portable battery-operated receivers tend to cease operation long before the batteries have terminated their useful life. This is usually due to the set's oscillator shutting off because of reduced voltages on the tube elements. By increasing the signal feed-back voltage however, the oscillator will continue operation even on reduced voltages. A few extra turns of wire added to the "tickler" winding of the oscillator coil will boost the feed-back enough to insure a longer battery life, and considerable saving in replacement dollars.
—John A. Comstock.

Powered-Phone Intercom

By HOMER L. DAVIDSON

HERE is a small intercom unit that is easily constructed with cabinet material taken from the scrap pile. It uses only two small transistors, two miniature transformers, two powered phones and a few capacitors and resistors. A DPDT push-type switch will switch either of the powered phones into operation when calling or listening.

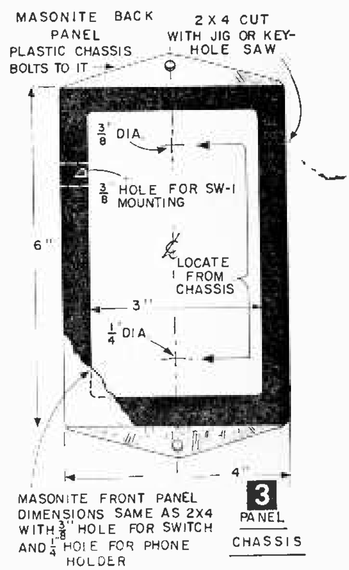
1

Small, rugged and inexpensive, this powered-phone intercom can be set up at any location, to any location in the house.

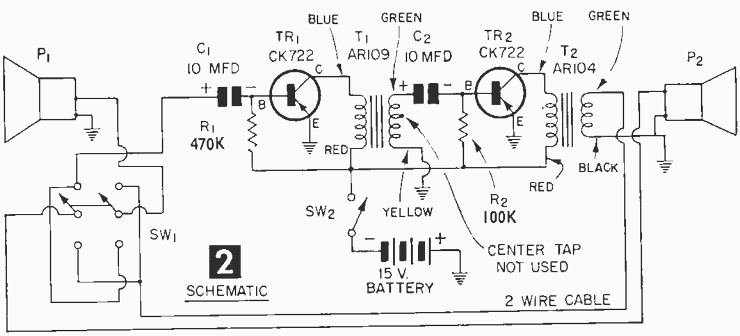
The circuit is very simple. A powered phone is switched through coupling capacitor C1 to the base connection of TR1 (see Fig. 2). Transistors TR1 and TR2 can be either CK722 Raytheon or 2N107 General Electric. The emitter connection of TR1 is grounded. R1 is a 470,000-ohm, ½ watt, base return resistor; a miniature coupling transformer, T1, couples TR1 and TR2—a second 10 *mfd* electrolytic capacitor is in series with this transformer to the base of TR2. T2 is a step-down transformer matching the impedance of the powered phone units. A small rotary SPST switch turns the intercom Off and On, the 15-*v*. battery is a Burgess transistor miniature battery.

The mounting chassis is a ¼ x 2 x 2½-in. strip of plastic. Circuit components are mounted on one side, all of the wiring is done on the other side. Drill small holes through the plastic so that all wire leads from the components can be pulled through and soldered on the opposite side. Solder transistors directly to their common components after soldering components together, thus eliminating extra heating of the connection and presenting damage to the transistors. (Another method is to hold a long nose pliers at the point of connection so that excess heat will be distributed to the metal pliers.) Complete all of the wiring on the plastic chassis and then solder connecting wires to the DPDT switch. Two small bolts hold the chassis securely to the rear panel; the remote phone, P2, is simply hung from a nail or screw by placing a stiff piece of wire into two small holes drilled into each side of it. P1 is suspended from the front of the intercom chassis with the same wire.

To test the unit, turn the SPST switch On. If P2 is placed within a few feet of P1, a feedback whistle should be heard. Now take the remote P2 outside or away from the master phone unit and talk into it. Talking can be heard 10 or 12 ft. from either phone unit. Each power-phone is used as a microphone to talk into and a speaker to listen to. You can hold either in the palm of your hand, speak, and easily be heard. There is no need for a volume control since volume is adequate up to 100 ft. of remote



3 PANEL CHASSIS



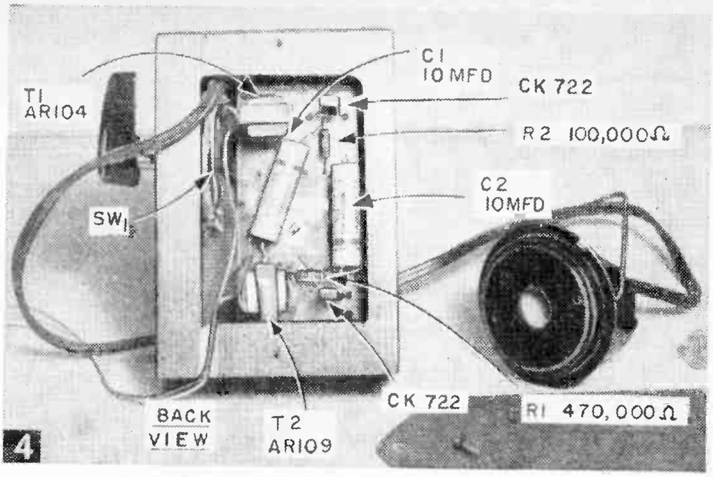
2 SCHEMATIC

MATERIALS LIST—POWERED PHONE INTERCOM

Desig.	Description
P1 & P2	powered phones (see text)
C1 & C2	10 mfd, 15-v electrolytic capacitor
R1	470,000-ohm, ½-watt resistor
R2	100,000-ohm, ½-watt resistor
TR1 & TR2	CK722 (see text)
T1	AR109 (Argonne or equivalent)
T2	AR104 (Argonne or equivalent)
SW1	DPST push-to-talk switch
SW2	rotary On-Off switch
BaH	15 v Burgess battery

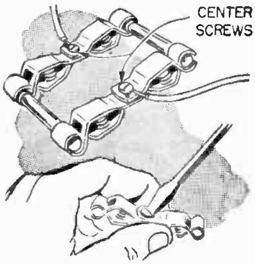
All parts available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y.

cable used. You can use this small powered-phone intercom anywhere in the house.



View of rear of unit (back panel removed) showing component placement on inner plastic panel.

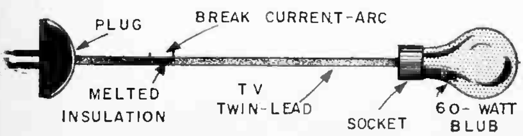
Improved Test Clips



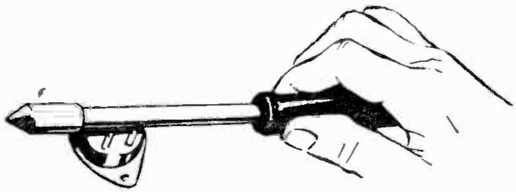
• Two test clips screwed together back-to-back work better for fast temporary connections than one ordinary clip. To fasten the clips together, clip off the wire support tips at the back of the clips, remove the screws and use just one common screw to fasten both clips together. Used in pairs, clips at one end connect to components and clips at other end connect to terminals or wires. By connecting wires to center screws and placing various components in the jaws of each clip, parts can be connected in parallel, increasing or reducing values to meet existing requirements.

Current Reveals Twin-Lead Break

• Often, broken wires in weathered television twin-lead are undetectable visually since they part *inside* the tough plastic insulation. Rather than discard such a line as unusable, try the hookup shown in the diagram, connecting one end of the lead-in to a bulb socket containing a 60-watt light bulb, the opposite end to a line plug. Now, plug the hookup momentarily into a convenient wall outlet. More often than not, current will bridge the gap between the broken wires and the heat produced will melt the insulation at the location of the break. Once the break is found, splice the lead-in in the usual way and the line will be serviceable once again.



Socket Is Hot Iron Rest

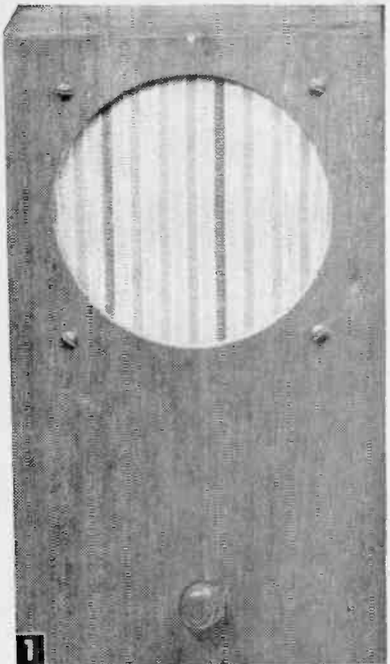


• If you've ever lost or misplaced the stand that came with your soldering iron when it was first purchased, you soon come to realize how handy the little gadget was, and wish that you could purchase another to take its place. Don't try, because you can't—that is, not without buying another soldering iron. But you can obtain a useful substitute from an old junked radio, or for about 12c from a radio parts supply store—a molded tube socket like that shown in drawing. The Bakelite base of such a socket makes an ideal heat insulator and if you obtain a four-pronged base, it's practically impossible for the iron to roll off the prongs and burn the bench top.—J.A.C.

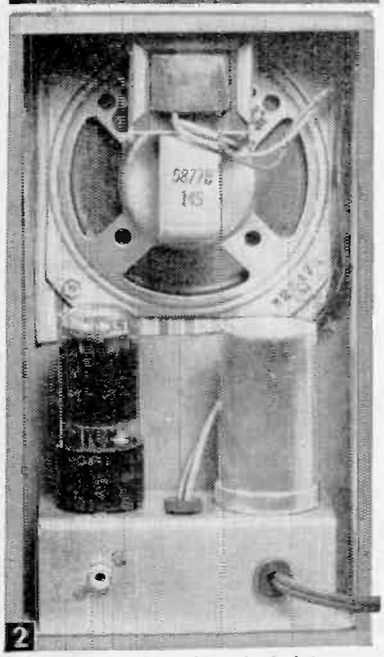
One-Tube Cigar-Box Amplifier

For low-cost convenience or as an extra amplifier for radio or record fans, try building this simply designed unit

BY THOMAS A. BLANCHARD

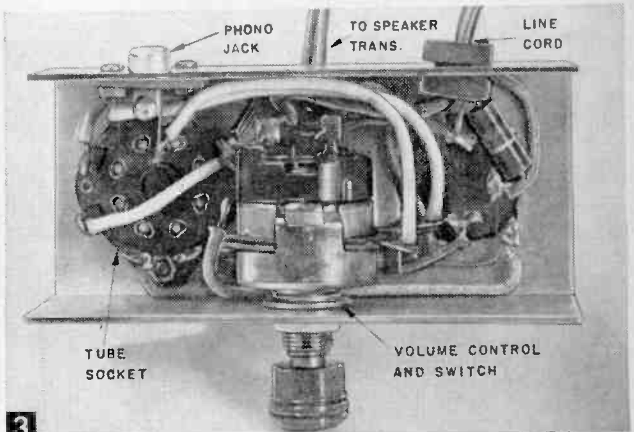


1



2

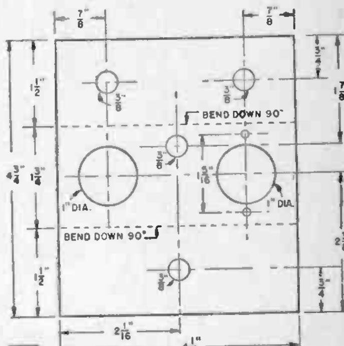
Above, utility amplifier built into converted cigar box makes a handy addition to the radio experimenter's work and test bench. Below, mounting 2500-ohm output transformer for PM speaker on speaker frame instead of chassis saves space and leaves amplifier section flexible for connecting to other remote speakers if desired.



3

Underside of chassis shows the few parts and simple wiring that make this amplifier easy to build.

A SMALL portable amplifier that requires a minimum of parts and time to assemble will be a handy addition to your radio experimenting workbench. You can use this 1-tube circuit for the "innards" of a child's phonograph with a high-output pick-up (2 to 4 volts) or radio tuner.



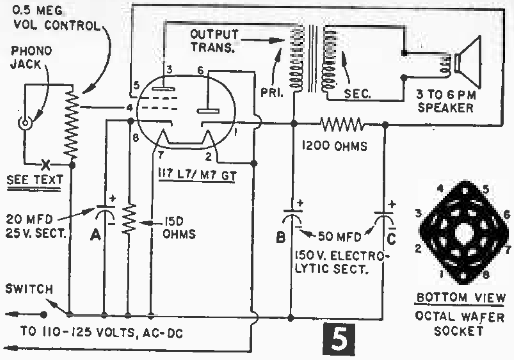
4 CHASSIS LAYOUT

The simplicity of the circuit is due to the single tube — a 117L7/-M7GT that is actually two tubes in one. Half of the tube is a beam power amplifier similar to a 50L6GT. The other half of the tube acts as a half-wave rectifier similar to a 35Z4GT. The tube's two series heaters require no voltage-drop resistor or stepdown transformer, but operate directly off the standard household 110-125-volt *ac-dc* power line.

The metal chassis is simply a 4⅛ x 4¾-in. piece of 16-gage (.050 in.) aluminum. Lay out and cut the holes with a hole saw or fly-cutter and bend to shape. To keep the number of parts to a minimum, a triple-section electrolytic filter capacitor mounts in one of the large holes. The second hole is for the tube. The two 50-*mfd*, 150-volt sections of the capacitor are connected into the *dc* filter circuit, while the third section (20 *mfd*, 25 volts) bypasses the cathode resistor. All positive capacitor sections terminate at insulated soldering lugs. The capacitor can forms a common negative for all three sections (shown as points A, B and C in the illustration, Fig. 5).

MATERIALS LIST—1-TUBE AMPLIFIER

1 pc. #16 gage aluminum (for chassis) 4⅛ x 4¾"
1 octal wafer socket; 1$\frac{5}{16}$ mtg. centers
1 C-D electrolytic capacitor, triple section (50-50 mfd., 150 v., 20 mfd., 25 v.) Type U.P., #5515C. Note: Constructor may substitute 20-20-20; 30-30-20, etc.
1 0.5 megohm volume control with switch
1 150 ohm, ½ watt resistor
1 1200 ohm, 1 watt resistor
1 phono jack (ICA, RCA) 1 4-in. PM speaker
1 output transformer (2500 ohm pri., 3-5 ohm sec.)
1 117L7/M7GT tube 1 6-ft. line cord & plug
Miscellaneous hardware, hook-up wire, rubber grommets
Suitable pickup cartridges for use with this unit are: Astatic L-72A, L-82A, L-12, L-12U, 15L3-AG and 16L3; or Shure W42N, W56A, or W56N.



5

To minimize wiring, the amplifier chassis forms the negative side of the circuit as a ground. While this arrangement leaves the chassis "hot", it is quite safe from shock when mounted in a wood or other non-metallic housing. Shock that might result from handling metal pick-up arm on a record player can be prevented by inserting a .05-*mfd* 200-volt paper capacitor at (X) in Fig. 5 and mounting the *phono jack* on a *Bakelite* disc. However, most modern pick-up arms are plastic. The only chance for a shock from touching chassis is when you're standing on a damp concrete floor or touching some grounded object.

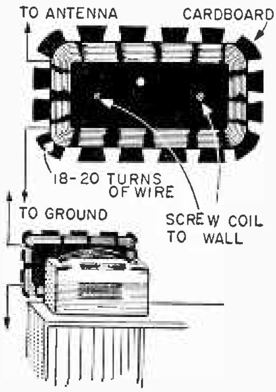
The completed amplifier was so small there was no commercial stock cabinet that would fit. I made the cabinet shown in Fig. 1 from a cigar box. Remove all the printing or decorative paper with a sanding disc mounted in a portable electric drill. Cut out the 3⅝-in. hole for speaker with a fly-cutter, coping or keyhole saw. After a fine sanding, apply two coats of white shellac, sanding after each coat is dry with 6/0 garnet paper. Apply paste wax and polish. Cement a disc of cloth to the back side of the speaker hole.

The cigar box cabinet takes a 4-in. PM speaker, but any size up to 12 in. may be used in a suitable baffled box with greater volume and improved tone quality. Since the amplifier is a complete unit, the speaker may be mounted separately from the amplifier. The output transformer for the speaker may be mounted directly on the speaker (brackets are usually provided).

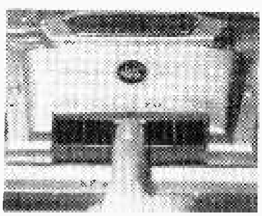
You can mount the amplifier in the cigar box cabinet with the threaded ⅜-in. bushing of the 0.5 megohm volume control. Bring out the two flexible leads from socket lugs #3 and #1 for connecting to the primary of the speaker transformer. Use rubber grommets on these two flexible leads and on the power line into the back of the chassis.

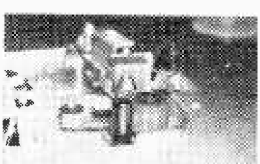
Antenna for Small Radio

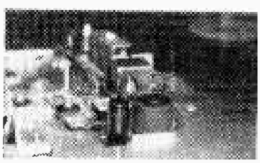
• If your miniature battery radio proves almost useless in your mountain cabin, try this simple method of increasing its range, which will also work equally well on *ac-dc* sets. If you are unable to obtain a loop antenna coil from a junked radio or a radio supply house, cut a piece of cardboard to shape shown in sketch. In basket weave fashion, wind on this form 18 or 20 turns of cotton-covered copper wire or bell wire. To one end of the coil connect an antenna wire 30 to 50 ft. long and at least 10 ft. from the ground. Connect the other end to a water pipe or a metal rod driven into damp ground. No connections are necessary to the set itself; simply screw the coil to the wall over a bookcase, table or shelf and place the radio close to it.—Fred W. Moorehead.



Tape Recorder Kink



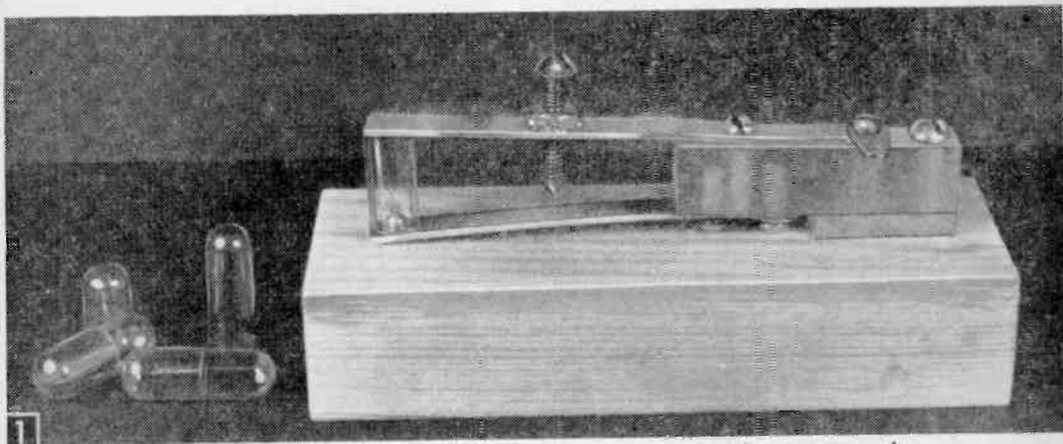




• If your tape recorder has a roller-release pushbutton marked "Stop" (as shown being depressed in top photo), it's a wise idea always to *leave* this button depressed when the recorder is standing idle. If you don't, the roller will develop a "bump" or depression in its surface from being tightly pressed against the round capstan (center photo). Such an irregularity in the roller's surface may cause undesirable flutter, wow, or thumping. When the stop button is depressed, the roller and capstan separate as shown in bottom photo.—John A. Comstock.

Low-Cost Fire Alarm Systems

These simple systems sound their alarms when a fire first starts, thus providing an opportunity to limit damage and even to save lives

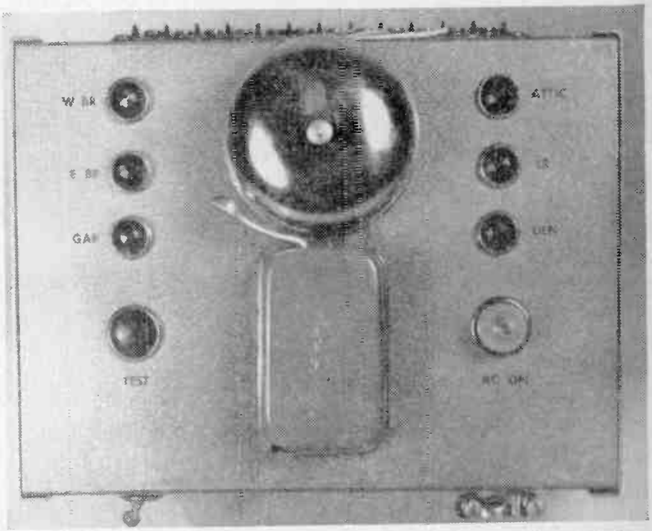


Sensor unit with capsule section in place, extra capsules at left, cover removed.

By W. F. GEPHART

WITH the exception of explosions, most damaging fires start small—and aren't discovered until they have gotten a good start. If they could be discovered when they first start, they could be extinguished easily. These systems will discover them early.

Their "heart" is a simple, homemade fire "sensor" (see Figs. 1 and 2). The control element in this sensor is an ordinary pharmaceutical capsule, which melts as heat increases and by doing so closes the electrical circuit which sounds the alarm. By using different sizes and thicknesses of capsule sections, and by adjusting the tension screw on the sensor, the closing temperature can be varied between 100° up to over 250° F.



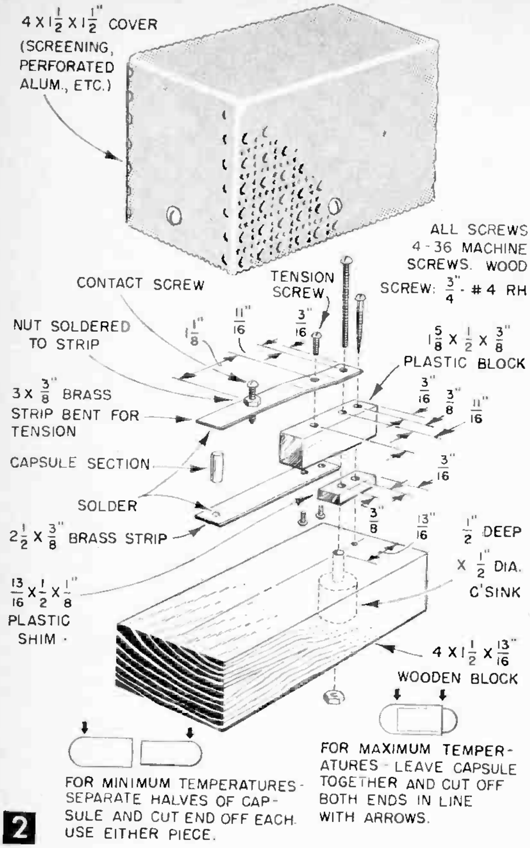
Front panel of indicating unit. Note Romax cable clamp lower right for power entry, SW1 lower left.

Construction details of the sensor unit are shown in Fig. 2. Basically, it consists of two strips of spring brass (#20 or #22 gauge), insulated from each other by a plastic block, and spread apart by a section of capsule. An adjustable contact is provided and —as the capsule collapses under heat—the spring brass strips move together until contact is made and the circuit closes. The bottom brass strip is held to the plastic block by two 4-36 machine screws threaded into the block, one of which has a solder lug under it for connection. The back 4-36 machine screw on the top strip goes through the plastic block and shim and wooden base to help fasten the assembly to the base; the top strip is kept in line with the bottom strip by a tension screw threaded into the plastic block.

Bend the top brass strip slightly (see Fig. 2), so that as the tension screw is tightened, the outer end of the strip will move down. Since the two strips are held apart by a capsule section, tightening the tension screw will cause the capsule to collapse more rapidly as heat increases.

Between the end of the upper strip and the plastic block, mount a contact screw in a nut soldered to the top of the strip. To insure good contact, grind the end of the screw to a point and, to maintain adjustment, "burr" the screw's threads so it is hard to turn.

A "glob" of solder at the end of each strip prevents the capsule section from slipping. To make



2

"globs," drip hot solder on a piece of glass, hardwood or other smooth, non-metallic surface, then tin ends of the brass strips and carefully lay globs in place. Cautiously heat opposite sides of strips until bottom of globs just *begin* to melt and they will stick in place without flattening out.

Pharmaceutical capsules come in several sizes and can be purchased at any drug store. The smallest size have the thinnest walls (and therefore collapse most rapidly under heat) and should only be used when the alarm is to sound at relatively low temperatures. The largest size, particularly when used double thickness, withstands very high temperatures when only light tension is used. A single section large capsule, with moderate tension and 1/16-in. contact clearance, will close the circuit at approximately 150°.

Make a sensor for each location to be guarded. The temperature set for may vary for different locations. In a basement, for example, it should be set for a low temperature (around 100°) since normal room temperatures do not get very high, while in an attic it should be set high, since summer room temperatures sometimes exceed 110°.

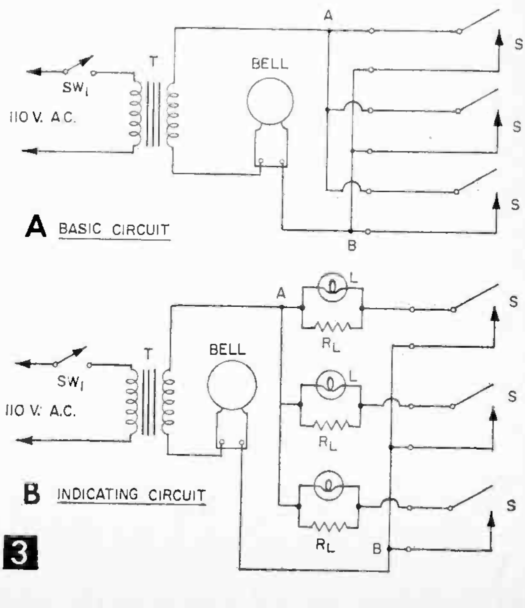
To set the sensors, connect them to the alarm unit (whose construction will be covered later) or to flashlight batteries and a bulb, and put the sensor in a large fruit juice can. Borrow your wife's candy or deep-frying thermometer (or buy one for 69c) and put it in the can beside the sensor, making sure the bulb of the thermometer does not touch the side of the can and that it is as near the capsule section as possible. Lay the can on its side and play a blow torch along it. Watch the air temperature as registered on the thermometer and set the sensor to the desired alarm temperature by adjusting the tension screw and contact distance so that the capsule melts at the desired temperature, ringing the alarm or lighting the bulb. If several tests have to be made, be sure to cool the brass strips with a damp cloth between tests. Since capsules are consistent in size and thickness, changing capsules will not affect the accuracy of adjustments.

If sensors are to be placed in bedrooms, living rooms, etc., appearance becomes important, and a cover should be made. Some sort of a cover (at least screen wire) should be provided in all cases to prevent mice from eating the gelatin capsule.

A perforated aluminum or extruded metal cover makes a neat and nice appearance. For dimensions, see Fig. 2. Whatever *is* used should provide a free flow of air through the unit and should be painted, if possible, to minimize heat reflection. For the same reason, the wood block and inside of the cover should be painted black to absorb heat.

Alarm Unit. There are several types of alarm circuits that can be used. Figure 3A shows the simplest circuit, all sensors wired in parallel, in series with a bell. This provides an alarm, but gives no indication which sensor has closed.

Figure 3B shows an "indicating" alarm. A pilot light indicates which sensor has closed when an alarm sounds; the bell does not necessarily have to be at the pilot-light box location. This type of circuit is particularly useful when some of the sensor locations are widely separated, as would

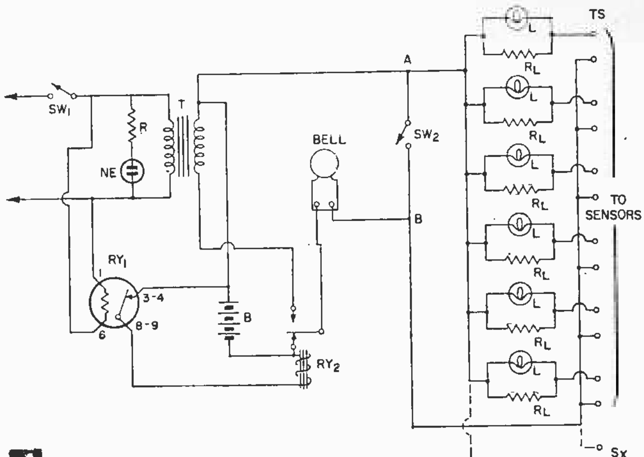


3

be the case with out-buildings on a farm, separate garages, etc.

Many fires, however, are started by defective electrical wiring which kindles a fire, and then blows the fuses, rendering the alarm units shown in Fig. 3 valueless, since power would be gone by the time the fire got hot enough to close the sensor switch. Figure 4 shows a complete alarm unit which provides for automatic power switch to battery in case of power failure.

A fast-acting, normally closed thermal relay (Ry1) is across the power line, and is held in the "open" position by line voltage. In this position, Ry2 is not energized and voltage from the transformer secondary operates the system. If the power fails,



4 AC - BATTERY INDICATING CIRCUIT

MATERIALS LIST—FIRE ALARMS

The following materials are required for all diagrams:

SW1	SPST toggle switch
T	Bell transformer, or 6.3 volt @ 1 amp. filament transformer (see text)
Bell	2½" or 3½" doorbell
S	Sensor units; one per location (see text)

The following additional materials are required for the units in Fig. 3B:

L	2.0 volt @ .06 amp. pilot light (GE #48 or #49)
RL	3.3 ohm 2 watt (with filament trans.) or 2.2 ohm 2 watt (with bell trans.)
	Pilot light holders

Further additional materials required for the unit shown in Fig. 4 are:

NE	Neon bulb (NE-51)
R	56,000 ohm ½ watt (if not included in NE holder)
Ry1	Thermostatic Delay relay, 115 volt, 2 second delay, normally closed (Amperite 115C2 or 115C2T)
Ry2	SPDT relay with coil sensitivity of 12 milliwatts or less (Sigma 5F-2500-S/SIL, Advance SO/1C/6500D, or any relay that will close on the current that 6 volts will send through its coil)
B	6 volt battery (Four flashlight batteries—see text)
SW2	SPST push button

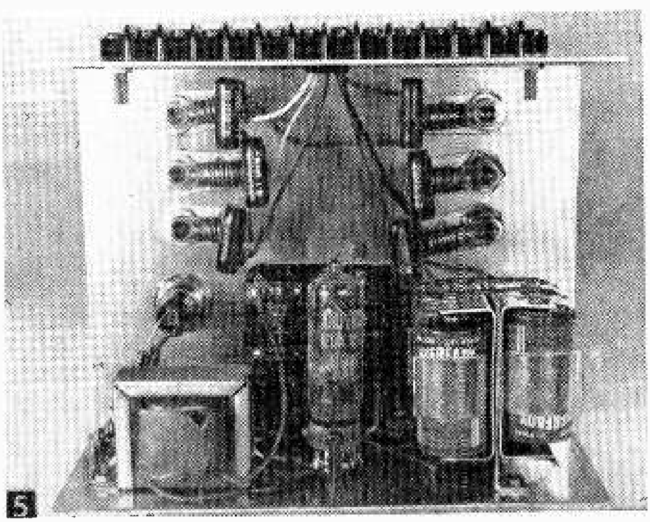
Socket for Ry1 (Octal for 115C2, 9-pin min. for 115C2T)
Optional: Battery clamps, terminal strip (Jones 140 series), screening, perforated aluminum (Reynolds), or extruded metal for sensor covers

Ry1 closes (after a few seconds), energizing Ry2, which connects the battery to the alarm system. When power is restored, Ry1 opens, de-energizing Ry2, and re-connecting the system to the transformer voltage.

This circuit has two other features that could be added to either of the two circuits shown in Fig. 3. One is a neon lamp across the primary of the transformer to indicate the presence of line voltage, the other is a test button (SW2) for testing the alarm unit by momentarily shorting the sensor circuits. The test feature can be added to the other circuits by connecting the push buttons to points "A" and "B" (Fig. 3), the neon lamp feature can be added by wiring across the primary of the transformer.

In the indicating circuit shown in Fig. 4, Ry1 is a continuous-duty relay and it, together with the neon bulb and transformer, consumes less than 3 watts. Operating expenses are therefore only a few cents a month. The sensitive plate-circuit relay (Ry2) in the battery circuit was used instead of an ordinary 6-*v* *dc* relay because of its low power consumption. It draws only a few *ma*, so battery operation is possible for many hours, even on the small flashlight batteries used. A cheaper, ordinary 6-*v* relay can be used if larger batteries are provided.

While the Materials List specifies either a 6.3-*v* filament transformer or a bell transformer, and specifies four flashlight batteries, use the bell transformer (with its higher output voltage) and add two additional flashlight batteries (to provide 9 *v*) if there are any long leads to sensors. Lamps and resistances would not have to be changed if higher battery



5

Back panel view of indicating unit schematicized in Fig. 4. Note "tube" relay (center), Jones terminal strip at top for sensor lead connections.

voltage is used, but resistances used will vary with the transformer used (see Materials List).

With either indicating circuit, it is unnecessary to have a pilot light with the sensor covering the room in which the pilot light box is located. If the alarm sounds and you go to the pilot-light box room to check location, you don't need a light to tell you the room is on fire. (Connect the sensor as shown by the "Sx" dotted connections).

Figure 5 is a photo of the alarm unit shown in Fig. 4. Since needs will vary depending upon how many sensors your home is equipped with, layout dimensions are not given. I mounted bell and batteries with the light indicators, although either or both could have been located elsewhere. In any case where line voltage is present, enclose components in a metal box to meet Underwriter's and local electrical codes.

Some of the parts shown in Fig. 5 were used because they were on hand or were less expensive than standard items. Jeweled pilot light holders need not be used (but were on hand); the lamp resistors were surplus items, as was the transformer, which actually gives about 7 *v*, not 6.3.

In setting up a system, the location of a sensor within a room or area should be on (or near) the ceiling, as near the center of the area as possible. Placing the sensor above (or in air-flow line with) a heating vent, radiator, stove, etc., may require too high an alarm temperature, and placing it too near a window may mean that it won't close (if cooled by air from the window) until the fire has gotten a good start. Keep in mind that the sensor operates due to heat. It should be located where it is unnatural for heat to build up, where only a fire can actuate it.

Once installed, the system should be tested at regular intervals. Each sensor capsule should be "burnt out" with a match to make sure the alarm sounds. If a test button is provided, the unit itself should be tested on *ac*, and (if battery is provided) on battery, by turning power switch SW1 to *Off*.

Capacitor Pops TV Pix Tube Short

• There's no need to discard a TV set's picture tube just because there's an internal short circuit between some of the inner elements. More often than not, the short is caused by conductive "dandruff" that has flaked off from one or more of the elements and can be removed easily with a charged electrolytic filter capacitor connected to the outer base pins.

Select a healthy capacitor with a high value of capacitance and a high voltage rating. (about 50 microfarads at 250 volts), and connect it momentarily to a *dc* source not exceeding the capacitor's voltage rating. (Be sure to observe polarity—plus to positive, minus to negative). Now connect the charged capacitor to the two element pins that are shorted internally. The current from the capacitor will flow through the internal short and burn it out with a loud pop and flash from the inside neck of the tube.—J.A.C.

It will only take me a minute to vacuum, dear!

Treating TV Tubes Like Eggs

• When transporting TV tubes to your local testing station, place them in an egg carton for carrying without danger of breakage. Attach a small piece of adhesive tape to each tube so that you can jot down its condition after checking.

Answer to Crossfigure, Page 91

(1) 1	6	0	0	■	(2) 3	(3) 1	0	■	(4) 0	0	(5) 1
7	■	■	■	(6) 1	0.	7	■	(7) 2	0	■	8
(8) 5	2	(9) 5	■	5	■	(10) 4	(11) 5	■	(12) 0	(13) 0	6
2	■	(14) 5	0	■	(15) 6	■	0	■	■	(16) 9	0
■	(17) 6	0	■	■	(18) 3	0	0	■	(19) 3	■	0
(20) 1	5	■	(21) 8	8	■	■	■	(22) 1	0	0	0
0	■	(23) 4	0	■	(24) 1	■	(25) 2	5	0	■	■
(26) 8	0	■	0	■	(27) 2	0	1	■	(28) 0	0	(29) 4
■	■	(30) 6	■	(31) 1	0	■	■	(32) 1	■	■	5
(33) 3	0	0	■	(34) 2	0	0	■	(35) 9	0	■	6
6	■	■	(36) 4	■	■	■	■	2	■	(37) 4	■
0	■	(38) 1	8	7	7	■	(39) 1	9	2	0	■

Finger-Clip Transistor Radio

Is It the World's Smallest?

SO SMALL is this radio, it fits easily on a ring clip on the finger. Granted it makes a large ring, but as a radio, it might qualify as the world's smallest transistor set. Complete with built-in power supply, it measures a mere 1⅛ in. square and ⅝ in. high. And, to make it even more interesting, it will operate on a simple, homemade "dry charge" battery using 1/10th cent worth of material, or it may be powered with a mercury cell scarcely larger than an aspirin tablet. Or the builder may, if he wishes, operate the set with a silicon *solar* cell.

All components used in building the ring radio are standard, with only the ferrite slug-tuned antenna coil modified, and the excess coil form cut off to fit the available space. Components are neatly and securely mounted to a 1 x 1-in. plastic chassis board, except, of course, the miniature magnetic hearing aid earphone. This makes for a neat wiring job, and the set can be removed from the tiny plastic box simply by removing the ¼ in. long, 3/48 flathead screw and nut, which hold chassis, ring band and case together.

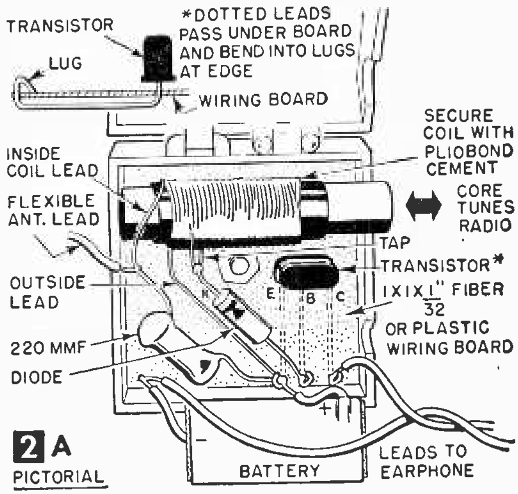
For the case, use a small plastic trinket box, such as is used to package fishing tackle, sewing notions, phono needles, etc. For the chassis, use 1/32-in. fiber or Bakelite (but not acetate, which would melt when making soldered connections). Draw a line from corner to corner of chassis to locate the center hole which is drilled to clear the 3/48 screw.

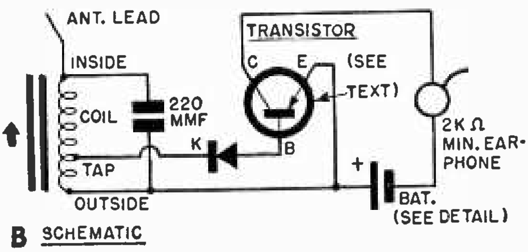
The coil in its original form is wound on a paper-base Bakelite form 2 in. long and ¼ in. diameter. First unscrew the core from the coil, then unsolder the coil leads terminated on the lugs. With a safety razor blade, cut off the excess portion of the coil form so that the remaining coil form is just ¾ in. long.

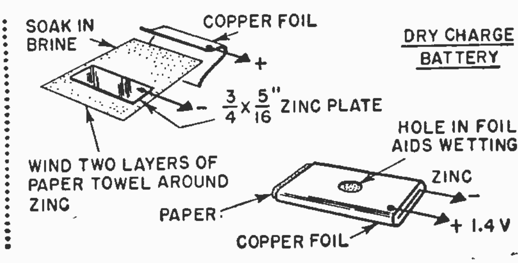
Because the coil form is brittle, use a gentle sawing motion. Once the razor's edge passes through the Bakelite, slide the ferrite core into the form, to provide an inner support while you sever the rest of the plastic tubing.

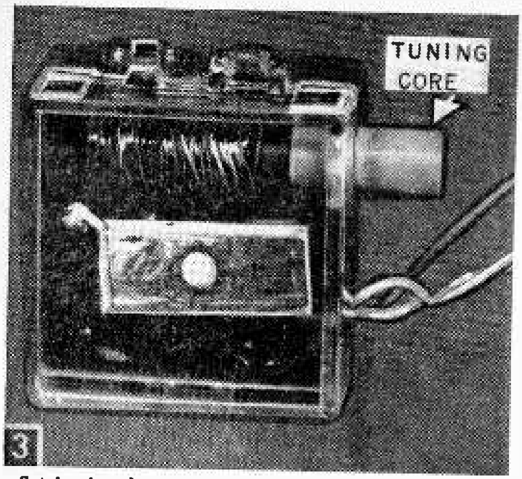
Transistorized ring radio tunes entire broadcast band. Set is housed in tiny ⅝ x 1⅛ x 1⅛ in. plastic case, has removable chassis.

To get an efficient match between the tuned circuit and diode detector, the coil is provided with a low impedance tap. To make the tap, care-

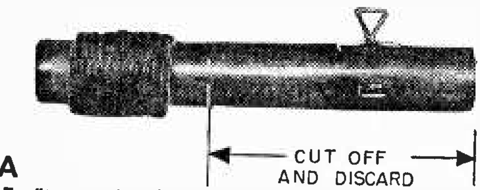








Set is sharply tuned by sliding core in and out of coil.



To fit case, Standard antenna 'loop' coil-form is cut off at point shown.

fully unwind 21 inches of wire from the outside end of the coil. Gently remove about ½ in. of the cotton insulation, bend the wire like a hairpin and twist the bare section together for the tap point. Now rewind the wire back into the space it formerly occupied. Of course, you can't duplicate the progressive lattice effect of a machine winding nor is it necessary. Merely "scramble-wind" as neatly as you can and secure the wire about an inch from the end with a few drops of Duco cement.

Drop the chassis board into the plastic case, after first roughing the area where the coil will be located with sandpaper. Now apply a generous dab of Pliobond cement to the coil board and directly on the coil wire. Allow the cement to air dry for a minute or so; then press coil onto board while it is still in the box. This insures the coil not being too close to the edge of the wiring board, which would prevent the finished set from fitting into the case.

Once the cement has set, the radio is ready for wiring. Spacing for the three transistor leads is best determined with the transistor in hand. Pierce the three holes with a push-pin (one of those glass- or plastic-tipped tacks with a needle sharp point). Next drop in the transistor, and, holding it firmly against the wiring board, use flat- or needle-nose pliers to bend the leads flat on the underside and then up and around the front edge of the board, so that they form hook-like lugs (Fig. 2A).

In order to provide a solid termination for the antenna, capacitor and coil leads, as well as the battery minus and earphone cord, simple tie-pins are made by pushing small flathead brads (cigar box nails) through the underside of the wiring board and securing them with a drop of solder. Clip off excess length of brads with diagonal wire-cutting pliers.

The diode detector may be any miniature germanium general purpose type and the transistor can be any P-N-P a.f. type (such as the 2N107, 2N34, CK-722, etc.). When soldering in these semi-conductor devices, always use a "heat sink" so that excess soldering iron heat is not carried up the lead and into the diode or transistor. A wad of damp cleansing tissue squeezed around the leads while soldering in place will prevent internal thermal damage.

The polarity of the diode connection to coil tap shown in Figs. 1 and 2 applies to this radio when you operate it with the homemade cell or the mercury battery. If a silicon solar cell is used, reverse the diode so the K or banded end terminates on transistor B (base) lug.

The ring band is merely a strip of copper or aluminum ⅜ in. wide and long enough to fit around the user's finger. Drill and countersink a hole in the center of the metal strip so that the 3/48 x ¼-in. machine screw fits flush. Also drill a hole through the bottom of the plastic case, using the center hole in the chassis board as a guide. For the ¼-in. hole in the side of the plastic case which lines up with the tuning coil, first locate the hole's position with chassis board fastened in place. Since this ¼-in. hole will be cut, half in the box lid and half in the base, hold cover securely while drilling. Finally, file a notch in the edge of the box large enough for the phone cord and antenna lead to pass through.

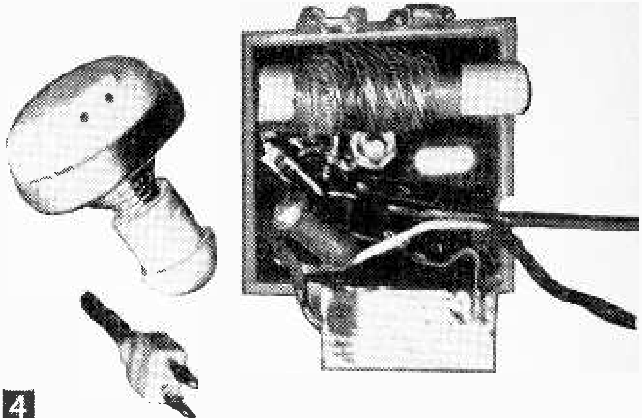
The radio is tuned by sliding the ferrite core in and out of the coil. If core slides too freely, stick a narrow strip of Scotch tape along its length. The antenna lead when clipped to various metal objects, such as a dial phone clip, will pick up stations with surprising volume.

Homemade Battery Power. If you want to power your ring radio with the tiny "dry charge" battery (Fig. 2B) you'll need just a few scraps of copper foil, zinc salvaged from a dead flashlight battery, and a piece of paper hand towel.

Break open the flashlight battery, remove the compound inside and cut up the zinc can into ¾ x 5/16-in. strips. If much of the battery case has been eaten away, use only the zinc in good condition and clean it up with steel wool. Solder a length of light flexible hookup wire to the corner or end of the zinc plate.

Next dissolve about 1 teaspoonful table salt in half a glass of water. Dip the paper into the salt solution, then hang paper up and allow it to drip dry. Meanwhile cut strips of copper foil (sold by hobby shops, etc.) ¾ in. wide and about 1 in. long. When the salt treated paper has dried, cut it into strips about 13/16 wide or just a trifle wider than the copper and zinc plates or electrodes. Wind two layers of paper towel over the zinc plate. Finally wrap a layer of copper foil over the paper and secure the end with a drop of solder to which a second flexible lead has been attached.

Any number of cells can be made up at one time and stored in a dry place until needed. Wired into the radio circuit, the set will come to life when a drop of water is applied to the exposed paper at each end of the cell. One charge will operate the radio continuously for about 4 hours, then volume will taper off. However, after allowing the set to rest awhile with earphone disconnected, it will recharge again when moisture is applied. In tests we have discharged one battery numerous times over a period of a month and each time it came back.



4 "Dry Charge" cell folds back for removing chassis plate screw. To disconnect battery power, disengage the cord from the miniature earphone.

MATERIALS LIST—RING RADIO

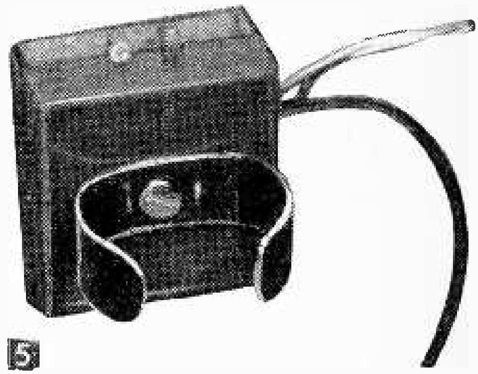
1 plastic trinket box, size 1⅛" sq x ⅝" deep o.d.
1 pc 1/32" plastic 1" sq
1 General purpose germanium diode
1 P-N-P transistor a.f. type (2N107, 2N34, CK722, etc)
1 Ferrite slug-tuned antenna 'loop' coil
1 220 mmf ceramic capacitor
1 strip ⅜" wide aluminum or copper
1 3/48 x ½" fh machine screw and nut

misc. zinc scraps, copper foil, light hookup wire.

Readers may obtain all parts listed above for building the ring radio by sending $3.49 to: Electro-Mite, Springdale 636, Conn.

NOTE: Few radio supply houses stock the #520 Mercury Cell. It is readily available throughout U. S., Canada, Alaska, T.H.I., and P. R. from any Zenith Hearing Aid dealer. See yellow pages of phone book under "Hearing Aids."

If you desire solar power, four 58C silicon solar cells are needed, available from Hoffman Electronics Corp., Semi-Conductor Div., 930 Pitnar Ave., Evanston, Ill. Cost is about 80¢ each.



5 Strip of ⅜" aluminum or copper forms expansion ring band. A single 4/48 x ¼-in. flathead screw and nut joins chassis, case, ring band into a secure unit.

This condition will not last indefinitely, however, and a new cell will be required due to minute hydrogen action on the copper foil known as polarization. A Voltaic cell variation such as this little "dry charge" unit delivers about 1.44 volts. Because its output is but a few milliwatts it cannot be measured with ordinary instruments, but current is ample for the minute needs of a transistor.

Unique Mercury Cell. If you wish to power your set with a more stable voltage source, the unique 1.34 volt #520 mercury cell employed in eyeglass hearing aids may be used. Unlike carbon/zinc and other batteries, the mercury cell delivers a steady 1.34 volts up to the moment it becomes exhausted. Moreover, these cells, which are about aspirin tablet size, will never swell up, corrode and leak electrolyte into the radio as happens with carbon/zinc cells. Because it is encased in a nickel jacket, leads cannot be soldered to the mercury cell. But two small clips can be fashioned from brass and the cell mounted in the lid of the plastic case for easy replacement.

For Solar-power Fans, the ring radio can be powered with a tiny silicon battery consisting of 4 horizontally stacked cells having a total length of ⅝ in. long and 3/32 in. wide. Each tiny cell has a peak output of 0.4 volt at 2 *ma*. Thus a unit of 4 cells, costing about $3.20, delivers 1.6 volts which is more than ample for the ring radio.

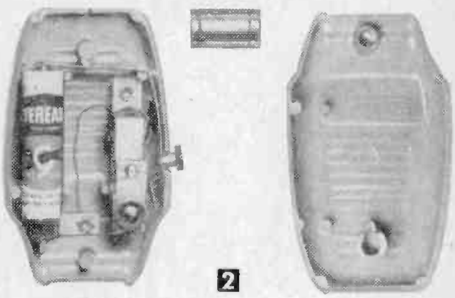
Toys for Practicing Radio Code

HERE are two electric toys, sold by mail-order houses and toy stores, that with no modification whatsoever can be used for code practice. Figure 1 shows a toy electric shaver called a "Fuzz Buzz" (manufactured by the Electric Game Co., Holyoke, Mass.), Fig. 2 shows its inner workings—a buzzer, battery, and switch, just what the doctor ordered for a code practice set which can be carried around in the pocket! Fasten a paper cut-out of the radio code to the outside of the toy's case with transparent tape; to practice the code, simply press on the push-switch to make your dots and dashes.

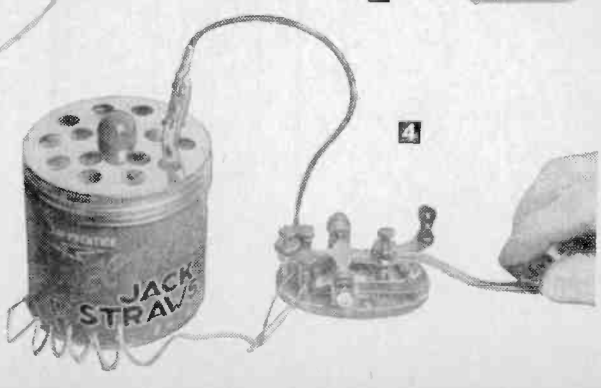
Figures 3 and 4 show an electric game called "Electric Jack Straws" (also manufactured by the Electric Game Co.). This toy contains a buzzer, flashlight battery, and flashlight bulb. The object of the game played with it is to insert the tweezers through the holes in the metal lid, and to pull out the straws without setting off the buzzer and lighting the lamp. You can practice the code with it by tapping the tweezers on the metal lid—the buzzer sounds and the lamp lights each time you touch tweezers to lid. Figure 4 shows how to connect a transmitting key, if desired. Simply fasten the tweezers in one binding post of the key, and run a wire from the other binding post on the key to the metal lid (using an alligator clip, as shown). This gives a child a dandy "buzzer and blinker" code practice set.—ART TRAUFFER

1

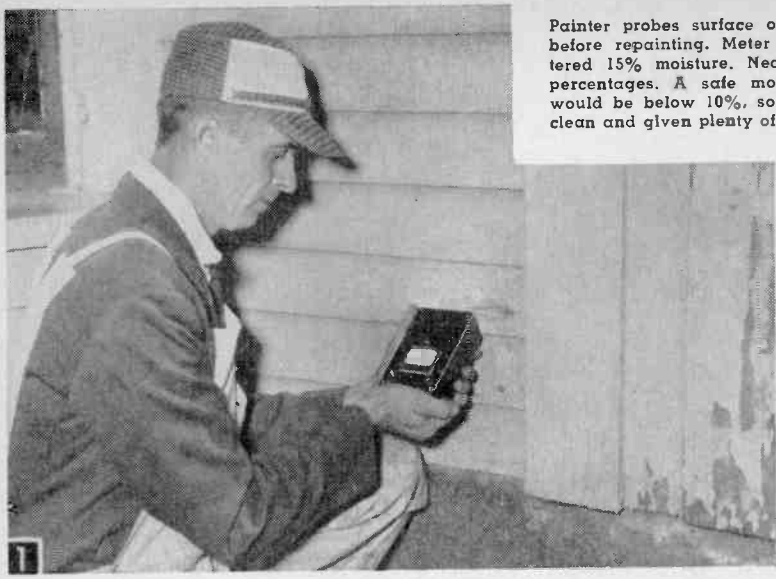
3



2



4



Painter probes surface of house with moisture tester before repainting. Meter showed this test spot registered 15% moisture. Nearby areas registered higher percentages. A safe moisture content for repainting would be below 10%, so this area should be scraped clean and given plenty of time to dry before repainting.

For good insurance on costly paint jobs use this

Electronic Moisture Tester

By HAROLD P. STRAND

BEFORE repainting your house, you should know how much moisture there is on or just below the old paint surfaces. If there is much moisture, the new paint you apply may peel off in a short time. The cure, of course, would be to scrape off the old paint, and let the sun and air dry out the excess moisture before you apply the new paint.

But how do you find out how much moisture is in the wood, and how do you know when this amount is too much? Sometimes, of course, simply feeling it with your hand will tell you whether it is damp. Sometimes, however, this "hand test" will tell you nothing. The actual surface may seem dry and yet 1/16 in. below the surface there is plenty of moisture, which, in time, will work out to the surface and ruin the new paint job.

This simple tester (Fig. 1) shows you how much moisture is below the surface of the wood. Parts for the tester cost about $9, which is a small amount to pay in order to make sure an expensive house repainting job will last.

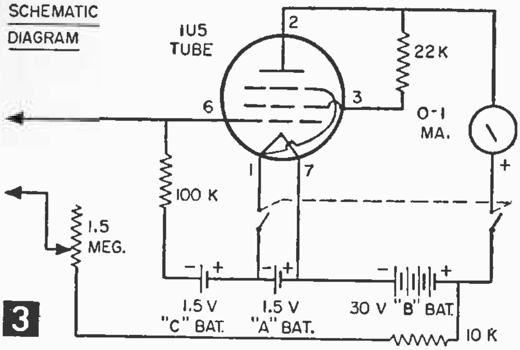
How the Tester Works. This tester has pointed steel electrodes (Fig. 2), which are in the grid circuit of a simple vacuum tube amplifier (Figs. 3 through 5). The amount of resistance in the material to be tested varies with the moisture content; the more moisture, the lower the resistance. When the grid circuit is closed by pressing the pointed steel electrodes into the surface you are testing, a positive voltage is applied to the grid causing the tube to conduct, and the amplified value indicating relative moisture content is shown on a milliammeter in the plate circuit.

Before using for the first time, the tester is calibrated by pressing the points into a piece of wood that has been thoroughly saturated in water (Fig. 2). You then adjust the rheostat so the meter reads full scale or 1. This represents 100% saturation. Tests in surfaces with less moisture will then be in percentage of full scale or saturation, giving you a fairly accurate picture of the percent of moisture present (Fig. 1).

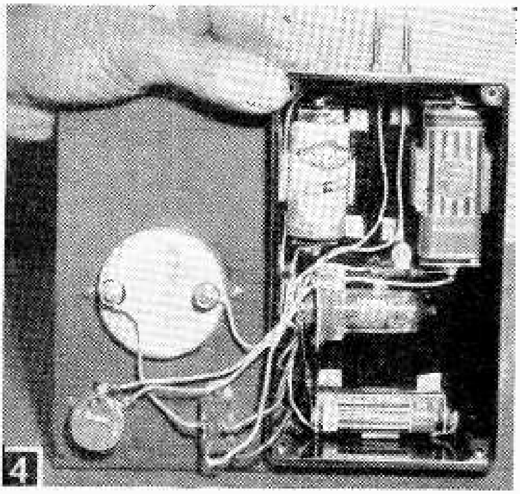
For the most accurate results, the wood used for calibrating should be of the same kind as that on the house surface you plan to test (usually pine or spruce), because different woods will give some changes in readings. You don't, however, need highly accurate readings (such as you

Tester is calibrated by sticking probes into a thoroughly saturated area of soft wood. Then adjust control to read full scale on meter, which represents 100% moisture content.

SCHEMATIC DIAGRAM

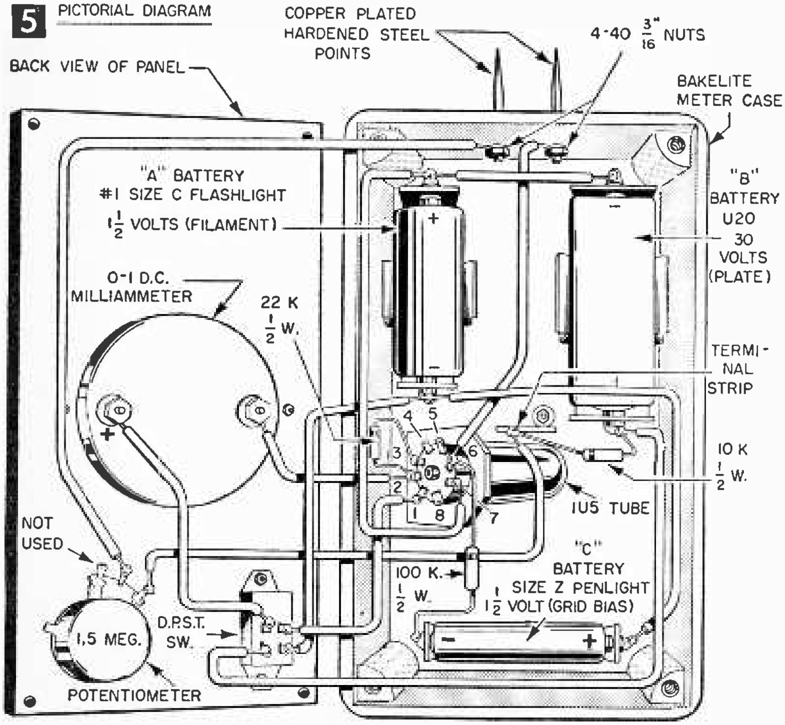


3



4

5 PICTORIAL DIAGRAM



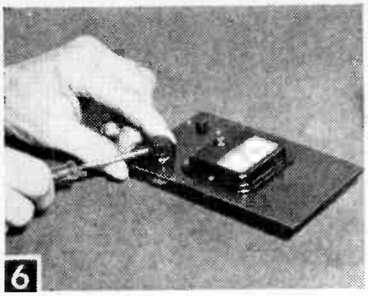
MATERIALS LIST—MOISTURE TESTER

No.	Description
1	Bakelite meter case 2 x 3¾ x 6¼" Lafayette MS-216
1	1U5 miniature tube
1	7-pin miniature socket (Amphenol Type 147-500 or equivalent)
1	Milliammeter, 0-1 ma. Shurite Model 950, Stock #9300Z
1	slide switch, D.P.S.T. #SW-16
1	Control, 1.5 megohm, Mallory Midgetrol, IRC Q type or similar, linear taper terminal strip, 1—terminal chassis type (also called tie points or mounting strips)
1	10,000-ohm ½ watt resistor
1	100,000-ohm ½ watt resistor
1	22,000-ohm ½ watt resistor
1	battery holder for one size Z penlight cell
1	battery holder for one size C or #1 flashlight cell
1	battery holder for one 30 volt Burgess U-20 B battery
1	miniature knob for ¼" shaft
1	30-volt Burgess U-20 B battery
1	1½-volt penlight Z cell
1	1½-volt flashlight C cell Above parts can be supplied by Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, N. Y. or in New England from their branch at 110 Federal Street, Boston, Mass.
1	piece drill rod .108-.110" dia., about 2½" long (Points)
1	piece black Bakelite ⅛ or 3/32" thick x 3½" x 6" (Panel)
1	Bakelite rod stock, ¾" diam., 3¼" long (for remote handle—see Fig. 1)
1	piece phosphor bronze or hard brass about .012-.014" x ¼" x 3⅛" (contact pieces in plastic block)
2	pieces drill rod .108-.110" about 2⅜" long (points for remote handle if desired) Misc. screws, nuts, hook-up wire, and solder

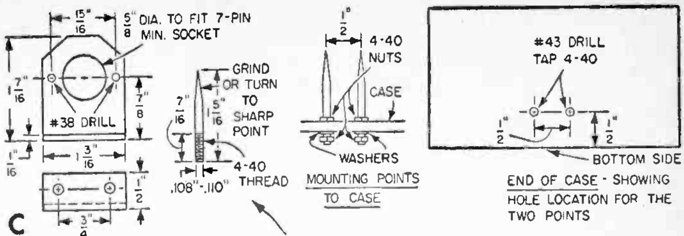
might get with the expensive bridge-circuit type commercial meters) when your only problem is to test a surface to be painted. Tests with this meter have shown that readings over about 10% moisture present an unfavorable condition for painting.

Building the Tester. Cut a piece of ⅛ in. thick black Bakelite to fit neatly in the recess in the open top side of the meter case. Or you could, instead, use ⅛ in. Masonite hardboard for this panel, if you finish it with black lacquer or enamel (using several rubbed coats for a good smooth black surface) to resemble Bakelite. Rub the final coat lightly with fine steel wool for a satin finish.

You'll need a 2 3/16 in. diameter hole in the front panel (Fig. 7A) for the meter. If your front panel is cut down from a larger piece, you'll find it easier to cut this hole first in the



Parts fitted to front panel.



DETAIL OF SOCKET SUPPORT BRACKET MATERIAL-ALUMINUM OR BRASS

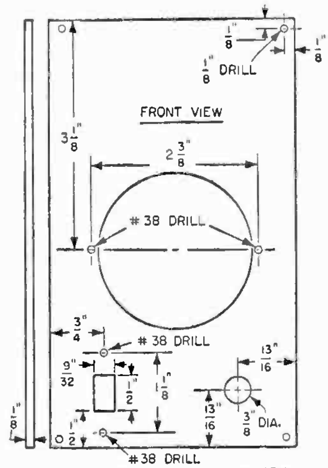
CONTACT POINTS - 2 REQ., MATERIAL- DRILL ROD. HARDEN BY HEATING CHERRY RED. PLACE IN COLD WATER. HAVE COPPER PLATED.

larger piece, using a circle or fly cutter in the drill press. Also cut the 3/8 in. diameter hole for the potentiometer. To make the rectangular hole for the slide switch, first lay it out on the panel with a scriber, drill several small holes within the area, and dress opening to size with a small file.

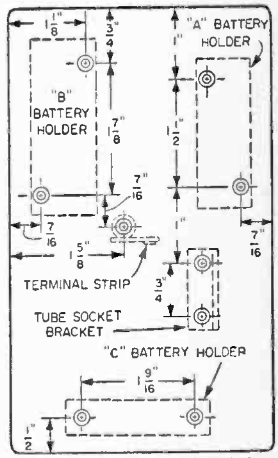
Note drilled holes for two small machine screws which hold switch in place (Fig. 7A), and the corner holes for screws that hold panel to case. Match these carefully to holes in case before drilling. To adapt case holes for 4-40 screws, drill 1/4 in. down in bottom of existing case holes with #43 and then tap them 4-40. Use 1/2 in. long 4-40 binder or button-head plated screws in these corner holes. When all openings have been made, mount meter, switch and potentiometer on front panel (Fig. 6).

Make the two pointed steel electrodes from drill rod, about .108-109 in. diameter, which is threaded at one end for 4-40 and (after shaping to points at the other ends) hardened (Fig. 7B). If you can, have these points copper- (or cadmium-) plated in some plating shop to provide good contact and freedom from corrosion.

The parts to be fitted in the bottom of the case (Figs. 4, 5 and 8) are three battery holders, an angle bracket support for the tube socket and a 1-terminal terminal strip. Secure these parts with *fh* 4-40 screws and nuts, with the heads countersunk flush at the other side. Bend up the socket

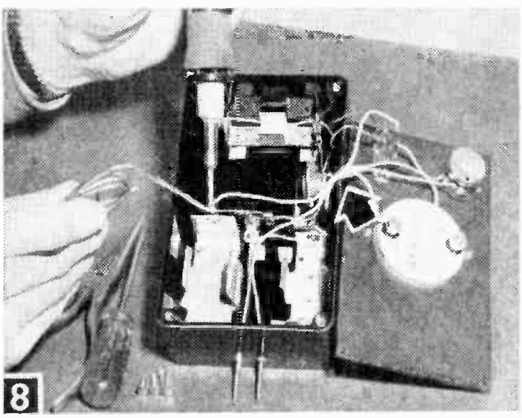


7A FRONT PANEL DRILLING - MATERIAL BAKELITE OR MASONITE, BLACK



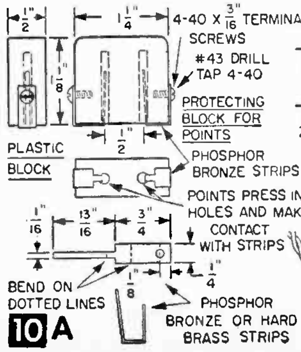
B BOTTOM VIEW OF CASE - HOLE LOCATIONS

USE #33 DRILL, C'SINK FOR 4-40 FH SCREWS CHECK HOLE LOCATIONS IN BAT. HOLDERS BEFORE DRILLING. THEY MAY DIFFER FROM ABOVE

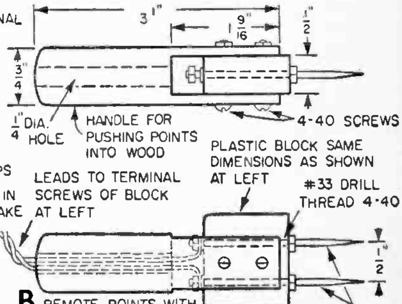


Above, plastic block protects sharp points of electrodes.

Left, making final solder joint on case wiring. Note tape (arrow) used to group wires for easy handling.



10A



B REMOTE POINTS WITH HANDLE - LEADS SHOWN CONNECTED bracket (Fig. 7C) from aluminum or other soft stock about .062 in. thick with a 5/8 in. hole for the socket body and two #44 holes for the 2-56 screws and nuts which attach socket to the bracket. Drill two #33 holes in the bracket base for securing it to the case.

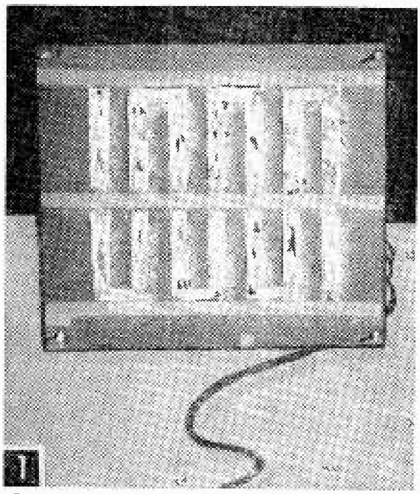
The wiring (Figs. 3 and 4) is done with #24-26 plastic covered hook-up wire. Solder all joints, except those at the steel points and the meter terminals, where clamping nuts are used. Make wiring to panel long enough so panel can be laid open as in Fig. 8, for working on the connections.

Note in Fig. 4 that, on the back connections of the double-pole single-throw slide switch, one side is used to open the B-battery circuit and the other side opens the filament circuit. The *Shurite* meter is well adapted for this layout, as its shallow body assures clearance with the fixed parts, if you locate these parts exactly as shown.

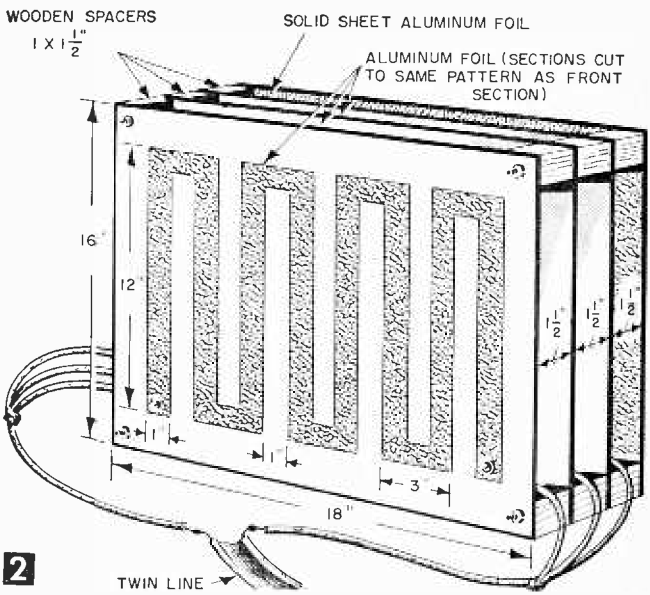
To protect the pointed steel electrodes, make up a plastic block as shown in Figs. 9 and 10A. This block can serve a dual purpose by fitting thin strips of phosphor bronze or hard brass in the holes, with their ends terminating in screws at the sides. You can then employ a remote set of points in a Bakelite handle (shown in Fig. 10B) with leads connecting from the terminal screws on the first block to the points in the second block as shown. With the aid of this extension, you can test probe in hard-to-reach areas.

Make a VHF ANTENNA

By THOMAS J. HIDLEY



1 Stacked in parallel, this six-bay, home-made TV antenna reaches out and drags stations in. More bays can be added if desired; this will increase signal strength.



2

MATERIALS LIST—VHF TV ANTENNA

No. Req'd.	Description
4 pcs	corrugated cardboard 16 x 18"
1	roll aluminum foil 18" wide
4	3/16 x 6" bolts, 8 washers
6	5/32 x 3/4" brass bolts (used as terminals), 12 brass washers
1	roll masking tape
6 pcs	#16 insulated wire, 6" long
5 ft	twin line

FAR superior to the antenna now wired into your television set, this paralled-stacked antenna can be constructed quickly and inexpensively (see Materials List and Fig. 2). Begin by cutting out and cementing or taping the first three sections of aluminum foil to corrugated cardboard. Each of the three sections has aluminum foil on both sides, a total of six pieces of aluminum foil cut to the front-view pattern of Fig. 2. Cut two pieces at a time, using a safety razor blade. (Scissors will seal the edges of the foil).

At the ending and the beginning of each section, use 5/32-in. brass terminals. Connect one 6-in. length wire to one terminal, another wire to the terminal on the other end on all sections.

The last section is a solid piece of aluminum foil, no connections, which stops interference from the opposite direction.

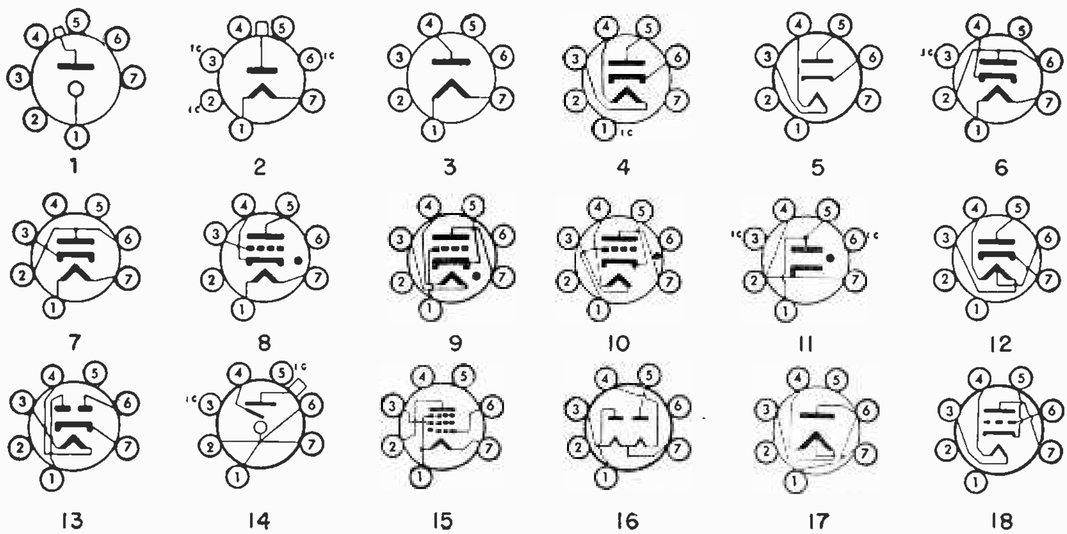
With all four sections completed, assemble, using 1 x 1½-in. wood spacers, drilled out with a 13/64-in. drill. Bolt together with 6-in. bolts. Solder three wires and one end of the twin line together as shown in Fig. 2. Do this at both ends of the assembly.

The length of the aluminum foil totals 100-in. per side for a total of 200 in. per section. The grand total is 600 in. If 100 in. of foil per section side is too long for your locality, shorten each section.

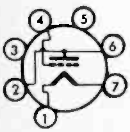
Miniature Tube Guide

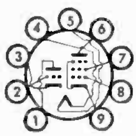
The following chart contains electronic, physical and circuit application data on all miniature electronic tubes in general use. The numbers under the heading "Base Connections" refer to the base diagrams below the chart

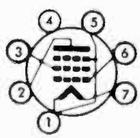
Type Designation	Description	Prototype	Cathode Heater & Filament Ratings			Base Connections	Over-all Height	Circuit Application	Typical Operating Voltages	
			Type	Volts	Amps				Plate	Screen
OA2	Gaseous v regulator	OD3/VR150	Cold	—	—	11	$2\frac{5}{8}$	Voltage regulator	185 min.	150v
OB2	Gaseous v regulator	OC3/VR105	Cold	—	—	11	$2\frac{5}{8}$	Voltage regulator	133 min.	108v
OG3	Gaseous v regulator	—	Cold	—	—	11	$2\frac{1}{8}$	Voltage regulator	125 max.	85v
1A3	Vhf diode	—	Cath.	1.4	.15	7	$2\frac{1}{8}$	H-w rect. or det.	117	—
1AB6	Pentagrid converter	—	Fil.	1.4	.025	57	$2\frac{3}{16}$	Converter	67.5	67.5
1AC6	Pentagrid converter	—	Fil.	1.4	.050	57	$2\frac{1}{8}$	Converter	67.5	67.5
1AE4	Pentode, sharp cutoff	—	Fil.	1.25	.1	21	$2\frac{1}{8}$	Voltage amplifier	90	90
1AF4	R-f pentode	—	Fil.	1.4	.025	21	$2\frac{1}{8}$	Voltage amplifier	90	90
1AF5	Diode-pentode	—	Fil.	1.4	.025	22	$2\frac{1}{8}$	Voltage amplifier	90	90
1AH5	Diode, a-f pentode	—	Fil.	1.4	.025	22	$2\frac{3}{16}$	Voltage amplifier	64	—
									85	—
1AJ4	R-f pentode	—	Fil.	1.4	.25	21	$2\frac{3}{16}$	Voltage amplifier	85	Rs=39
1AX2	H-w rectifier	1X2A	Fil.	1.4	.65	126	$2\frac{13}{16}$	High-voltage rectifier	25K	—
1C3	Triode	1LE3	Fil.	1.45	.05	19	$2\frac{1}{8}$	Voltage amplifier	90	—
1E3	Uhf triode	—	Fil.	1.25	.22	87	$2\frac{3}{16}$	Oscillator, volt. amp	150	—
1L4	R-f pentode,	1N5GT	Fil.	1.4	.05	21	$2\frac{1}{8}$	Voltage amplifier	90	90
	sharp cutoff							Voltage amplifier	90	67.5
1L6	Pentagrid converter	1LA6	Fil.	1.4	.050	55	$2\frac{1}{8}$	Converter	90	45
1R5	Pentagrid converter	1A7GT	Fil.	1.4	.05	31	$2\frac{1}{8}$	Converter	90	67.5
								Converter	90	45
1S4	Power amp pentode	1Q5GT	Fil.	1.4	.1	32	$2\frac{1}{8}$	Power output amp	45	45
								Power output amp	67.5	67.5
								Power output amp	90	67.5
1S5	Diode, a-f pentode	—	Fil.	1.4	.05	22	$2\frac{1}{8}$	Detector and volt. amp	67.5	67.5
1T4	R-f pentode,	1P5GT	Fil.	1.4	.05	21	$2\frac{1}{8}$	Voltage amplifier	45	45
	remote cutoff							Voltage amplifier	67.5	67.5
								Voltage amplifier	90	45
								Voltage amplifier	90	67.5
1U4	R-f pentode,	1N5GT	Fil.	1.4	.05	21	$2\frac{1}{8}$	Voltage amplifier	90	90
	sharp cutoff							Voltage amplifier	90	67.5
1U5	Diode, a-f pentode	—	Fil.	1.4	.05	26	$2\frac{1}{8}$	Detector and volt. amp	67.5	67.5
1U6	Pentagrid converter	—	Fil.	1.4	.025	55	$2\frac{1}{8}$	Converter	90	45
1V2	H-w diode	—	Fil.	0.625	.3	123	$2\frac{3}{16}$	Rectifier		—
1W4	Power amp pentode	1LB4	Fil.	1.4	.05	15	$2\frac{1}{8}$	Power amplifier	62.5	62.5
								Power amplifier	90	90
1X2	H-w rectifier	1B3GT/8016	Fil.	1.25	.22	126	$2\frac{11}{16}$	Flyback voltage rectifier	15K	—
1X2A	H-w rectifier	1B3GT	Fil.	1.25	.22	126	$2\frac{13}{16}$	Rectifier	20K	—
1X2B	H-w rectifier	—	Fil.	1.25	.2	126	$2\frac{13}{16}$	Flyback voltage rectifier	22K	—
1Z2	H-w rectifier	—	Fil.	1 5	.3	46	$2\frac{11}{16}$	Rectifier	7800	—
2AF4	Uhf triode	6AF4	Cath.	2.35	.600	59	$2\frac{1}{8}$	950 mc. osc.	100	—
								Voltage amplifier	80	—
2B25	H-w rectifier	—	Fil.	1.4	.11	3	$2\frac{1}{8}$	Rectifier	1000	—
2C4	Triode thyratron	—	Cath.	2.5	.6	8	$2\frac{1}{8}$	Rectifier	350	—
2C51	Twin triode	7F8	Cath.	6.3	.3	63	$1\frac{3}{4}$	Voltage amplifier	150	—

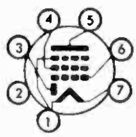


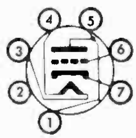
Type Designation	Description	Prototype	Cathode Heater & Filament Ratings: Type	Volts	Amps	Base Connections	Overall Height	Circuit Application	Typical Operating Voltages: Plate	Screen
2D21	Tetrode thyratron	2050	Cath.	6.3	.6	40	2 1/8	Relay service	1300	—
2E30	Beam pentode	—	Fil.	6.0	.65	50	2 5/8	Power amplifier	250	250
2T4	Low-mu triode	6T4	Cath.	2.35	.600	59	1 3/4	Oscillator, volt. amp-	80	—
3A2	H-w rectifier	—	Cath.	3.15	.22	111	2 13/16	High-voltage rectifier	18K	—
3A4	Power amp pentode	—	Fil.	2.8	.1	34	2 1/8	Power output amp	135	90
				1.4	.2			Power output amp	150	90
3A5	Twin triode	—	Fil.	2.8	.11	35	2 1/8	Voltage amplifier	90	—
				1.4	.22					
3AL5	Twin diode	6AL5	Cath.	3.15	.600	25	1 13/16	F-m discriminator		—
								Rectifier	150	—
3AU6	R-f pentode, sharp cutoff	6AU6	Cath.	3.15	.600	39	2 1/8	Voltage amplifier	100	100
								Voltage amplifier	250	150
3AV6	Duplex diode, high-mu triode	6AV6	Cath.	3.15	.600	43	2 1/8	Detector and volt. amp	100	—
								Dtector and volt. amp	250	—
3B4	Vhf beam pentode	—	Fil.	2.50	.165	53	2 1/8	Power amplifier		—
			Tap	1.25	.330			Power amplifier	150	135
3BC5	R-f pentode	6BC5	Cath.	3.15	.600	36	2 1/8	Voltage amplifier	100	100
								Voltage amplifier	250	150
3BE6	Pentagrid converter, remote cutoff	6BE6	Cath.	3.15	.600	48	2 1/8	Converter	100	100
								Converter	250	100
3BN6	Gated-beam disc.	6BN6	Cath.	3.15	.600	56	2 5/8	F-m discriminator	80	60
3BY6	Pentagrid amplifier	6BY6	Cath.	3.15	.600	48	2 1/8	Sync. separator and clipper	10	25
3BZ5	High-gm, semi-remote cutoff, pentode amplifier	6BZ6	Cath.	3.15	.600	49	2 1/8	Voltage amplifier	200	150
3C4	Power output pentode	—	Fil.	1.4	.05	27	2 3/16	Power amplifier	64	64
								Power amplifier	85	85
3CB6	R-f pentode, remote cutoff	6CB6	Cath.	3.15	.600	49	2 1/8	Voltage amplifier	200	150
3E5	Power amp pentode	—	Fil.	1.4	.05	27	2 1/8	Power output amp	67.5	67.5
				2.8	.025			Power output amp	90	90
3Q4	Power amp pentode	3Q5GT	Fil.	1.4	.1	33	2 1/8	Power output amp	90	90
				2.8	.05			Power output amp	90	90
3S4	Power amp pentode	3Q5GT	Fil.	1.4	.1	33	2 1/8	Power output amp	90	67.5
				2.8	.05			Power output amp	90	67.5
								Power output amp	67.5	67.5
								Power output amp	67.5	67.5
3V4	Power amp pentode	3Q5GT	Fil.	2.8	.05	27	2 1/8	Power output amp	90	90
				1.4	.1			Power output amp	90	90
4BQ7A	Double triode	6BQ7A	Cath.	4.2	.600	74	2 3/16	Voltage amplifier	150	—
4BZ7	Vhf twin triode	6BZ7	Cath.	4.2	.600	74	2 3/16	Voltage amplifier	150	—
5A6	Beam pentode	—	Fil.	5.0	.23	116	2 5/8	R-f power amp and frequency multiplier		
5AM8	Diode-pentode	6AM8	Cath.	4.7	.600	107	3 3/16	1-f amplifier	200	150
5AQ5	Beam pentode	6AQ5	Cath.	4.70	.600	44	2 5/8	Power output amplifier	180	180
								Power output amplifier	250	250
5BK7A	Twin triode	6BK7A	Cath.	4.7	.600	74	2 3/16	Voltage amplifier	150	—
5J6	Twin triode	6J6	Cath.	4.7	.600	37	2 1/8	Voltage amplifier	100	—
5T8	Triple diode, triode	6T8	Cath.	4.7	.600	112	2 3/16	Det. and Volt. amplifier	100	—
								Det. and Volt. amplifier	250	—
5U8	Triode-pentode	6U8	Cath.	4.7	.600	71	2 3/16	Pentode volt. amp	250	110
								Triode volt. amp	150	—
5X8	Triode-pentode	6X8	Cath.	4.7	.600	75	2 3/16	Converter:		
								Triode oscillator	150	—
								Pentode mixer	150	150
6AB4	Uhf triode	—	Cath.	6.3	.15	18	2 1/8	Voltage amplifier	250	—

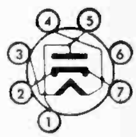

19

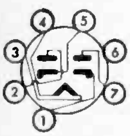

20

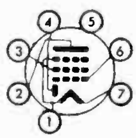

21

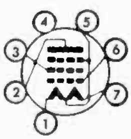

22

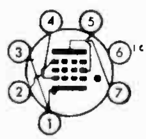

23

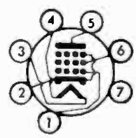

24

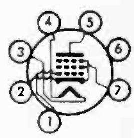

25

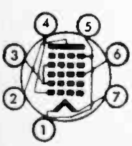

26

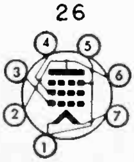

27

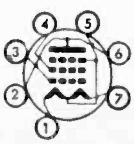

28

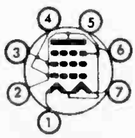

29

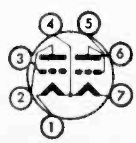

30

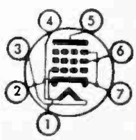

31


32

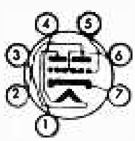

33


34

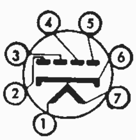

35


36

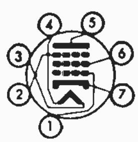
Type Designa-tion	Description	Prototype	Cathode Heater & Filament Ratings			Base Con-nec-tions	Over-all Height	Circuit Application	Typical Operating Voltages	
			Type	Volts	Amps				Plate	Screen
6AB8	Triode-pentode	—	Cath.	6.3	.3	80	2⅝	Triode: A-f pre-amplifier		
								and osc.	100	—
								Pentode:Synch. sep. or		
								output amp	200	200
6AD8	Double diode, pentode	—	Cath.	6.3	.3	122	2⅝	Voltage amplifier	250	85
6AE8	Triode, hexode	—	Cath.	6.3	.3	65	2¼	Frequency converter	—	—
6AF4	Uhf triode	—	Cath.	6.3	.225	59	2⅛	950 mc. osc.	100	—
								Voltage amplifier	80	—
6AF4A	Medium-mu triode	6AF4	Cath.	6.3	.225	59	1¾	950 mc. osc.	100	—
6AG5	R-f pentode, sharp cutoff	6SH7GT	Cath.	6.3	.3	36	2⅛	Voltage amplifier	100	100
								Voltage amplifier	250	150
6AH6	R-f pentode, sharp cutoff	6AC7	Cath.	6.3	.45	39	2⅛	Voltage amplifier	300	150
								Triode volt. amp.	150	150
6AJ4	Uhf triode	—	Cath.	6.3	.225	97	1¾	Grounded-grid amp	125	—
								(900 mc.)		
6AJ5	R-f pentode,	—	Cath.	6.3	.175	36	1¾	Voltage amplifier	28	28
	sharp cutoff							Class AB power amp	180	75
6AJ8	Triode-heptode	—	Cath.	6.3	.3	100	2⅝	Heptode mixer	250	R=22K
								Triode volt. amp	100	—
6AK5	R-f pentode,	—	Cath.	6.3	.175	36	1¾	Voltage amplifier	120	120
	sharp cutoff							Voltage amplifier	180	120
6AK6	Power amp pentode	—	Cath.	6.3	.15	39	2⅛	Power output amp	135	135
								Power output amp	180	180
6AK8	Triple diode, triode	—	Cath.	6.3	.45	112	2⅝	Detector and volt. amp	100	—
								Detector and volt. amp	250	—
6AL5	Twin diode	6H6GT	Cath.	6.3	.3	25	1 13/16	F-m discriminator		
								Rectifier	150	
6AM4	High-mu uhf triode	—	Cath.	6.3	.225	97	1¾	Grounded-grid mixer	150	
6AM5	Power amp pentode	—	Cath.	6.3	.2	30	2⅛	Power output amp	250	250
6AM6	R-f pentode	—	Cath.	6.3	.3	54	2⅛	Voltage amplifier	250	250
6AM8	Diode-pentode	—	Cath.	6.3	.45	107	2 3/16	I-f amplifier	200	150
6AN4	High-mu uhf triode	—	Cath.	6.3	.225	59	2⅛	Grounded-grid mixer	200	—
6AN5	Power amp pentode	6AG7	Cath.	6.3	.5	36	2⅛	Power amplifier	120	120
6AN6	Quadruple diode	—	Cath.	6.3	.2	38	2⅛	Rectifier	117	—
6AN7	Triode, hexode, converter	—	Cath.	6.3	.23	119	2⅝	Converter	250	85
6AN8	Medium-mu triode, sharp-cutoff pentode	—	Cath.	6.3	.45	20	2 3/16	Triode voltage amplifier	300	—
								Pentode voltage amp	300	150
6AQ4	Triode	—	Cath.	6.3	.3	60	2⅛	Grounded-grid amplifier	250	—
6AQ5	Beam pentode	6V6GT	Cath.	6.3	.45	44	2⅝	Power output amp	180	180
								Power output amp	250	250
6AQ6	Duplex diode,	6T7G	Cath.	6.3	.15	43	2⅛	Detector and volt. amp	100	—
	high-mu triode							Detector and volt. amp	250	—
6AR5	Power amp pentode	6K6GT	Cath.	6.3	.4	29	2⅝	Power amplifier	180	180
								Power amplifier	250	250
6AS5	Beam pentode	7A5	Cath.	6.3	.800	52	2⅝	Power amplifier	150	117
6AS6	R-f pentode, dual control, sharp c.o.	—	Cath.	6.3	.175	49	1¾	Voltage amplifier	120	120
6AS8	Diode, sharp-cutoff —pentode	—	Cath.	6.3	.45	110	2 3/16	Video amplifier	200	150
6AT6	Duplex diode,	6Q7GT	Cath.	6.3	.3	43	2⅛	Detector and volt. amp	100	—
	high-mu triode							Detector and volt. amp	250	—
6AT8	Medium-mu triode, —sharp-cutoff pentode	6X8	Cath.	6.3	.45	110	2 3/16	Converter:		
								Triode oscillator	150	—
								Pentode mixer	150	150
6AU6	R-f pentode,	6SH7GT	Cath.	6.3	.3	39	2⅛	Voltage amplifier	100	100
	sharp cutoff							Voltage amplifier	250	150



37



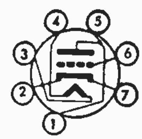
38



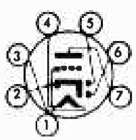
39

40

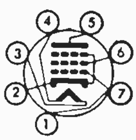
41



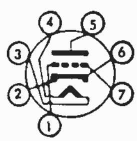
42



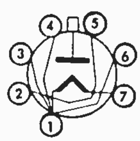
43



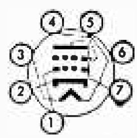
44



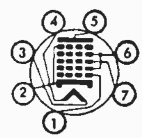
45



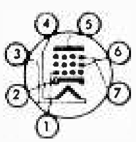
46



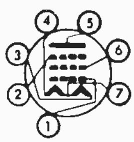
47



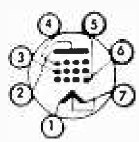
48



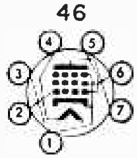
49



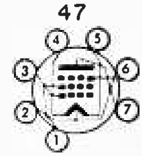
50



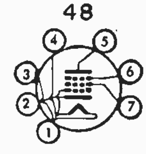
51



52

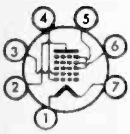


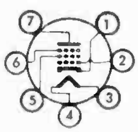
53

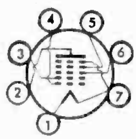


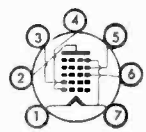
54

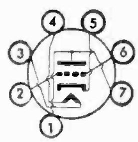
Type Designation	Description	Prototype	Cathode Heater & Filament Ratings			Base Connections	Over-all Height	Circuit Application	Typical Operating Voltages	
			Type	Volts	Amps				Plate	Screen
6AV4	Double diode	6X4	Cath.	6.3	.95	13	$2\frac{5}{8}$	F-w rectifier	1250	
6AV6	Duplex diode,	6SQ7GT	Cath.	6.3	.3	43	$2\frac{1}{8}$	Detector and volt. amp	100	—
	high-mu triode							Detector and volt. amp	250	—
6AX7	Twin triode	12AX7	Cath.	6.3/3.15	3/0.6	66	$2\frac{3}{16}$	Voltage amplifier	100	—
								Voltage amplifier	250	—
6BA6	R-f pentode,	6SG7GT	Cath.	6.3	.3	39	$2\frac{1}{8}$	Voltage amplifier	100	100
	remote cutoff							Voltage amplifier	250	100
6BA7	Pentagrid converter	6SB7Y	Cath.	6.3	.300	64	$2\frac{5}{8}$	Converter	100	100
								Converter	250	100
6BC4	Uhf medium-mu triode	—	Cath.	6.3	.225	109	$1\frac{3}{4}$	Voltage amplifier	150	—
6BC5	R-f pentode	—	Cath.	6.3	.3	36	$2\frac{1}{8}$	Voltage amplifier	100	100
								Voltage amplifier	250	150
6BC7	Triple diode	—	Cath.	6.3	.45	81	—	Rectifier	5	—
6BD6	R-f pentode,	6SK7GT	Cath.	6.3	.3	39	$2\frac{1}{8}$	Voltage amplifier	100	100
	remote cutoff							Voltage amplifier	250	100
6BD7	Double-diode, triode	—	Cath.	6.3	.23	127	$2\frac{5}{8}$	Voltage amplifier	250	—
6BE6	Pentagrid, converter,	6SA7GT	Cath.	6.3	.3	48	$2\frac{1}{8}$	Converter	100	100
	remote C.O.							Converter	250	100
6BE7	Heptode converter	—	Cath.	6.3	.2	67	$2\frac{5}{8}$	Conv. f-m det., a-m amp/	250	100
6BF5	Pentode	—	Cath.	6.3	.2	44	$2\frac{5}{8}$	Power amplifier	225	225
6BF6	Duplex diode	6SR7GT	Cath.	6.3	.3	43	$2\frac{1}{8}$	Voltage amplifier	250	—
	medium-mu triode									
6BH5	Pentode, remote c.o.	—	Cath.	6.3	.2	82	$2\frac{5}{8}$	Voltage amplifier	250	R-90M
	variable mu									
6BH6	R-f pentode	—	Cath.	6.3	.150	49	$2\frac{1}{8}$	Voltage amplifier	100	100
	sharp c.o.							Voltage amplifier	250	150
6BJ5	Pentode	—	Cath.	6.3	.64	30	$2\frac{3}{4}$	Power amplifier	250	250
6BJ6	R-f pentode	6SS7GT	Cath.	6.3	.15	49	$2\frac{1}{8}$	Voltage amplifier	100	100
	remote cutoff							Voltage amplifier	250	100
6BJ7	Triple diode	—	Cath.	6.3	.45	81	$2\frac{3}{16}$	D-c restorer	330	—
6BK5	Beam pentode	—	Cath.	6.3	.2	93	$2\frac{5}{8}$	Power amplifier	250	250
6BK6	Duplex diode	—	Cath.	6.3	.3	43	$2\frac{5}{8}$	Voltage amplifier	100	—
	High-mu triode							Voltage amplifier	250	—
6BK7	Twin triode	12AV7	Cath.	6.3	.45	74	$2\frac{3}{16}$	Cascode amplifier	100	—
								Cascode amplifier	150	—
6BK7A	Twin triode	6BK7	Cath.	6.3	.45	74	$2\frac{3}{16}$	Voltage amplifier	150	—
6BM5	Power amp pentode	—	Cath.	6.3	.45	44	$2\frac{5}{8}$	Power amplifier	250	250
6BN6	Gated-beam disc.	—	Cath.	6.3	.3	56	$2\frac{5}{8}$	F-m discriminator	80	60
6BN7	Double triode	—	Cath.	6.3	.75	74	$2\frac{5}{8}$	Voltage amplifier	Sec. 1 250	—
									Sec. 2 120	—
6BQ7	Double triode	—	Cath.	6.3	.4	74	$2\frac{3}{16}$	Voltage amplifier	150	—
6BQ7A	Double triode	—	Cath.	6.3	.4	74	$2\frac{3}{16}$	Voltage amplifier	105	—
6BR7	H-f pentode, sharp. c.o.	6J7	Cath.	6.3	.15	84	$2\frac{3}{16}$	Voltage amplifier	100	100
								Voltage amplifier	250	100
6BS5	Beam power amplifier	—	Cath.	6.3	.75	89	$2\frac{5}{8}$	A-f power amplifier	250	250
6BS7	Sharp-cutoff h-f pentode	6BR7	Cath.	6.3	.150	84	$2\frac{1}{32}$	Voltage amplifier	100	100
								Voltage amplifier	250	100
6BT6	Duplex diode	—	Cath.	6.3	.3	43	$2\frac{5}{8}$	Voltage amplifier	100	—
	hi-mu triode							Voltage amplifier	250	—
6BU6	Duplex diode	—	Cath.	6.3	.3	43	$2\frac{5}{8}$	Voltage amplifier	100	—
	low-mu triode							Voltage amplifier	250	—
6BV7	Double diode, pentode	—	Cath.	6.3	.8	94	$2\frac{5}{8}$	Power amplifier	180	180
								Power amplifier	250	250
6BW6	Beam pentode	—	Cath.	6.3	.45	76	$2\frac{5}{8}$	Power amplifier	180	180
								Power amplifier	250	250
								Power amplifier	315	225

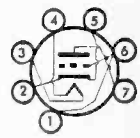

55

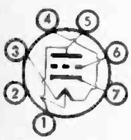

56

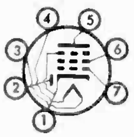

57

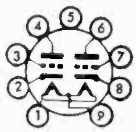

58

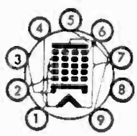

59

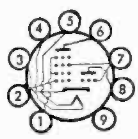

60

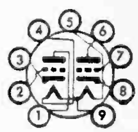

61

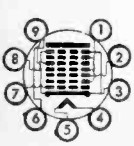

62


63

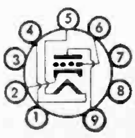

64

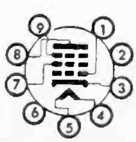

65

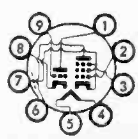

66

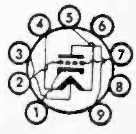

67


68


69

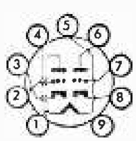

70

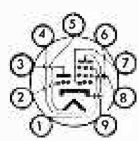

71

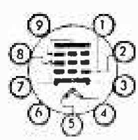

72

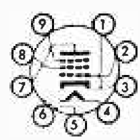
Type Designation	Description	Prototype	Cathode Heater & Filament Ratings: Type	Volts	Amps	Base Connections	Over-all Height	Circuit Application	Typical Operating Voltages: Plate	Screen
6BW7	R-f pentode	——	Cath.	6.3	.150	77	2 3/16	Voltage amplifier	180	180
								Voltage amplifier	250	250
6BX4	F-w rectifier	——	Cath.	6.3	.6	13	2 3/8	Rectifier	1350	
6BX6	R-f pentode	——	Cath.	6.3	.3	77	2 5/8	Voltage amplifier	170	170
6BY6	Pentagrid amplifier	——	Cath.	6.3	.3	48	2 1/8	Sync. Separator clipper	10	25
6BY7	R-f pentode	——	Cath.	6.3	.3	77	2 5/8	Wide-hand amplifier	250	100
6BZ6	High-gm, semi-remote cutoff, pentode amplifier	——	Cath.	6.3	.300	49	2 1/8	Voltage amplifier	200	150
6BZ7	Vhf twin triode	6BQ7	Cath.	6.3	.4	74	2 3/16	Voltage amplifier	150	——
6C4	Power triode	6J5GT	Cath.	6.3	.15	23	2 1/8	Voltage amplifier	100	——
								Voltage amplifier	250	——
6CB6	R-f pentode sharp cutoff	——	Cath.	6.3	.3	49	2 1/8	Voltage amplifier	200	150
6CF6	Sharp-cutoff pentode	——	Cath.	6.3	.3	49	2 1/8	Voltage amplifier	200	150
6CG6	Pentode, remote c.o.	——	Cath.	6.3	.3	39	2 1/8	Voltage amplifier	250	150
6CH6	R-f pentode	——	Cath.	6.3	.75	83	2 5/8	Video output amplifier	250	250
6CJ6	Pentode	——	Cath.	6.3	.05	79	3 3/16	Audio output amplifier	250	250
								Horizontal sweep amp.	70	170
6CK6	R-f pentode	——	Cath.	6.3	.71	78	3 1/16	Video output amplifier	250	250
6CL6	R-f pentode	——	Cath.	6.3	.65	95	2 5/8	Power amplifier	250	150
6CM6	Beam pentode	——	Cath.	6.3	.45	101	2 5/8	Vert. deflection amp.	250	250
6CQ6	Variable-mu h-f pentode	——	Cath.	6.3	.2	54	2 1/8	Voltage amplifier	250	100
								Voltage amplifier	250	250
6CR6	Diode-pentode	——	Cath.	6.3	.3	62	2 1/8	Audio amplifier	250	100
6CS6	Dual control heptode	——	Cath.	6.3	.3	48	2 1/8	Sync. separator	10	30
6D4	Triode thyratron	——	Cath.	6.3	.25	10	2 1/8		320	
6DB6	Sharp cutoff r-f pentode	——	Cath.	6.3	.3	49	2 1/8	Color demodulator	150	150
6DC6	Semi-remote c.o. pentode	——	Cath.	6.3	.3	49	2 1/8	Voltage amplifier	200	150
6DE6	Sharp-cutoff pentode	——	Cath.	6.3	.3	49	2 1/8	Voltage amplifier	200	150
6J4	Triode, uhf grounded grid	——	Cath.	6.3	.4	41	2 1/8	Voltage amplifier	100	——
								Voltage amplifier	150	——
6J6	Twin triode	——	Cath.	6.3	.45	37	2 1/8	Voltage amplifier	100	——
6M5	Power amp pentode	——	Cath.	6.3	.71	118	3 1/16	Power output amp	250	250
6N4	Triode uhf	——	Cath.	6.3	.2	45	1 3/4	Voltage amplifier	180	——
6N8	Duplex diode, pentode	——	Cath.	6.3	.3	122	2 5/8	Voltage amplifier	250	85
6Q4	Grounded grid triode	——	Cath.	6.3	.48	121	2 3/16	Voltage amplifier	250	——
6R4	Uhf triode	——	Cath.	6.3	.2	120	2 3/16	Voltage amplifier	150	—
6R8	Triple diode, triode	——	Cath.	6.3	.45	112	3 3/16	Voltage amplifier	250	——
6S4	Triode	——	Cath.	6.3	.6	69	2 5/8	Voltage amplifier	250	——
6S4A	Triode	6S4	Cath.	6.3	.600	69	2 5/8	Voltage amplifier	250	——
6T4	Low-mu triode		Cath.	6.3	.225	59	1 3/4	Oscillator, volt. amp	80	——
6T8	Triple diode triode	——	Cath.	6.3	.450	112	2 3/16	Det. and voltage amp.	100	——
								Det. and voltage amp.	250	——
6U3	Diode	——	Cath.	6.3	.9	91	3 1/16	Damper diode	4000	——
6U8	Triode-pentode	——	Cath.	6.3	.45	71	2 3/16	Pentode volt. amp	250	110
								Triode volt. amp	150	——
6V3	H-w rectifier	——	Cath.	6.3	.75	85	2 13/16	Rectifier	350	——
								Damper diode	6000	——
6V4	F-w rectifier	——	Cath.	6.3	.6	117	3 1/16	Rectifier	350	——
6V8	Triple diode triode	——	Cath.	6.3	.45	73	2 3/16	Voltage amplifier	100	——
								Voltage amplifier	250	——
6X4	Double diode	——	Cath.	6.3	.6	13	2 5/8	F-w rectifier	650	Cap.
								F-w rectifier	900	Choke
6X8	Triode pentode	——	Cath.	6.3	.45	75	2 3/16	Converter:		
								triode oscillator	150	——
								Pentode mixer	150	150


73

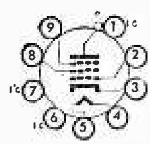

74

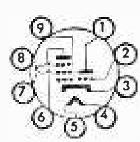

75

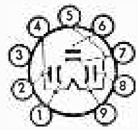

76

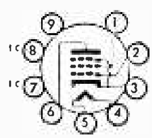

77

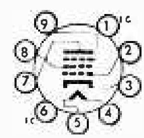

78

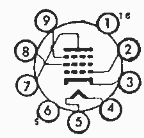

79


80

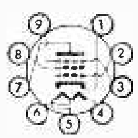

81

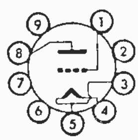

82

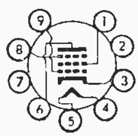

83

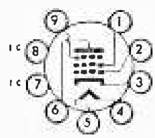

84

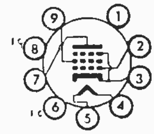

85


86

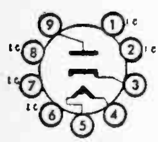
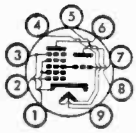
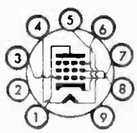
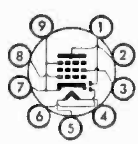
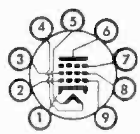
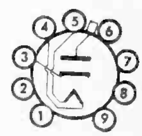
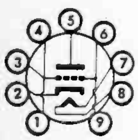
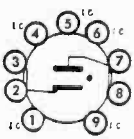
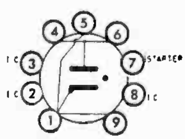
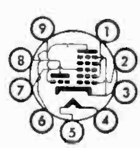
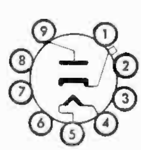
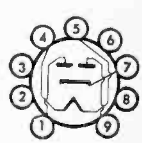
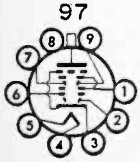
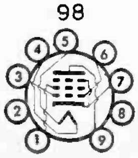
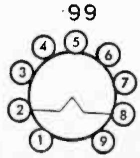
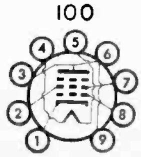
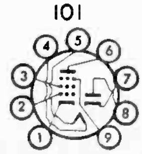
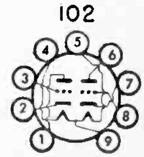

87


88

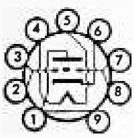

89

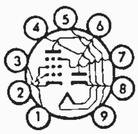

90

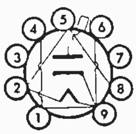
Type Designation	Description	Prototype	Cathode Heater & Filament Ratings: Type	Volts	Amps	Base Connections	Overall Height	Circuit Application	Typical Operating Voltages: Plate	Screen
9BM5	Power amp pentode	—	Cath.	9.5	.3	44	2⅝	Power amplifier	250	250
9BW6	Beam pentode	6BW6	Cath.	9.45	.3	76	2⅝	Power amplifier	180	180
								Power amplifier	250	250
								Power amplifier	315	225
12A4	Medium-mu triode	—	Cath.	12.6 6.3	.3	72	2⅝	Voltage amplifier	250	—
12AH8	Triode-heptode	—	Cath.	12.6 6.3	.15 .3	92	2⅝	Converter:		
								Heptode	250	100
								Oscillator	100	—
12AL5	Twin diode	12H6GT	Cath.	12.6	.15	25	1$\frac{13}{16}$	F-m discriminator		
								Rectifier	117	—
12AQ5	Beam power amplifier	12V6GT	Cath.	12.6	.225	44	2⅝	A-f power amplifier Class A-1	180	180
								A-f power amplifier Class A-1	250	250
12AT6	Duplex diode high-mu triode	12Q7GT	Cath.	12.6	.15	43	2⅛	Detector and volt amp	100	—
								Detector and volt amp	250	—
12AT7	Twin triode	—	Cath.	12.6 6.3	.150 .300	66	2$\frac{3}{16}$	Voltage amplifier	100	—
								Voltage amplifier	250	—
12AU6	R-f pentode sharp cutoff	12SH7GT	Cath.	12.6	.15	39	2⅛	Voltage amplifier	100	100
								Voltage amplifier	250	150
12AU7	Twin triode	12SN7GT	Cath.	12.6 6.3	.15 .3	66	2$\frac{3}{16}$	Voltage amplifier	100	—
								Voltage amplifier	250	—
12AV6	Twin diode high-mu triode	12SQ7GT	Cath.	12.6	.150	43	2⅛	Detector and volt. amp	100	—
								Detector and volt. amp	250	—
12AV7	Double triode	—	Cath.	12.6 6.3	.225 .45	66	2$\frac{3}{16}$	Voltage amplifier	100	—
								Voltage amplifier	150	—
12AW6	R-f pentode sharp cutoff	—	Cath.	12.6	.15	49	2⅛	Voltage amplifier	100	100
								Voltage amplifier	250	150
12AX7	Twin triode	12SL7GT	Cath.	12.6 6.3	.150 .300	66	2$\frac{3}{16}$	Voltage amplifier	100	—
								Voltage amplifier	250	—
12AY7	Double triode	—	Cath.	12.6/6.3	.150/.30	66	2$\frac{3}{16}$	Voltage amplifier	250	—
12AZ7	Double triode	—	Cath.	12.6 6.3	.225 .45	66	2$\frac{3}{16}$	Voltage amplifier	100	—
								Voltage amplifier	250	—
12B4	Low-mu triode	—	Cath.	12.6 6.3	.3 .6	72	2⅝	Voltage amplifier	150	—
								Vertical sweep amp	250	—
12B4A	Low-mu triode	12B4	Cath.	12.6 6.3	.3 .6	72	2⅝	Voltage amplifier	150	—
								Vertical sweep arm	250	—
12BA6	R-f pentode remote cutoff	12SG7GT	Cath.	12.6	.15	39	2⅛	Voltage amplifier	100	100
								Voltage amplifier	250	100
12BD6	R-f pentode remote cutoff	12SK7GT	Cath.	12.6	.15	39	2⅛	Voltage amplifier	100	100
								Voltage amplifier	250	100
12BE6	Pentagrid converter remote c.o.	12SA7GT	Cath.	12.6	.15	48	2⅛	Converter	100	100
								Converter	250	100
12BF6	Duplex diode low-mu triode	12SR7GT	Cath.	12.6	.15	43	2⅛	Detector and volt. amp	250	—
12BH7	Double triode	6SN7GT	Cath.	12.6 6.3	.3 .6	66	2⅝	Voltage amplifier	250	—
								Vertical sweep amp.	350	
12BK5	Beam pentode	6BK5	Cath.	12.6	.600	93	2⅝	Power amplifier	250	250
12BK6	Duplex diode high-mu triode		Cath.	12.6	.15	43	2⅝	Voltage amplifier	100	—
								Voltage amplifier	250	—
12BN6	Gated-beam disc.		Cath.	12.6	.15	56	2⅝	F-m discriminator	80	60
12BT6	Duplex diode high-mu triode	—	Cath.	12.6	.15	43	2⅝	Voltage amplifier	100	—
								Voltage amplifier	250	—
12BU6	Duplex diode low-mu triode	—	Cath.	12.6	.15	43	2⅝	Voltage amplifier	100	—
								Voltage amplifier	250	—

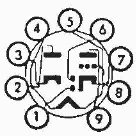

91

92

93

94

95

96

97

98

99

100

101

102

103

104

105

106

107

108

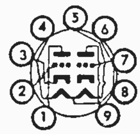
Type Designation	Description	Prototype	Cathode Heater & Filament Ratings: Type	Volts	Amps	Base Connections	Overall Height	Circuit Application	Typical Operating Voltages: Plate	Screen
12BY7	R-f pentode	—	Cath.	12.6	.3	56	2⅝	Video amplifier	250	150
				6.3	.6					
12BY7A	R-f pentode	12BY7	Cath.	12.6	.3	56	2⅝	Video amplifier	250	150
				6.3	.6					
12BZ7	Twin triode	12AX7	Cath.	12.6	.3	66	2⅝	TV sync. amplifier	250	—
				6.3	.6					
12CM6	Beam Pentode	—	Cath.	12.6	.225	104	2⅝	Power amplifier Class A1	180	180
								Power amplifier, Class A1	315	225
12G4	Triode	—	Cath.	12.6	.150	23	2⅝	Voltage amplifier	90	—
								Voltage amplifier	250	—
12H4	Triode	—	Cath.	12.6	.150	61	2⅝	Voltage amplifier	90	—
				6.3	.30			Voltage amplifier	250	—
12X4	F-w rectifier	6X4	Cath.	12.6	.3	13	2⅝	Rectifier	650	Cap
								Rectifier	900	Choke
15A6	R-f pentode	—	Cath.	15	.3	78	3 1/16	Video output amplifier	180	180
16A5	R-f pentode	—	Cath.	16.5	.3	90	3 1/16	Power output amp	170	170
								Power output amp	200	R=680
17Z3	Diode	—	Cath.	17	.3	101	3 3/16	Damper diode	4500	
19AQ5	Beam pentode	—	Cath.	18.9	.15	44	2⅝	Power amplifier	180	180
								Power amplifier	250	250
19C8	Triple diode, triode	—	Cath.	18.9	.15	112	—	Voltage amplifier	100	—
19J6	Twin triode	—	Cath.	18.9	.150	35	2⅛	Voltage amplifier	100	—
19T8	Triple diode triode	—	Cath.	18.9	.150	112	2 3/16	Detector and volt. amp	100	—
								Detector and volt. amp	250	—
19V8	Triple diode, triode	—	Cath.	18.9	.15	73	2 3/16	Voltage amplifier	100	—
								Voltage amplifier	250	—
19X3	H-w rectifier	—	Cath.	19.0	.3	91	3 1/16	Damper diode	4000	—
19X8	Triode-pentode	—	Cath.	18.9	.15	75	2 3/16	Triode, 250 mc. osc.	150	—
								pentode mixer	150	150
19Y3	H-w rectifier	—	Cath.	19.0	.3	91	3 1/16	Rectifier	900	—
21A6	R-f pentode	—	Cath.	21.5	.3	79	3 3/16	Horizontal time base	180	180
								Horizontal time base	180	180
25BK5	Beam pentode	6BK5	Cath.	25	.3	93	2⅝	Power amplifier	250	250
26A6	R-f pentode remote cutoff	—	Cath.	26.5	.07	39	2⅛	Voltage amplifier	26.5	26.5
								Voltage amplifier	250	100
26BK6	Duplex diode high-mu triode	—	Cath.	26.5	.07	43	2⅝	Voltage amplifier	100	—
								Voltage amplifier	250	—
26C6	Duplex diode low-mu triode	—	Cath.	26.5	.07	43	2⅛	Detector and volt amp.	26.5	—
								Detector and volt amp.	250	
26CG6	Pentode, remote c.o.	—	Cath.	26.5	.07	93	2⅛	Voltage amplifier	250	150
26D6	Pentagrid converter, remote cutoff	—	Cath.	26.5	.07	48	2⅛	Converter	26.5	26.5
								Converter	250	100
26Z5W	Twin diode	—	Cath.	26.5	.2	16	2 3/16	H-w rectifier	325	Cap
								H-w rectifier	450	Choke
35B5	Beam pentode	35L6GT	Cath.	35	.15	44	2⅝	Power amplifier	110	110
35C5	Beam pentode	35L6GT	Cath.	35.0	.150	52	2⅝	Power amplifier	110	110
35W4	H-w rectifier	35Z5GT	Cath.	35	.15	12	2⅝	Rectifier	117	Max. plate
45Z3	H-w rectifier	—	Cath.	45	.075	6	2⅛	Rectifier	125	Max. plate
50A1	Ballast tube	—	—	—	—	105	2⅝	Current regulator		
50B5	Beam pentode	50L6GT	Cath.	50	.15	44	2⅝	Power output amp.	110	110
50C5	Beam pentode	50L6GT	Cath.	50.0	.150	52	2⅝	Power amplifier	110	110
117Z3	H-w rectifier	117Z4GT	Cath.	117	.04	5	2⅝	Rectifier	117	—

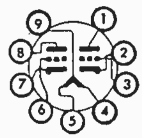

109

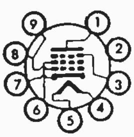

110

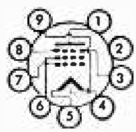

111

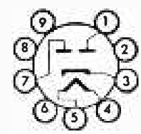

112

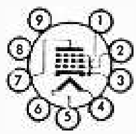

113

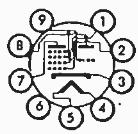

114

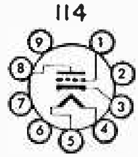

115

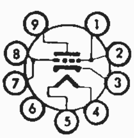

116

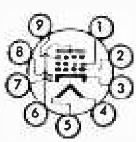

117

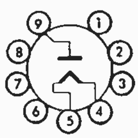

118

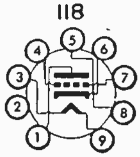

119

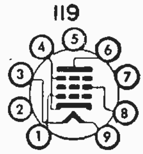

120

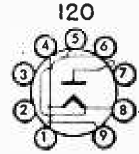

121


122


123

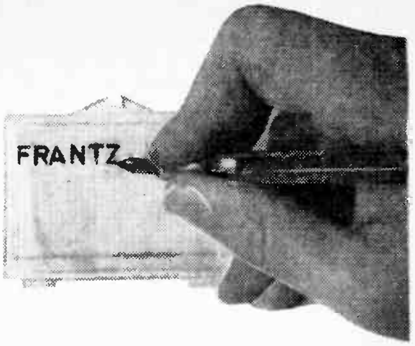

124


125


126

Getting the Most From Plastic Cases

By FORREST H. FRANTZ, SR.

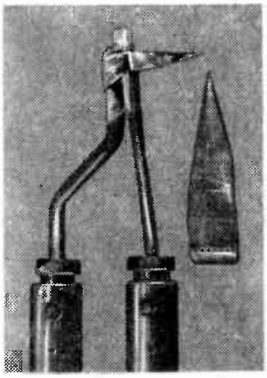


Since plastic cases melt readily, you can emboss them with a heated ice pick (use letters printed on white sheet placed inside case as guide), filling the embossing with India ink or gold ink for attractive panels.

SMALL plastic cases have become very popular as enclosures for electronic devices because of their extremely low cost and the minimum amount of work required in preparing them for use. They can be obtained from a number of sources. Some hardware stores stock them, they are frequently used to package electronic parts, and quite often to box gift products. Indeed, these plastic cases have become so popular for electronic construction that one radio parts distributor (Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, N. Y.) lists them in its catalog among other electronic supplies.

The smallest case listed by Lafayette is 1 x 1⅝ x 2⅛ in. (MS-156; cost, 9¢). This case has a ball type hinge and the two halves are easily separated. Several other sizes with the ball type hinge are available, the largest (MS-159) being 1 x 2⅝ x 3⅝ in. This range of sizes will accommodate almost any transistor construction project and many simple vacuum-tube projects. A number of additional plastic cases—some with handles—are available in larger sizes for housing more complex or bulkier equipment.

These plastic cases are clear. Sometimes, however, it is desirable to have an opaque case which will have decorative beauty by virtue of its color. All right, simply paint the inside of the case. Spraying usually gives a smooth finish, a crinkled effect can be obtained by brushing on a thick coat of enamel inside the case and then, when it is partially dry, molesting the painted surface with irregular brush marks. If the brush marks are made deep enough to leave clear openings in the paint, a second coat of paint of a different color over the first produces a two-color, mottled effect.



A soldering iron can be equipped with a tin-can scrap tip for cutting large holes in plastic cases.

Before you paint the case, wash it in lukewarm, soapy water, rinse, and dry it thoroughly. If you fail to do this, you may find the paint flaking off after a short time or you may find that there are very obvious finger prints between the plastic case and the paint coat.

Painting should be done before construction holes are made; so should decoration of the cabinet with aluminum foil, colored paper, plastic, leather, or cloth, if you plan that. Such decorating material can be applied inside or outside the case. Aluminum foil and cloth are acceptable outside case decorations; fasten them with suitable cement (Duco will hold cloth to plastic, but a "to-metal" cement such as Pliobond is required for aluminum foil). If the decorative material is to be fastened inside the case, back the cloth, paper or foil with a moderately stiff piece of paper or cardboard. Don't use cement. The control knobs fastened to the plastic case hold the interior decoration in place. If you mark dial scales with India ink on a piece of filing card cut to fit inside of the case you will have an attractive scale that will never get dirty.

If you attach aluminum foil to a plastic case, the equipment in the case is shielded. The shield connection to the equipment's chassis ground is made through a volume control case or hex nut contact to the foil. If the equipment does not include a volume control, use a lug under a machine screw or nut introduced specifically for grounding purposes.

In using any of the "fasten-to" decorative approaches, cut required holes in the material after it's fastened. To make small round holes up to about ½ in. dia., use a heated ice pick to make small pilot holes, then ream these to size with a taper reamer. To make larger round holes or square holes, use a heated knife or hacksaw blade. Or equip a soldering iron with a pointed cutter attachment made from a piece of tin can. The cutter can be made for either the quick-heat type of iron or a conventional soldering iron. (The size of the cutter attachment and the method of attaching it to the iron may have to be determined experimentally to get the right amount of heat transfer for easy cutting without excessive melting of the plastic.) Trim the edge build-up on the sides of the hole with a pocket knife and smooth with a file.

To emboss a monogram and dial marks on the case, use a heated ice pick.

WHITE'S RADIO LOG

An up-to-date broadcasting directory
AM, FM, TV and Short-Wave Stations

Vol. 36 No. 1

QUICK REFERENCE INDEX

U. S. and Canadian AM Stations by Frequency

U.S. stations listed alphabetically by states within groups, Canadian stations precede U.S.

Abbreviations: Kc., frequency in kilocycles; W.P., watt power; d—operates daytime only. Wave length is given in meters

Kc. Wave Length W.P.

540—555.5

Station	Location	W.P.
CBK	Regina, Sask.	50000
KVIP	Redding, Calif.	1000d
KFMB	San Diego, Calif.	5000
WGTO	Cypress Gardens, Florida	50000d
KBRV	Soda Springs, Idaho	500d
KWMT	Ft. Dodge, Iowa	1000d
WDVM	Pocomoke City, Md.	500d
WCNG	Canonsburg, Pa.	250d
WDXN	Clarksville, Tenn.	250d
WRIC	Richlands, Va.	1000d

550—545.1

Station	Location	W.P.
CFNB	Fredericton, N.B.	5000
CFBR	Sudbury, Ont.	1000
CHLN	Three Rivers, Que.	5000
CKPG	Prince George, B.C.	250
KENI	Anchorage, Alaska	5000
KOY	Phoenix, Ariz.	5000
KAFY	Bakersfield, Calif.	1000
KRAI	Craig, Colo.	1000
WGGA	Gainesville, Ga.	5000
KFRM	Concordia, Kansas	5000d
WHYN	Springfield, Mass.	1000
WCBI	Columbus, Miss.	1000
KSD	St. Louis, Mo.	5000
KOPR	Butte, Mont.	1000
WGR	Buffalo, N.Y.	5000
WDBM	Statesville, N.C.	500d
KFYR	Bismarck, N.Dak.	5000
WKRC	Cincinnati, Ohio	5000
KOAC	Corvallis, Oreg.	5000
WHLM	Bloomsburg, Pa.	500
WPAB	Ponce, P.R.	5000
WPAW	Pawtucket, R.I.	1000d
KMVI	Wailuku, T.H.	1000
KCRS	Midland, Tex.	5000
KTSA	San Antonio, Tex.	5000
WDEV	Waterbury, Vt.	5000
WSVA	Harrisonburg, Va.	5000
WSAU	Wausau, Wis.	5000

560—535.4

Station	Location	W.P.
CFRA	Ottawa, Ont.	5000
CJKL	Kirkland Lake, Ont.	5000
CFOS	Owen Sound, Ont.	1000
WOOF	Dothan, Ala.	5000d
KYUM	Yuma, Ariz.	1000
KSFO	San Fran., Calif.	5000
KLZ	Denver, Colo.	5000
WQAM	Miami, Fla.	5000
WIND	Chicago, Ill.	5000
WMIK	Middlesboro, Ky.	500d
WGAN	Portland, Maine	5000
WHYN	Springfield, Mass.	1000
WMIC	Monroe, Mich.	500d
WEBC	Duluth, Minn.	5000
KWTO	Springfield, Mo.	5000
KMON	Great Falls, Mont.	5000
WGAI	Elizabeth City, N.C.	1000
WFIL	Philadelphia, Pa.	5000
WIS	Columbia, S.C.	5000
WHBQ	Memphis, Tenn.	5000
KFDM	Beaumont, Tex.	5000
KPQ	Wenatchee, Wash.	5000
WJLS	Beckley, W.Va.	5000

570—526.0

Station	Location	W.P.
CKEK	Cranbrook, B.C.	1000
CKCQ	Quesnel, B.C.	1000
CJEM	Edmundston, N.B.	1000
WCAS	Gadsden, Ala.	5000d
KCNO	Alturas, Calif.	1000
KLAC	Los Angeles, Calif.	5000
WGMS	Washington, D.C.	5000
WACL	Waycross, Ga.	5000
WKYB	Paducah, Ky.	1000
WVMI	Biloxi, Miss.	1000d
KGRT	Las Cruces, N.Mex.	1000d
WMCA	New York, N.Y.	5000
WSYR	Syracuse, N.Y.	5000
WWNC	Asheville, N.C.	5000
WMSN	Raleigh, N.C.	500d
WKBN	Youngstown, Ohio	5000
WNAX	Yankton, S.Dak.	5000
WFAA	Dallas, Tex.	5000
WBAP	Ft. Worth, Tex.	5000
KLUB	Salt Lake City, Utah	5000
KVI	Seattle, Wash.	5000
WMAM	Marinette, Wis.	250

580—516.9

Station	Location	W.P.
CFCL	Timmins, Ont.	1000
CJFX	Antigonish, N.S.	5000
CKEY	Toronto, Ont.	5000
CKPR	Ft. William, Ont.	5000
CKUA	Edmonton, Alta.	1000
CKY	Winnipeg, Man.	5000
WTUS	Tuskegee, Ala.	500d
KCNA	Tucson, Ariz.	5000
KMJ	Fresno, Calif.	5000
KUBC	Montrose, Colo.	5000
WDBO	Orlando, Fla.	5000
WGAC	Augusta, Ga.	5000
KFXD	Nampa, Idaho	5000
WILL	Urbana, Ill.	5000d
KSAC	Manhattan, Kans.	5000
WIBW	Topeka, Kans.	5000
KALB	Alexandria, La.	5000
WTAG	Worcester, Mass.	5000
WELO	Tupelo, Miss.	1000
WHP	Harrisburg, Pa.	5000
WKAQ	San Juan, P.R.	5000
WRKH	Rockwood, Tenn.	500d
KDAV	Lubbock Tex.	500d
WCHS	Charleston, W.Va.	5000
WKTY	LaCrosse, Wis.	1000

590—508.2

Station	Location	W.P.
CFAR	FlinFlon, Man.	1000
CKAR	Huntsville, Ont.	1000
CKRS	Jonquiere, Que.	1000
VOCM	St. Johns, N.F.	10000
WRAG	Carrollton, Ala.	1000d
KBHS	Hot Springs, Ark.	5000d
KFXM	San Bernardino, Cal.	1000
KCSJ	Pueblo, Colo.	1000
WDLP	Panama City, Fla.	1000
WAGA	Atlanta, Ga.	5000
KGMB	Honolulu, Hawaii	5000
KID	Idaho Falls, Idaho	5000
WVLK	Lexington, Ky.	1000
WEEI	Boston, Mass.	5000
WKZO	Kalamazoo, Mich.	5000
WOW	Omaha, Nebr.	5000
WROW	Albany, N.Y.	5000
WGTM	Wilson, N.C.	5000
KUGN	Eugene, Oreg.	5000
WARM	Scranton, Pa.	5000
WMBS	Uniontown, Pa.	1000
KTBC	Austin, Tex.	5000
KSUB	Cedar City, Utah	1000
WLVA	Lynchburg, Va.	1000
KHQ	Spokane, Wash.	5000

600—499.7

Station	Location	W.P.
CFCF	Montreal, Que.	5000
CFCH	North Bay, Ont.	1000
CFQC	Saskatoon, Sask.	5000
CJOR	Vancouver, B.C.	5000
CKCL	Truro, N.S.	1000
WIRB	Enterprise, Ala.	1000
KCLS	Flagstaff, Ariz.	5000
KVCV	Redding, Calif.	1000
KFSD	San Diego, Calif.	5000
WICC	Bridgeport, Conn.	1000
WPDQ	Jacksonville, Fla.	5000
WMT	Cedar Rapids, Iowa	5000
WYFE	New Orleans, La.	1000d
WFST	Caribou, Maine	5000d
WCAO	Baltimore, Md.	5000
WTAC	Flint, Mich.	1000
KGEZ	Kalispell, Mont.	2000
WSJS	Winston-Salem, N.C.	5000

Kc. Wave Length		W.P.
KSJB	Jamestown, N.D.	5000
WFRM	Coudersport, Pa.	1000d
WAEL	Mayaguez, P.R.	1000
WREC	Memphis, Tenn.	5000
KROD	El Paso, Tex.	5000
KERB	Kermit, Tex.	1000d
KTBB	Tyler, Tex.	1000

610—491.5

CHNC	New Carlisle, Que.	5000
CJAT	Trail, B.C.	1000
CKKL	Thompson, Man.	1000
CKTB	St. Catharines, Ont.	5000
WSGN	Birmingham, Ala.	5000
KAVL	Lancaster, Calif.	1000
KFRC	San Francisco, Calif.	5000
WCKR	Miami, Fla.	5000
WCEH	Hawkinsville, Ga.	500d
KUAM	Agana, Guam	1000
KESE	Iowa Falls, Iowa	250
WRUS	Russellville, Ky.	500d
KDAL	Duluth, Minn.	5000
WDAF	Kansas City, Mo.	5000
KOJM	Havre, Mont.	1000
WGIR	Manchester, N.H.	5000
KGGM	Albuquerque, N.Mex.	5000
WAYS	Charlotte, N.C.	5000
WTVN	Columbus, Ohio	5000
WIP	Philadelphia, Pa.	5000
KILT	Houston, Tex.	5000
KVNU	Logan, Utah	1000
WSLS	Roanoke, Va.	5000
KEPR	Kennewick, Wash.	5000

620—483.6

CKCK	Regina, Sask.	5000
KTAR	Phoenix, Ariz.	5000
KNGS	Hanford, Calif.	1000
KSTR	Grand Junction, Colo.	5000d
WSUN	St. Petersburg, Fla.	5000
WTRP	LaGrange, Ga.	1000d
KWAL	Wallace, Idaho	1000
KMNS	Sioux City, Iowa	1000
WTMT	Louisville, Ky.	500d
WLBZ	Bangor, Maine	5000
WJDX	Jackson, Miss.	5000
WVNJ	Newark, N.J.	5000
WHEN	Syracuse, N.Y.	5000
WDNC	Durham, N.C.	5000
KGW	Portland, Oreg.	5000
WHJB	Greensburg, Pa.	1000
WCAY	Cayce, S.C.	500d
WATE	Knoxville, Tenn.	5000
KWFT	Wichita Falls, Tex.	5000
WCAX	Burlington, Vt.	5000
WWNR	Beckley, W.Va.	1000
WTMJ	Milwaukee, Wis.	5000

630—475.9

CFCO	Chatham, Ont.	1000
CHLT	Sherbrooke, Que.	5000
CFCY	Charlottetown, P.E.I.	5000
CJET	Smith Falls, Ont.	1000
CKRC	Winnipeg, Man.	5000
CKOV	Kelowna, B.C.	1000
CKYL	Peace River, Alta.	1000
WAVU	Albertville, Ala.	1000d
WJDB	Thomasville, Ala.	1000d
KJNO	Juneau, Alaska	1000
KVMA	Magnolia, Ark.	1000d
KIDD	Monterey, Calif.	1000
KHOW	Denver, Colo.	5000
WMAL	Washington, D.C.	5000
WSAV	Savannah, Ga.	5000
KIDO	Boise, Idaho	5000
WLAP	Lexington, Ky.	5000
KTIB	Thibodaux, La.	500
WJMS	Ironwood, Mich.	1000
KXOK	St. Louis, Mo.	5000
KOH	Reno, Nev.	5000
KLEA	Lovington, N.Mex.	500
WIRC	Hickory, N.C.	1000d
WMFD	Wilmington, N.C.	1000
WEJL	Scranton, Pa.	500d
WPRO	Providence, R.I.	5000
KGFX	Pierre, S.Dak.	250
KPOA	Honolulu, T.H.	5000
KMAC	San Antonio Tex.	5000
KGDN	Edmunds, Wash.	1000d
KZUN	Opportunity, Wash.	500d

640—468.5

CBN	St. John's, N.F.	10000
KFI	Los Angeles, Calif.	50000
WOI	Ames, Iowa	5000d
WHKK	Akron, Ohio	1000
WNAD	Norman, Okla.	1000d

650—461.3

WSM	Nashville, Tenn.	50000
KRCT	Baytown, Texas	250d

660—454.3

KFAR	Fairbanks, Alaska	10000
KOWH	Omaha, Nebr.	500d
WRCA	New York, N.Y.	50000
WESC	Greenville, S.C.	5000d
KSKY	Dallas, Tex.	1000

670—447.5

WMAQ	Chicago, Ill.	50000

680—440.9

CHFA	Edmonton, Alta.	5000
CHLO	St. Thomas, Ont.	1000
CJOB	Winnipeg, Man.	10000
CKGB	Timmins, Ont.	5000
KNBC	San Fran., Calif.	50000
WPIN	St. Petersburg, Fla.	1000d
WCTT	Corbin, Ky.	1000
WCBM	Baltimore, Md.	10000
WNAC	Lawrence, Mass.	50000
WDBC	Escanaba, Mich.	1000
KFEQ	St. Joseph, Mo.	5000
WINR	Binghamton, N.Y.	1000
WRVM	Rochester, N.Y.	250d
WPTF	Raleigh, N.C.	50000
WISR	Butler, Pa.	250d
WAPA	San Juan, P.Rico.	10000
WMPS	Memphis, Tenn.	10000
KENS	San Antonio, Tex.	50000
KOMW	Omak, Wash.	1000d

690—434.5

CBU	Vancouver, B.C.	10000
CBF	Montreal, Que.	50000
WVOK	Birmingham, Ala.	50000d
KVNA	Flagstaff, Ariz.	1000
KEVT	Tucson, Ariz.	250d
KBBA	Benton, Ark.	250d
WADS	Ansonia, Conn.	500d
KBLI	Blackfoot, Idaho	1000d
KGGF	Coffeyville, Kans.	10000
WTIX	New Orleans, La.	5000
KSTL	St. Louis, Mo.	1000d
KRCO	Prineville, Oreg.	1000d
KUSD	Vermillion, S.Dak.	1000d
KULA	Honolulu, T.H.	10000
KHEY	El Paso, Tex.	10000
KPET	Lamesa, Tex.	250
KZEY	Tyler, Tex.	250d
WCYB	Bristol, Va.	10000d
WNNT	Warsaw, Va.	250d
WELD	Fisher, W.Va.	500d

700—428.3

WLW	Cincinnati, Ohio	50000

710—422.3

CJSP	Leamington, Ont.	250d
CFRG	Gravelbourg, Sask.	5000d
CKVM	Ville Marie, Que.	1000
WKRG	Mobile, Ala.	1000
KMPC	Los Angeles, Calif.	50000
KMYR	Denver, Colo.	5000
WGBS	Miami, Fla.	50000
WROM	Rome, Ga.	1000d
KEEL	Shreveport, La.	10000
WHB	Kansas City, Mo.	10000
WOR	New York, N.Y.	50000
DZRH	Manila, P.I.	10000
WKJB	Mayaguez, P.Rico	1000
WTPR	Paris, Tenn.	250d
KGNC	Amarillo, Tex.	10000
KURV	Edinburg, Tex.	250
KIRO	Seattle, Wash.	50000
WDSM	Superior, Wis.	5000

720—416.4

WGN	Chicago, Ill.	50000

730—410.7

CJNR	Blind River, Ont.	1000
CKAC	Montreal, Que.	50000
CKDM	Dauphin, Man.	1000
CKLG	No. Vancouver, B.C.	10000
KFQD	Anchorage, Alaska	10000
WJMW	Athens, Ala.	1000d
KNBY	Newport, Ark.	1000d
WKTG	Thomasville, Ga.	1000d
KBLR	Goodland, Kans.	1000d
WFMW	Madisonville, Ky.	250d
WMTC	Vancleve, Ky.	1000d
KTRY	Bastrop, La.	250d
WARB	Covington, La.	250d
WMMS	Bath, Maine	500d
WACE	Chicopee, Mass.	1000d
KWRE	Warrenton, Mo.	500d
KWOA	Worthington, Minn.	1000d
WDOS	Oneonta, N.Y.	500d
WFMC	Goldsboro, N.C.	1000d
WOHS	Shelby, N.C.	1000d
WTLG	Bowling Green, Ohio	250d
KBOY	Medford, Oreg.	1000d
WNAK	Nanticoke, Pa.	1000d
WPIT	Pittsburgh, Pa.	1000d
WPAL	Charleston, S.C.	1000d
WLIL	Lenoir, Tenn.	1000d
KBCS	Grand Prairie, Tex.	500d
KKOG	Ogden, Utah	1000d
WPIK	Alexandria, Va.	1000d
WMNA	Gretna, Va.	1000d
KULE	Ephrata, Wash.	1000d

740—405.2

CBXA	Edmonton, Alta.	250
CBL	Toronto, Ont.	50000
WBAM	Montgomery, Ala.	50000d
KUEQ	Phoenix, Ariz.	1000d
KBIG	Avalon, Calif.	10000d
KCBS	San Francisco, Calif.	50000
KWBY	Colo. Sprgs., Colo.	250d
KVFC	Cortez, Colo.	1000d
WKIS	Orlando, Fla.	5000
KYME	Boise, Idaho	500d
WVLN	Olney, Ill.	250d
KBOE	Oskaloosa, Iowa	250d
WNOP	Newport, Ky.	1000d
WTAO	Cambridge, Mass.	250d
KPBM	Carlsbad, N.Mex.	1000d
WGSM	Huntington, N.Y.	1000d
WMBL	Morehead City, N.C.	1000d
WPAQ	Mount Airy, N.C.	10000d
KRMG	Tulsa, Okla.	50000
WVCH	Chester, Pa.	1000d
WIBS	Santurce, P.Rico	10000d
WBAW	Barnwell, S.C.	500d
WIRJ	Humbolt, Tenn.	250d
WJIG	Tullahoma, Tenn.	250d
KTRH	Houston, Tex.	50000

750—399.8

WSB	Atlanta, Ga.	50000
WBMD	Baltimore, Md.	1000d
KMMJ	Grand Island, Neb.	1000
WHEB	Portsmouth, N.H.	1000
KSEO	Durant, Okla.	250d
KXL	Portland, Oreg.	10000
WPDX	Clarksburg, W.Va.	1000d

760—394.5

KGU	Honolulu, Hawaii	10000
WJR	Detroit, Mich.	50000
WCPS	Tarboro, N.C.	1000

770—389.4

KUOM	Minneapolis, Minn.	5000d
WCAL	Northfield, Minn.	5000d
WEW	St. Louis, Mo.	1000d
KOB	Albuquerque, N. Mex.	50000
WABC	New York, N.Y.	50000
KXA	Seattle, Wash.	1000

780—384.4

WBBM	Chicago, Ill.	50000
WJAG	Norfolk, Neb.	1000
WCKB	Dunn, N.C.	1000d
WBBO	Forest City, N.C.	1000d
KSPI	Stillwater, Okla.	250d
WARL	Arlington, Va.	1000d

790—379.5

CBY	Corner Brook, N.F.	1000
CKMR	Newcastle, N.B.	1000
CKSO	Sudbury, Ont.	5000
WTUG	Tuscaloosa, Ala.	500d
KCEE	Tucson, Ariz.	1000d
KOSY	Texarkana, Ark.	1000
KDAN	Eureka, Calif.	5000d
KABC	Los Angeles, Calif.	5000
WLBE	Leesburg, Fla.	1000
WPFA	Pensacola, Fla.	1000d
WQXI	Atlanta, Ga.	5000
WGRA	Cairo, Ga.	1000d
KXXX	Colby, Kans.	5000d
WGRC	Louisville, Ky.	5000
WRUM	Rumford, Me.	1000d
WSGW	Saginaw, Mich.	1000
KGHL	Billings, Mont.	5000
WWNY	Watertown, N.Y.	1000
WLSV	Wellsville, N.Y.	500d
WTNC	Thomasville, N.C.	1000d
WKLM	Wilmington, N.C.	500d
KXGO	Fargo, N.Dak.	5000
KWIL	Albany, Oreg.	1000
WAEB	Allentown, Pa.	500
WPIC	Sharon, Pa.	1000d
WEAN	Providence, R.I.	5000
WWBD	Bamberg, S.C.	1000d
WETB	Johnson City, Tenn.	1000d
WMC	Memphis, Tenn.	5000
KTHT	Houston, Tex.	5000
KFYO	Lubbock, Tex.	5000
WSIG	Mount Jackson, Va.	1000d
WTAR	Norfolk, Va.	5000
KVOS	Bellingham, Wash.	1000
KNEW	Spokane, Wash.	5000
WEAU	Washington, Wis.	5000

800—374.8

CHAB	Moose Jaw, Sask.	10000
CKOK	Penticton, B.C.	1000
CFOB	Ft. Frances, Ont.	1000
CJBQ	Belleville, Ont.	1000
CKLW	Windsor, Ont.	50000
CHRC	Quebec, Que.	10000
CJAD	Montreal, Que.	10000
VOWR	St. Johns, N.F.	1000
WHOS	Decatur, Ala.	1000d
WMGY	Montgomery, Ala.	1000d
KINY	Juneau, Alaska	5000
KAGH	Crossett, Ark.	250d
KVOM	Morrilton, Ark.	250d
KHIL	Brighton, Colo.	500d
WLAD	Danbury, Conn.	250d
WMBM	Miami Beach, Fla.	1000d
WSUZ	Palatka, Fla.	1000d
WJAT	Swainsboro, Ga.	1000d
KXIC	Iowa City, Iowa	1000d
WRUS	Russellville, Ky.	1000d
WBOK	New Orleans, La.	1000d
WCCM	Lawrence, Mass.	1000d
KREI	Farmington, Mo.	1000d
KDBM	Dillon, Mont.	1000d
WKDN	Camden, N.J.	1000d
KTOW	Okla. City, Okla.	250d
KPDQ	Portland, Oreg.	1000d
WCHA	Chambersburg, Pa.	1000d
DZPI	Manila, P.I.	10000
WDSC	Dillon, S.C.	1000d
WEAB	Greer, S.C.	250d
WDEH	Sweetwater, Tenn.	1000d
KDDD	Dumas, Tex.	250d
KBUH	Brigham City, Utah	250d
WSVS	Crewe, Va.	1000d
WHTN	Huntington, W.Va.	1000d
WDUX	Waupaca, Wis.	1000d

810—370.2

KGO	San Francisco, Calif.	50000
WABW	Annapolis, Md.	250d
KCMO	Kansas City, Mo.	50000
WGY	Schenectady, N.Y.	50000
WKBC	N.Wilkesboro, N.C.	1000d
WCEC	Rocky Mount, N.C.	1000d
WEDO	McKeesport, Pa.	1000d
WKVM	San Juan, P.R.	25000

820—365.6

WAIT	Chicago, Ill.	5000d
WCBD	Chicago, Ill.	5000d
WIKY	Evansville, Ind.	250d
WOSU	Columbus, Ohio	5000d
KIKI	Honolulu, Hawaii	250
WFAA	Dallas, Tex.	50000
WBAP	Ft. Worth, Tex.	50000

830—361.2

WCCO	Minneapolis, Minn.	50000
KBOA	Kennett, Mo.	1000d
WNYC	New York, N.Y.	1000d

840—356.9

WKAB	Mobile, Ala.	1000d
WKNB	New Britain, Conn.	1000d
WHAS	Louisville, Ky.	50000
WVPO	Stroudsburg, Pa.	250d

850—352.7

CKVL	Verdun, Que.	50000
CKRD	Red Deer, Alta.	1000
WYDE	Birmingham, Ala.	10000
KOA	Denver, Colo.	50000
WRUF	Gainesville, Fla.	5000
WEAT	W. Palm Beach, Fla.	1000
KILA	Hilo, Hawaii	1000
WHDH	Boston, Mass.	50000
WKBZ	Muskegon, Mich.	1000
KFUO	St. Louis, Mo.	5000d
WKIX	Raleigh, N.C.	10000
WJW	Cleveland, Ohio	5000
WEEU	Reading, Pa.	1000
WABA	Aguadilla, P.R.	250
WRAP	Norfolk, Va.	5000
KTAC	Tacoma, Wash.	1000

860—348.6

CJBC	Toronto, Ont.	50000
WHRT	Hartselle, Ala.	250d
WAMI	Opp, Ala.	1000d
KIFN	Phoenix, Ariz.	1000d
KOSE	Osceola, Ark.	1000d
KWRF	Warren, Ark.	250d
KTRB	Modesto, Calif.	10000
WKKO	Cocoa, Fla.	1000d
WERD	Atlanta, Ga.	1000d
WDMG	Douglas, Ga.	5000d
WMRI	Marion, Ind.	250d
KWPC	Muscatine, Iowa	250d
KOAM	Pittsburg, Kans.	10000
WSON	Henderson, Ky.	500d
WAYE	Dundalk, Md.	500d
WSBS	Gt. Barrington, Mass.	250d
KNUJ	New Ulm, Minn.	1000d
WMAG	Forest, Miss.	500d
WFMO	Fairmont, N.C.	1000d
WAMO	Homestead, Pa.	250d
WTEL	Philadelphia, Pa.	250d
WLBG	Laurens, S.C.	250d
WIVK	Knoxville, Tenn.	1000d
WMTS	Murfreesboro, Tenn.	250d
KFST	Ft. Stockton, Tex.	250d
KPAN	Hereford, Tex.	250d
KSFA	Nacogdoches, Tex.	1000d
KONO	San Antonio, Tex.	5000d
KWHO	Salt Lake City, Utah	1000d
WEVA	Emporia, Va.	1000d
WOAY	Oak Hill, W.Va.	10000d
WFOX	Milwaukee, Wis.	250d

870—344.6

KIEV	Glendale, Calif.	250d
KAIM	Kaimuki, Hawaii	1000
WWL	New Orleans, La.	50000
WKAR	E. Lansing, Mich.	5000d
WHCU	Ithaca, N.Y.	1000d
WGTL	Kannapolis, N.C.	1000d
KJIM	Ft. Worth, Tex.	250d
WFLO	Farmville, Va.	1000d

880—340.7

WCBS	New York, N.Y.	50000

Kc. Wave Length W.P.

WRRZ	Clinton, N.C.	1000d
WRFD	Worthington, Ohio	5000d

890—336.9

WLS	Chicago, Ill.	50000
WHNC	Henderson, N.C.	1000d
KBYE	Okla. City, Okla.	1000d

900—333.1

CKTS	Sherbrooke, Que.	1000
CHML	Hamilton, Ont.	5000
CHNO	Sudbury, Ont.	1000
CJBR	Rimouski, Que.	10000
CKJL	St. Jerome, Que.	1000
CJVI	Victoria, B.C.	10000
CKBI	Prince Albert, Sask.	10000
CJGX	Yorkton, Sask.	10000
WATV	Birmingham, Ala.	1000d
WOZK	Ozark, Ala.	1000d
KFRB	Fairbanks, Alaska	10000
KHOZ	Harrison, Ark.	250d
KBIF	Centerville, Calif.	1000d
WJWL	Georgetown, Del.	1000d
WSWN	Belle Glade, Fla.	1000d
WMOP	Ocala, Fla.	1000d
WCGA	Calhoun, Ga.	1000d
WCRY	Macon, Ga.	250d
WJIV	Savannah, Ga.	1000d
KSIR	Wichita, Kan.	250
WKYW	Louisville, Ky.	1000d
WLSI	Pikeville, Ky.	1000d
KREH	Oakdale, La.	250d
WCME	Brunswick, Maine	500d
WATC	Gaylord, Mich.	1000d
KTIS	Minneapolis, Minn.	1000d
WDDT	Greenville, Miss.	1000d
KFAL	Fulton, Mo.	1000d
KJSK	Columbus, Nebr.	1000d
WOTW	Nashau, N.H.	1000d
WBRV	Boonville, N.Y.	500d
WSPN	Saratoga Sprgs., N.Y.	250d
WAYN	Rockingham, N.C.	1000d
WIAM	Williamston, N.C.	1000d
KFNW	Fargo, N.Dak.	1000d
WAND	Canton, Ohio	500d
WFRO	Fremont, Ohio	500d
KLAD	Klamath Falls, Oreg.	1000d
WCPA	Clearfield, Pa.	1000d
WKXV	Knoxville, Tenn.	1000d
WCOR	Lebanon, Tenn.	250d
KALT	Atlanta, Tex.	1000d
KMCO	Conroe, Tex.	500d
KFLD	Floydada, Tex.	250d
KCLW	Hamilton, Tex.	250d
WAFC	Staunton, Va.	1000d
KUEN	Wenatchee, Wash.	500
WATK	Antigo, Wis.	250d

910—329.5

CJDV	Drumheller, Alta.	1000
CKLY	Lindsay, Ont.	1000
CBO	Ottawa, Ont.	5000
CFJC	Kamloops, B.C.	1000
CHRL	Roberval, Que.	1000
KPHO	Phoenix, Ariz.	5000
KLCN	Blytheville, Ark.	5000d
KAMD	Camden, Ark.	1000
KDEO	El Cajon, Calif.	1000
KLX	Oakland, Calif.	5000
KOXR	Oxnard, Calif.	1000d
KPOF	nr. Denver, Colo.	5000
WHAY	New Britain, Conn.	5000
WPLA	Plant City, Fla.	1000d
WGAF	Valdosta, Ga.	5000
WSUI	Iowa City, Iowa	5000
WLCS	Baton Rouge, La.	1000
WABI	Bangor, Maine	5000
WFDF	Flint, Mich.	5000
WCOC	Meridian, Miss.	5000
KOYN	Billings, Mont.	1000d
KBIM	Roswell, N.Mex.	5000d
WLAS	Jacksonville, N.C.	1000d
KCJB	Minot, N.Dak.	1000
WPFB	Middletown, Ohio	1000
KGLC	Miami, Okla.	1000
KURY	Brookings, Oreg.	500
WAVL	Apollo, Pa.	1000d
WGBI	Scranton, Pa.	1000
WSBA	York, Pa.	1000
WPRP	Ponce, P.R.	5000
WORD	Spartanburg, S.C.	1000
WJHL	Johnson City, Tenn.	5000
WEPG	S. Pittsburgh, Tenn.	500d
KRIO	McAllen, Tex.	1000
KRRV	Sherman, Tex.	1000
KALL	Salt Lake City, Utah	1000
WRNL	Richmond, Va.	5000
WHYE	Roanoke, Va.	1000d
KORD	Pasco, Wash.	1000d
KQDE	Renton, Wash.	1000
KVAN	Vancouver, Wash.	1000
WHSM	Hayward, Wis.	1000d
WDOR	Sturgeon Bay, Wis.	500d

920—325.9

CJCH	Halifax, N.S.	10000
CKNX	Wingham, Ont.	2500
WCTA	Adalusia, Ala.	5000
WWWR	Russellville, Ala.	1000d
KARK	Little Rock, Ark.	5000
KDES	Palm Springs, Calif.	1000d
KVEC	San Luis Obispo, Cal.	1000
KIUP	Durango, Colo.	5000
KREX	Grd. Junction, Colo.	5000
KLMR	Lamar, Colo.	1000
WMEG	Eau Gallie, Fla.	1000d
WGST	Atlanta, Ga.	5000
KAHU	Waiphau, Hawaii	1000
WMOK	Metropolis, Ill.	1000d
WBAA	W. Lafayette, Ind.	5000
KFNF	Shenandoah, Iowa	1000
WTCW	Whitesburg, Ky.	1000d
WHXY	Bogalusa, La.	1000d
WPTX	Lexington Pk., Md.	500d
WMPL	Hancock, Mich.	1000d
KDHL	Faribault, Minn.	1000
KWAD	Wadena, Minn.	1000
KRAM	Las Vegas, Nev.	1000
KOLO	Reno, Nev.	1000
KQEO	Albuquerque, N.Mex.	1000
WTTM	Trenton, N.J.	1000
WKRT	Cortland, N.Y.	1000
WSKN	Saugerties, N.Y.	1000d
WBBB	Burlington, N.C.	5000d
WMNI	Columbus, Ohio	500
KGAL	Lebanon, Oreg.	1000
WKVA	Lewistown, Pa.	1000d
WJAR	Providence, R.I.	5000
WTND	Orangeburg, S.C.	1000d
WLIV	Livingston, Tenn.	1000d
KELP	El Paso, Tex.	1000
KECK	Odessa, Tex.	1000
KTLW	Texas City, Tex.	1000d
KXLY	Spokane, Wash.	5000
WMMN	Fairmont, W.Va.	5000
WOKY	Milwaukee, Wis.	1000

930—322.4

CFBC	Saint John, N.B.	5000
CJCA	Edmonton, Alta.	5000
CJON	St. John's, N.F.	10000
WETO	Gadsden, Ala.	1000d
KTKN	Ketchikan, Alaska	1000
KAPR	Douglas, Ariz.	1000d
KHJ	Los Angeles, Calif.	5000
KIUP	Durango, Colo.	5000
WKSB	Milford, Del.	500d
WJAX	Jacksonville, Fla.	5000
WKXY	Sarasota, Fla.	1000
WMGR	Bainbridge, Ga.	5000d
KSEI	Pocatello, Idaho	5000
WTAD	Quincy, Ill.	5000
WKCT	Bowling Green, Ky.	1000
WFMD	Frederick, Md.	1000
WREB	Holyoke, Mass.	500d
WBCK	Battle Creek, Mich.	1000
WSLI	Jackson, Miss.	5000
KWOC	Poplar Bluff, Mo.	1000
KOFI	Kalispell, Mont.	5000d
KOGA	Ogallala, Nebr.	500d
WWNH	Rochester, N.H.	5000d
WPAT	Paterson, N.J.	5000
WBEN	Buffalo, N.Y.	5000
WIST	Charlotte, N.C.	5000
WRRF	Washington, N.C.	5000
WEOL	Elyria, Ohio	1000
WKY	Oklahoma City, Okla.	5000
WCNR	Bloomsburg, Pa.	1000d
KSDN	Aberdeen, S.D.	1000
WSEV	Sevierville, Tenn.	5000d
KDET	Center, Tex.	1000d
KITE	San Antonio, Tex.	5000d
KENY	Bellingham-Ferndale Wash.	1000d
WSAZ	Huntington, W.Va.	5000
WLBL	Auburndale, Wis.	5000d

940—319.0

CBM	Montreal, Que.	50000
CJGX	Yorkton, Sask.	10000
CJIB	Vernon, B.C.	1000
KFRE	Fresno, Calif.	50000
WINZ	Miami, Fla.	50000
WMAZ	Macon, Ga.	10000
WMIX	Mt. Vernon, Ill.	1000
KIOA	Des Moines, Iowa	10000
WYLD	New Orleans, La.	1000
WESA	Charleroi, Pa.	250
WIPR	San Juan, P.R.	10000
KLYN	Amarillo, Tex.	1000

950—315.6

CKNB	Campbellton, N.B.	1000
CKBB	Barrie, Ont.	1000
WRMA	Montgomery, Ala.	1000d
KXJK	Forrest City, Ark.	5000d
KFSA	Ft. Smith, Ark.	1000
KAHI	Auburn, Calif.	500d
KIMN	Denver, Colo.	5000
WFBS	Ft. Walton Bch., Fla.	1000d
WLOF	Orlando, Fla.	5000
WGTA	Summerville, Ga.	1000d
WGOV	Valdosta, Ga.	5000
KBOI	Boise, Idaho	5000
KLER	Orofino, Idaho	500d
WAAF	Chicago, Ill.	1000d
WXLW	Indianapolis, Ind.	5000d
KOEL	Oelwein, Iowa	1000
KJRG	Newton, Kans.	500d
WBVL	Barbourville, Ky.	1000d
WORL	Boston, Mass.	5000d
WWJ	Detroit, Mich.	5000
WBKH	Hattiesburg, Miss.	5000d
KLIK	Jefferson City, Mo.	5000d
WBBF	Rochester, N.Y.	1000
WIBX	Utica, N.Y.	5000
WPET	Greensboro, N.C.	500d
WNCC	Barnesboro, Pa.	500d
WPEN	Philadelphia, Pa.	5000
WSPA	Spartanburg, S.C.	5000
KWAT	Watertown, S.Dak.	1000
WAGG	Franklin, Tenn.	1000d
KDSX	Denison, Tex.	500
KPRC	Houston, Tex.	5000
KSEL	Lubbock, Tex.	1000
WXGI	Richmond, Va.	1000d
KJR	Seattle, Wash.	5000
WKAZ	Charleston, W.Va.	5000
WSHE	Sheboygan, Wis.	500d

960—312.3

CFAC	Calgary, Alta.	5000
CHNS	Halifax, N.S.	10000
CKWS	Kingston, Ont.	5000
WBRC	Birmingham, Ala.	5000
WMOZ	Mobile, Ala.	1000
KOOL	Phoenix, Ariz.	5000
KAVR	Apple Valley, Calif.	5000d
KNEZ	Lompoc, Calif.	500
KROW	Oakland, Calif.	1000
WELI	New Haven, Conn.	5000
WJCM	Sebring, Fla.	1000d
WRFC	Athens, Ga.	5000
WSBT	South Bend, Ind.	5000
KMA	Shenandoah, Iowa	5000
WPRT	Prestonsburg, Ky.	1000d
KROF	Abbeville, La.	1000d
WBOC	Salisbury, Md.	5000
WHAK	Rogers City, Mich.	5000d
KLTF	Little Falls, Minn.	500d
WABG	Greenwood, Miss.	1000
KFVS	Cape Girardeau, Mo.	1000
KNEB	Scottsbluff, Nebr.	1000
KWYK	Farmington, N.Mex.	1000d
WEAV	Plattsburg, N.Y.	5000
WFTC	Kinston, N.C.	5000
WWST	Wooster, Ohio	1000d
KGWA	Enid, Okla.	1000
WHYL	Carlisle, Pa.	1000d
WADP	Kano, Pa.	500d
WATS	Sayre, Pa.	1000d
WBEU	Beaufort, S.C.	1000d
WBMC	McMinnville, Tenn.	500d
KIMP	Mt. Pleasant, Tex.	1000d
KGKL	San Angelo, Tex.	5000
KOVO	Provo, Utah	5000
WDBJ	Roanoke, Va.	5000
KALE	Richland, Wash.	1000
WTCH	Shawano, Wis.	1000

970—309.1

CKCH	Hull, Que.	5000
WERH	Hamilton, Ala.	5000d
WTBF	Troy, Ala.	5000
KNEA	Jonesboro, Ark.	1000d
KBIS	Bakersfield, Calif.	1000
KCHV	Coachella, Calif.	1000d
KBEE	Modesto, Calif.	1000
KFEL	Pueblo, Colo.	1000d
WFLA	Tampa, Fla.	5000
WIIN	Decatur, Ga.	1000d
WVOP	Vidalia, Ga.	5000d
KHBC	Hilo, Hawaii	1000
KAYT	Rupert, Idaho	1000d
WMAY	Springfield, Ill.	1000
WAVE	Louisville, Ky.	5000
KSYL	Alexandria, La.	1000
WCSH	Portland, Maine	5000
WAMD	Aberdeen, Md.	500d
WESO	Southbridge, Mass.	1000d
WKHM	Jackson, Mich.	1000
KOOK	Billings, Mont.	5000
KJLT	No. Platte, Nebr.	5000d
WNTA	Newark, N.J.	5000
WEBR	Buffalo, N.Y.	5000
WCHN	Norwich, N.Y.	500d
WRCS	Ahoskie, N.C.	1000d
WWIT	Canton, N.C.	1000d
WDAY	Fargo, N.Dak.	5000
WICA	Ashtabula, Ohio	5000
WATH	Athens, Ohio	1000d
KAKC	Tulsa, Okla.	1000
KOIN	Portland, Oreg.	5000
WWSW	Pittsburgh, Pa.	5000
WJMX	Florence, S.C.	5000
KNOK	Ft. Worth, Tex.	1000d
KREM	Spokane, Wash.	5000
WWYO	Pineville, W.Va.	1000d
WHA	Madison, Wis.	5000d

980—305.9

CKNW	New Westminster, Brit. Columbia	5000
CFPL	London, Ont.	5000
CBV	Quebec, Que.	5000
CHEX	Peterboro, Ont.	5000
CKRM	Regina, Sask.	5000
WKLF	Clanton, Ala.	1000d
KINS	Eureka, Calif.	5000
KEAP	Fresno, Calif.	500d
KFWB	Los Angeles, Calif.	5000
KGLN	GlenwoodSprgs., Colo.	1000d
WSUB	Groton, Conn.	1000
WRC	Washington, D.C.	5000
WDVH	Gainesville, Fla.	5000d
WTOT	Marianna, Fla.	1000d
WBOP	Pensacola, Fla.	500d
WKLY	Hartwell, Ga.	1000d
WBBN	Perry, Ga.	500d
KUPI	Idaho Falls, Idaho	1000d
WITY	Danville, Ill.	1000
KOKA	Shreveport, La.	5000d
WCAP	Lowell, Mass.	1000d
WPBC	Minneapolis, Minn.	1000d
WAPF	McComb, Miss.	1000d
KMBC	Kansas City, Mo.	5000
KSGM	Ste. Genevieve, Mo.	500
KICA	Clovis, N.Mex.	1000
KMIN	Grants, N.Mex.	1000d
WTRY	Troy, N.Y.	5000
WKLM	Wilmington, N.C.	5000d
WAAA	Win.-Salem, N.C.	1000d
WONE	Dayton, Ohio	5000
WILK	Wilkes-Barre, Pa.	5000
KDSJ	Deadwood, S.Dak.	1000
WSIX	Nashville, Tenn.	5000
KFRD	Rosenberg, Tex.	1000d
KSVC	Richfield, Utah	5000
WFHG	Bristol, Va.	5000
KUTI	Yakima, Wash.	1000d
WCUB	Manitowoc, Wis.	1000d
WPRE	Prairie du Chien, Wis.	500d

990—302.8

CBW	Winnipeg, Man.	50000
CBT	Grand Falls, N.F.	1000
WWWF	Fayette, Ala.	1000d
WTCB	Flomaton, Ala.	500d
KTKT	Tucson, Ariz.	10000d
KKIS	Pittsburg, Calif.	5000
KLIR	Denver, Colo.	1000d
WBZY	Torrington, Conn.	1000d
WHOO	Orlando, Fla.	10000
WDWO	Dawson, Ga.	1000d
WCAZ	Carthage, Ill.	1000d
WITZ	Jasper, Ind.	1000d
KAYL	Storm Lake, Iowa	250d
KRSL	Russell, Kans.	250d
WJMR	New Orleans, La.	250d
KCLP	Rayville, La.	250d
WABO	Waynesboro, Miss.	250d
KRMO	Monett, Mo.	250d
KSVP	Artesia, N.Mex.	1000
WEEB	Southern Pines, N.C.	1000d
WJEH	Gallipolis, Ohio	1000d
WTIG	Massillon, Ohio	250d
WIBG	Philadelphia, Pa.	10000
WVSC	Somerset, Pa.	250d
WPRA	Mayaguez, P.R.	10000
WAKN	Aiken, S.C.	1000d
WNOX	Knoxville, Tenn.	10000
KWEM	Memphis, Tenn.	1000d
KTRM	Beaumont, Tex.	1000
KAML	Kenedy, Tex.	250
KSYD	Wichita Falls, Tex.	10000
KTUT	Tooele, Utah	1000d
WNRV	Narrows, Va.	1000d
WANT	Richmond, Va.	1000d
WKLJ	Sparta, Wis.	250

1000—299.8

CKBW	Bridgewater, N.S.	1000
WCFL	Chicago, Ill.	50000
KTOK	Okla. City, Okla.	5000
KSTA	Coleman, Tex.	250d
KGRI	Henderson, Tex.	250d
WHWB	Rutland, Vt.	1000d
KOMO	Seattle, Wash.	50000

1010—296.9

CBX	Edmonton, Alta.	50000
CFRB	Toronto, Ont.	50000
KVNC	Winslow, Ariz.	1000
KLRA	Little Rock, Ark.	10000
KCHJ	Delano, Calif.	5000
KCMJ	Palm Sprgs., Calif.	1000
KSAY	San Fran., Calif.	10000d
WCNU	Crestview, Fla.	1000d
WZRO	Jacksonville Beach, Florida	1000d
WEAS	Decatur, Ga.	50000d
WCSI	Columbus, Ind.	500d
KSMN	Mason City, Iowa	1000d
KIND	Independence, Kans.	250d
KDLA	DeRidder, La.	1000d
WSID	Baltimore, Md.	1000d
KCHI	Chillicothe, Mo.	250d
KJCF	Festus, Mo.	250d
KRVN	Lexington, Nebr.	25000d
KLAS	Las Vegas, Nev.	5000d
WINS	New York, N.Y.	50000
WABZ	Albermarle, N.C.	1000d
WELS	Kinston, N.C.	1000d
WITT	Lewisburg, Pa.	250d
WHIN	Gallatin, Tenn.	1000d
WORM	Savannah, Tenn.	250d
KAMQ	Amarillo, Tex.	5000
KMLW	Marlin, Tex.	250d
WELK	Charlottesville, Va.	1000d
WMEV	Marion, Va.	1000d
WSPT	Stevens Pt., Wis.	1000d

1020—293.9

KPOP	Los Angeles, Calif.	5000
WCIL	Carbondale, Ill.	1000d
WPEO	Peoria, Ill.	1000d
KDKA	Pittsburgh, Pa.	50000

1030—291.1

WBZ	Boston, Mass.	50000
WBZA	Springfield, Mass.	1000
KATR	Corpus Christi, Tex.	50000d

Kc. Wave Length W.P.

1040—288.3

KHVH	Honolulu, Hawaii	5000
WHO	Des Moines, Iowa	50000
KIXL	Dallas, Tex.	1000d
WIVI	Christiansted, V.I.	250

1050—285.5

CFGP	Grand Prairie, Alta.	10000
CKSB	St. Boniface, Man.	10000
CJIC	Sault Ste. Marie, Ont.	250
CHUM	Toronto, Ont.	5000
WRFS	Alexander City, Ala.	1000d
WCRI	Scottsboro, Ala.	250d
KVWM	Show Low, Ariz.	250d
KVLC	Little Rock, Ark.	1000d
KOFY	San Mateo, Calif.	1000d
KWSO	Wasco, Calif.	1000d
KLMO	Longmont, Colo.	250d
WJSB	Crestview, Fla.	1000d
WIVY	Jacksonville, Fla.	1000d
WHBO	Tampa, Fla.	250d
WRMF	Titusville, Fla.	500d
WJAZ	Albany, Ga.	1000d
WAUG	Augusta, Ga.	1000d
WBIE	Marietta, Ga.	500d
KZIN	Coeur D'Alene, Idaho	250d
WDZ	Decatur, Ill.	1000d
KNCO	Garden City, Kans.	1000d
WZIP	Covington, Ky.	250d
WKTM	Mayfield, Ky.	1000d
KLPL	Lake Providence, La.	250d
KCIJ	Shreveport, La.	250d
WGAY	Silver Sprg., Md.	1000d
WPAG	Ann Arbor, Mich.	1000d
KLOH	Pipestone, Minn.	1000d
WACR	Columbus, Miss.	1000d
KSIS	Sedalia, Mo.	1000d
KRBO	Las Vegas, Nev.	500d
WBNC	Conway, N.H.	1000d
WMGM	New York, N.Y.	50000
WFSC	Franklin, N.C.	500d
WLON	Lincolnton, N.C.	1000d
WWGP	Sanford, N.C.	1000d
KCCO	Lawton, Okla.	250d
KFMJ	Tulsa, Okla.	1000d
KUBE	Pendleton, Oreg.	1000d
KEED	Springfield, Oreg.	1000d
WBUT	Butler, Pa.	250d
WLYC	Williamsport, Pa.	1000d
WSMT	Sparta, Tenn.	1000d
KLEN	Killeen, Tex.	250d
WBRG	Lynchburg, Va.	1000d
WCMS	Norfolk, Va.	1000d
KNBX	Kirkland, Wash.	1000d
WCEF	Parkersburg, W.Va.	1000d
WECL	Eau Claire, Wis.	1000d
WLIP	Kenosha, Wis.	250d
KWIV	Douglas, Wyo.	250d

1060—282.8

CFCN	Calgary, Alta.	10000
KPAY	Chico, Calif.	10000
WNOE	New Orleans, La.	50000
WHFB	Benton Harbor, Mich.	1000d
WMAP	Monroe, N.C.	250d
WCMW	Canton, Ohio	1000d
WRCV	Philadelphia, Pa.	50000

1070—280.2

CBA	Sackville, N.B.	50000
CHOK	Sarnia, Ont.	5000
WAPI	Birmingham, Ala.	10000
KNX	Los Angeles, Calif.	50000
WVCG	Coral Gables, Fla.	1000d
WIBC	Indianapolis, Ind.	50000
KFBI	Wichita, Kans.	10000
KHMO	Hannibal, Mo.	5000
WHPE	High Point, N.C.	1000d
WDIA	Memphis, Tenn.	50000
KOPY	Alice, Tex.	1000
WKOW	Madison, Wis.	10000

1080—277.6

CHED	Edmonton, Alta.	10000
KSCO	Santa Cruz, Calif.	1000
WTIC	Hartford, Conn.	50000
WKLO	Louisville, Ky.	5000
WOAP	Owosso, Mich.	250d
WINE	Kenmore, N.Y.	1000d
WEWO	Laurinburg, N.C.	1000d
KWJJ	Portland, Oreg.	10000
WEEP	Pittsburgh, Pa.	1000d
KRLD	Dallas, Tex.	50000

1090—275.1

CFJB	Brampton, Ont.	250
CHRS	St. Jean, Que.	1000
KTHS	Little Rock, Ark.	50000
WCRA	Effingham, Ill.	250d
KNWS	Waterloo, Iowa	1000d
WBAL	Baltimore, Md.	50000
WILD	Boston, Mass.	1000d
WMUS	Muskegon, Mich.	1000d
KING	Seattle, Wash.	50000

1100—272.6

KJBS	San Francisco, Calif.	1000d
WLBB	Carrollton, Ga.	250d
WHLI	Hempstead, N.Y.	10000d
KYW	Cleveland, Ohio	50000
WGPA	Bethlehem, Pa.	250d

1110—270.1

CFTJ	Galt, Ont.	250
KXLA	Pasadena, Calif.	10000
WALT	Tampa, Fla.	10000d
WMBI	Chicago, Ill.	5000d
KFAB	Omaha, Nebr.	50000
WBT	Charlotte, N.C.	50000
KBND	Bend, Oreg.	5000
WNAR	Norristown, Pa.	500d
WVJP	Caguas, P.R.	250
WHIM	Providence, R.I.	1000d
KIPA	Hilo, T.Hawaii	1000

1120—267.7

WUST	Bethesda, Md.	250d
KMOX	St. Louis, Mo.	50000
WWOL	Buffalo, N.Y.	1000d
KCLE	Cleburne, Tex.	250d

1130—265.3

CKWX	Vancouver, B.C.	50000
KSDO	San Diego, Calif.	5000
KWKH	Shreveport, La.	50000
WCAR	Detroit, Mich.	50000
WDGY	Minneapolis, Minn.	50000
WNEW	New York, N.Y.	50000

1140—263.0

CKXL	Calgary, Alta.	1000
KRAK	Stockton, Calif.	5000
WMIE	Miami, Fla.	10000
KGEM	Boise, Idaho	10000
WSIV	Pekin, Ill.	1000d
KLPR	Oklahoma City, Okla.	1000d
WITA	San Juan, P.R.	500
KSOO	Sioux Falls, S.Dak.	10000
KORC	Mineral Wells, Tex.	250
WRVA	Richmond, Va.	50000

1150—260.7

CKSA	Lloydminster, Alta.	1000
CHSJ	Saint John, N.B.	5000
CKOC	Hamilton, Ont.	5000
CKX	Brandon, Man.	5000
WBCA	Bay Minette, Ala.	1000d
WGEA	Geneva, Ala.	1000d
WJRD	Tuscaloosa, Ala.	5000
KCKY	Coolidge, Ariz.	1000
KXLR	No. Little Rock, Ark.	5000
KFSG	Los Angeles, Calif.	2500
KRKD	Los Angeles, Calif.	5000
KGMC	Englewood, Colo.	1000d
WCNX	Middletown, Conn.	500d
WDEL	Wilmington, Del.	5000
WNDB	Daytona Bch., Fla.	1000
WTMP	Tampa, Fla.	1000d
WFPM	Fort Valley, Ga.	1000d
WJEM	Valdosta, Ga.	1000d
KANI	Oahu, Hawaii	1000
WGGH	Marion, Ill.	5000d
KWDM	Des Moines, Iowa	1000
KSAL	Salina, Kans.	5000
WMST	Mt. Sterling, Ky.	500d
WLOC	Mumfordville, Ky.	1000d
WJBO	Baton Rouge, La.	5000
WGHM	Skowhegan, Maine	1000d
WCOP	Boston, Mass.	5000
WCEN	Mt. Pleasant, Mich.	1000
KASM	Albany, Minn.	500d
KRMS	Osage Beach, Mo.	1000d
KIYI	Shelby, Mont.	1000
KDEF	Albuquerque, N.Mex.	1000d
WRUN	Utica, N.Y.	5000
WFNS	Burlington, N.C.	1000d
WGBR	Goldsboro, N.C.	5000
WCUE	Akron, Ohio	1000d
WIMA	Lima, Ohio	1000
KNED	McAlester, Okla.	1000
KFJI	Klamath Falls, Oreg.	5000
WHUN	Huntingdon, Pa.	1000d
WKPA	New Kensington, Pa.	1000d
WDRA	Mayaguez, P.R.	1000
WRNO	Orangeburg, S.C.	5000
WTYC	Rock Hill, S.C.	1000d
WSNW	Seneca Township, South Carolina	1000d
WAPO	Chattanooga, Tenn.	5000
WCRK	Morristown, Tenn.	1000
WTAW	Bryan, Tex.	1000d
KCCT	Corpus Christi, Tex.	1000d
KOYE	El Paso, Tex.	1000d
KJBC	Midland, Tex.	1000d
KOLJ	Quanah, Tex.	500d
KOFE	Pullman, Wash.	1000d
KAYO	Seattle, Wash.	5000
KKEY	Vancouver, Wash.	1000d
WELC	Welch, W.Va.	1000d
WAXX	Chippewa Falls, Wis.	5000d
WISN	Milwaukee, Wis.	5000

1160—258.5

WJJD	Chicago, Ill.	50000
KSL	Salt Lake City, Utah	50000

1170—256.3

CFNS	Saskatoon, Sask.	1000
WCOV	Montgomery, Ala.	10000
KCBQ	San Diego, Calif.	5000
KLOK	San Jose, Calif.	10000
WLBH	Mattoon, Ill.	250d
KSTT	Davenport, Iowa	1000
KVOO	Tulsa, Okla.	50000
WLEO	Ponce, P.R.	250
KPUG	Bellingham, Wash.	1000
WWVA	Wheeling, W.Va.	50000

1180—254.1

WLDS	Jacksonville, Ill.	1000d
WHAM	Rochester, N.Y.	50000

1190—252.0

KNBA	Vallejo, Calif.	250d
WOWO	Ft. Wayne, Ind.	50000
WANN	Annapolis, Md.	1000d
WKOX	Fram'gham, Mass.	1000d
WLIB	New York, N.Y.	1000d
KEX	Portland, Oreg.	50000
WDTV	St. John, V.I.	1000
KLIF	Dallas, Tex.	5000

1200—249.9

WOAI	San Antonio, Tex.	50000

1210—247.8

WCNT	Centralia, Ill.	1000d
WKNX	Saginaw, Mich.	1000d
WADE	Wadesboro, N.C.	1000d
WAVI	Dayton, Ohio	250d
WCAU	Philadelphia, Pa.	50000

1220—245.8

CJOC	Lethbridge, Alta.	10000
CKDA	Victoria, B.C.	10000
CJRL	Kenora, Ont.	1000
CKEC	New Glasgow, N.S.	250
CKCW	Moncton, N.B.	10000
CKSF	Cornwall, Ont.	1000
CKSM	Shawinigan Falls, Quebec	1000
WEDR	Birmingham, Ala.	1000d
KVSA	McGehee, Ark.	1000d
KIBE	Palo Alto, Calif.	1000d
KFSC	Denver, Colo.	1000d
WPEG	Arlington, Fla.	250d
WRWB	Kissimmee, Fla.	250d
WFEC	Miami, Fla.	250d
WCLB	Camilla, Ga.	1000d
WSFT	Thomaston, Ga.	250d
KWEI	Weiser, Idaho	1000d
WLPO	LaSalle, Ill.	1000d
WKRS	Waukegan, Ill.	1000d
WSLM	Salem, Ind.	1000d
KJAN	Atlantic, Iowa	250d
KOFO	Ottawa, Kans.	250d
WFKN	Franklin, Ky.	250d
KBCL	Bossier City, La.	250d
WSME	Sanford, Maine	1000d
WBCH	Hastings, Mich.	250d
WAVN	Stillwater, Minn.	1000d
WMDC	Hazlehurst, Miss.	250d
KBHM	Branson, Mo.	1000d
KGMO	Cape Girardeau, Mo.	250d
KLPW	Union, Mo.	250d
WGNY	Newburgh, N.Y.	1000d
WKMT	Kings Mtn., N.C.	1000d
WREV	Reidsville, N.C.	250d
WENC	Whiteville, N.C.	1000d
WGAR	Cleveland, Ohio	50000
KGYN	Guymon, Okla.	1000d
WJUN	Mexico, Pa.	250d
WRIB	Providence, R.I.	1000d
WALD	Walterboro, S.C.	1000d
KABR	Aberdeen, S.Dak.	250d
WFWL	Camden, Tenn.	250
WCPH	Etowah, Tenn.	1000d
WHEY	Millington, Tenn.	250
KTET	Livingston, Tex.	250d
KZEE	Weatherford, Tex.	250d
WLSD	Big Stone Gap, Va.	1000d
WFAX	Falls Church, Va.	1000d
KBAM	Longview, Wash.	1000d

1230—243.8

CFCW	Camrose, Alta.	1000
CFKL	Schefferville, Que.	250
CFGR	Gravelbourg, Sask.	250
CFYT	Dawson City, Yukon T.	250
CJBQ	Belleville, Ont.	250
CFPA	Port Arthur, Ont.	250
CKEC	New Glasgow, N.S.	250
CKLD	Thetford Mines, Que.	250
VOAR	St. John's, Nfld.	100
CKVD	Val D'Or, Que.	250
WAUD	Auburn, Ala.	250
WJBB	Haleyville, Ala.	250
WBHP	Huntsville, Ala.	250
WHTB	Talledega, Ala.	250
WTBC	Tuscaloosa, Ala.	250
KIFW	Sitka, Alaska	250
KSUN	Bisbee, Ariz.	250
KAAA	Kingman, Ariz.	250
KRIZ	Phoenix, Ariz.	250
KCON	Conway, Ark.	250
KFPW	Ft. Smith, Ark.	250
KBTM	Jonesboro, Ark.	250
KGEE	Bakersfield, Calif.	250
KWTC	Barstow, Calif.	250
KIBS	Bishop, Calif.	250
KXO	El Centro, Calif.	250
KDAC	Ft. Bragg, Calif.	250
KGFJ	Los Angeles, Calif.	250
KPRL	Paso Robles, Calif.	250
KRDG	Redding, Calif.	250
KWG	Stockton, Calif.	250
KEXO	Grand Junc., Colo.	250
KLVC	Leadville, Colo.	250
KDZA	Pueblo, Colo.	250
KGEK	Sterling, Colo.	250
WINF	Manchester, Conn.	250
WGGG	Gainesville, Fla.	250
WONN	Lakeland, Fla.	250
WMAF	Madison, Fla.	250
WSBB	New Smyrna Bch., Fla.	250
WNVY	Pensacola, Fla.	250
WCNH	Quincy, Fla.	250
WJNO	W. Palm Beach, Fla.	250
WBIA	Augusta, Ga.	250
WBLJ	Dalton, Ga.	250
WFOM	Marietta, Ga.	250
WFRP	Savannah, Ga.	250
WAYX	Waycross, Ga.	250
KBAR	Burley, Idaho	250
KORT	Grangeville, Idaho	250
KRXK	Rexburg, Idaho	250
WJBC	Bloomington, Ill.	250
WQUA	Moline, Ill.	250
WHCO	Sparta, Ill.	250
WJOB	Hammond, Ind.	250
WSAL	Logansport, Ind.	250
WTCJ	Tell City, Ind.	250
WBOW	Terre Haute, Ind.	250
KFJB	Marshalltown, Iowa	250
WHIR	Danville, Ky.	250
WHOP	Hopkinsville, Ky.	250
WMLF	Pineville, Ky.	250
KLIC	Monroe, La.	250
WJBW	New Orleans, La.	250
KSLO	Opelousas, La.	250
WGUY	Bangor, Maine	250
WITH	Baltimore, Md.	250
WCUM	Cumberland, Md.	250
WMNB	No. Adams, Mass.	250
WESX	Salem, Mass.	250
WNEB	Worcester, Mass.	250
WJEF	Grand Rapids, Mich.	250
WIKB	Iron River, Mich.	250
WMPC	Lapeer, Mich.	250
WSOO	Slt. Ste. Marie, Mich.	250
WSTR	Sturgis, Mich.	250
WKLK	Cloquet, Minn.	250
KYSM	Mankato, Minn.	250
KTRF	Thief Riv. Flls., Minn.	250
KWNO	Winona, Minn.	250
WCMA	Corinth, Miss.	250
WHSY	Hattiesburg, Miss.	250
WSSO	Starkville, Miss.	250
WAZF	Yazoo City, Miss.	250
KODE	Joplin, Mo.	250
KLWT	Lebanon, Mo.	250
KNCM	Moberly, Mo.	250
KANA	Anaconda, Mont.	250
KBMN	Bozeman, Mont.	250
KXLO	Lewiston, Mont.	250
KOLL	Libby, Mont.	250
KTNC	Falls City, Nebr.	100
KHAS	Hastings, Nebr.	250
KELY	Ely, Nev.	250
KLAS	Las Vegas, Nev.	250
KDOT	Reno, Nev.	250
WKCB	Berlin, N.H.	250
WTSV	Claremont, N.H.	250
WCMC	Wildwood, N.J.	100
KALG	Alamogordo, N.Mex.	250
KOTS	Deming, N.Mex.	250
KFUN	Las Vegas, N.Mex.	250
KSWS	Roswell, N.Mex.	250
WNIA	Cheektowaga, N.Y.	250
WENY	Elmira, N.Y.	250
WHUC	Hudson, N.Y.	250
WLFH	Little Falls, N.Y.	250
WFAS	White Plains, N.Y.	250
WSKY	Asheville, N.C.	250
WFAI	Fayetteville, N.C.	250
WMFR	High Point, N.C.	250
WISP	Kinston, N.C.	250
WNNC	Newton, N.C.	250
WCBT	Roanoke Rap., N.C.	250
KDIX	Dickinson, N.Dak.	250
WCPO	Cincinnati, Ohio	250
WCOL	Columbus, Ohio	250
WIRO	Ironton, Ohio	250
WTOL	Toledo, Ohio	250
KADA	N. of Ada, Okla.	250
WBBZ	Ponca City, Okla.	250
KIAL	Astoria, Oreg.	250
KRNS	Burns, Oreg.	250
KOOS	Coos Bay, Oreg.	250
KGRO	Gresham, Oreg.	250
KYJC	Medford, Oreg.	250
KQIK	Lakeview, Oreg.	250
WBVP	Beaver Falls, Pa.	250
WEEX	Easton, Pa.	250
WKBO	Harrisburg, Pa.	250
WCRO	Johnstown, Pa.	250
WBPZ	Lock Haven, Pa.	250
WNIK	Arecibo, P.R.	250
WERI	Westerly, R.I.	250
WAIM	Anderson, S.C.	250
WNOK	Columbia, S.C.	250
WOLS	Florence, S.C.	250
KISD	Sioux Falls, S.Dak.	250
WHBT	Harriman, Tenn.	250
WMMT	McMinnville, Tenn.	250
KSIX	Corpus Christi, Tex.	250

Kc. Wave Length W.P.

KDLK	Del Rio, Tex.	250
KNUZ	Houston, Tex.	250
KERV	Kerrville, Tex.	250
KLVT	Levelland, Tex.	250
KEEE	Nacogdoches, Tex.	250
KOSA	Odessa, Tex.	250
KHHH	Pampa, Tex.	250
KSEY	Seymour, Tex.	250
KCMC	Texarkana, Tex.	250
KSST	Sulphur Sprgs., Tex.	250
KWTX	Waco, Tex.	250
KMUR	Murray, Utah	250
KOAL	Price, Utah	250
WJOY	Burlington, Vt.	250
WBBI	Abingdon, Va.	250
WCFV	Clifton Forge, Va.	250
WFVA	Fredericksburg, Va.	250
WNOR	Norfolk, Va.	250
KQTY	Everett, Wash.	250
KLYK	Spokane, Wash.	250
KREW	Sunnyside, Wash.	250
WLOG	Logan, W.Va.	250
WAJR	Morgantown, W.Va.	250
WCOM	Parkersburg, W.Va.	250
WHBY	Appleton, Wis.	250
WCLO	Janesville, Wis.	250
WHVF	Wausau, Wis.	250
KVOC	Casper, Wyo.	250

1240—241.8

CFNW	Norman Wells, Northwest Terr.	100
CFPR	Prince Rupert, B.C.	250
CJAV	Port Alberni, B.C.	250
CJCS	Stratford, Ont.	250
CJRW	Summerside, P.E.I.	250
CKLS	LaSarre, Que.	250
WEBJ	Brewton, Ala.	250
WULA	Eufaula, Ala.	250
WOWL	Florence, Ala.	250
WARF	Jasper, Ala.	250
KWJB	So. of Globe, Ariz.	250
KOFA	Yuma, Ariz.	250
KVRC	Arkadelphia, Ark.	250
KAGH	Crossett, Ark.	250
KHOZ	Harrison, Ark.	250
KWAK	Stuttgart, Ark.	250
KCRE	Crescent City, Calif.	250
KRDU	Dinuba, Calif.	250
KMBY	Monterey, Calif.	250
KPPC	Pasadena, Calif.	100
KRKS	Ridgecrest, Calif.	250
KROY	Sacramento, Calif.	250
KRNO	San Bernardino, Calif.	250
KSON	San Diego, Calif.	250
KSMA	Santa Maria, Calif.	250
KSUE	Susanville, Calif.	250
KROO	Colo. Sprgs., Colo.	250
KDGO	Durango, Colo.	250
KSLV	Monte Vista, Colo.	250
KCRT	Trinidad, Colo.	250
WWCO	Waterbury, Conn.	250
WBGC	Chipley, Fla.	250
WLCO	Eustis, Fla.	250
WINK	Fort Myers, Fla.	250
WMMB	Melbourne, Fla.	250
WFOY	St. Augustine, Fla.	250
WBHB	Fitzgerald, Ga.	250
WDUN	Gainesville, Ga.	250
WLAG	LaGrange, Ga.	250
WBML	Macon, Ga.	250
WWNS	Statesboro, Ga.	250
WPAX	Thomasville, Ga.	250
WTWA	Thomson, Ga.	250
KANI	Kailua, Hawaii	250
KVNI	Coeur d'Alene, Idaho	250
KWIK	Pocatello, Idaho	250
WCRW	Chicago, Ill.	100
WEDC	Chicago, Ill.	250
WSBC	Chicago, Ill.	250
WEBQ	Harrisburg, Ill.	250
WTAX	Springfield, Ill.	250
WSDR	Sterling, Ill.	100
WHBU	Anderson, Ind.	250
KDEC	Decorah, Iowa	250
KWLC	Decorah, Iowa	250
KBIZ	Ottumwa, Iowa	250
KICD	Spencer, Iowa	250
KIUL	Garden City, Kans.	250
KAKE	Wichita, Kans.	250
WINN	Louisville, Ky.	250
WFTM	Maysville, Ky.	250
WPKE	Pikeville, Ky.	250
WSFC	Somerset, Ky.	250
KASO	Minden, La.	250
KANE	New Iberia, La.	250
WCOU	Lewiston, Maine	250
WCEM	Cambridge, Md.	250
WJEJ	Hagerstown, Md.	250
WHAI	Greenfield, Mass.	250
WOCB	W. Yarmouth, Mass.	250
WATT	Cadillac, Mich.	250
WCBY	Cheboygan, Mich.	250
WJPD	Ishpeming, Mich.	250
WJIM	Lansing, Mich.	250
WMFG	Hibbing, Minn.	250
WJON	St. Cloud, Minn.	250
WMPA	Aberdeen, Miss.	250
WGRM	Greenwood, Miss.	250
WGCM	Gulfport, Miss.	250
WMOX	Meridian, Miss.	250
WMIS	Natchez, Miss.	250
KFMO	Flat River, Mo.	250
KWOS	Jefferson City, Mo.	250
KNEM	Nevada, Mo.	250
KBMY	Billings, Mont.	250
KLTZ	Glasgow, Mont.	250
KXLJ	Helena, Mont.	250
KFOR	Lincoln, Nebr.	250
KODY	North Platte, Nebr.	250
KELK	Elko, Nev.	250
WKBR	Manchester, N.H.	250
WSNJ	Bridgeton, N.J.	250
KAVE	Carlsbad, N.Mex.	250
KCLV	Clovis, N.Mex.	250
WGBB	Freeport, N.Y.	250
WGVA	Geneva, N.Y.	250
WJTN	Jamestown, N.Y.	250
WVOS	Liberty, N.Y.	250
WNBZ	Saranac Lake, N.Y.	250
WSNY	Schenectady, N.Y.	250
WATN	Watertown, N.Y.	250
WPNF	Brevard, N.C.	250
WSOC	Charlotte, N.C.	250
WCNC	Elizabeth City, N.C.	250
WJNC	Jacksonville, N.C.	250
WRAL	Raleigh, N.C.	250
KDLR	Devils Lake, N.Dak.	250
WBBW	Youngstown, Ohio	250
WHIZ	Zanesville, Ohio	250
KVSO	Ardmore, Okla.	250
KASA	Elk City, Okla.	250
KBEL	Idabel, Okla.	250
KHBG	Okmulgee, Okla.	250
KFLY	Corvallis, Oreg.	1000d
KWRC	Pendleton, Oreg.	250
KPRB	Redmond, Oreg.	250
KRXL	Roseburg, Oreg.	250
WRTA	Altoona, Pa.	250
WLEM	Emporium, Pa.	1000
WHUM	Reading, Pa.	250
WKOK	Sunbury, Pa.	250
WBAX	Wilkes-Barre, Pa.	250
WALO	Humacao, P.R.	250
WWON	Woonsocket, R.I.	250
WKDK	Newberry, S.C.	250
WBEJ	Elizabethton, Tenn.	250
WEKR	Fayetteville, Tenn.	250
WBIR	Knoxville, Tenn.	250
WKDA	Nashville, Tenn.	250
WENK	Union City, Tenn.	250
KVLF	Alpine, Tex.	250
KEAN	Brownwood, Tex.	100
KORA	Bryan, Tex.	250
KOCA	Kilgore, Tex.	250
KSOX	Raymondville, Tex.	250
KXOX	Sweetwater, Tex.	250
WSKI	Montpelier, Vt.	250
WSSV	Petersburg, Va.	250
WROV	Roanoke, Va.	250
WTON	Staunton, Va.	250
KXLE	Ellensburgh, Wash.	250
KGY	Olympia, Wash.	250
WKOY	Bluefield, W.Va.	250
WTIP	Charleston, W.Va.	250
WDNE	Elkins, W.Va.	250
WOMT	Manitowoc, Wis.	250
WIBU	Poynette, Wis.	250
WOBT	Rhinelander, Wis.	250
WJMC	Rice Lake, Wis.	250
KFBC	Cheyenne, Wyo.	250
KLUK	Evanston, Wyo.	250
KASL	Newcastle, Wyo.	250
KRAL	Rawlins, Wyo.	250
KTHE	Thermopolis, Wyo.	250

1250—239.9

CHWO	Oakville, Ont.	1000
CKBL	Matane, Que.	5000
CKRB	Ville St. Georges, Que.	5000
CKSB	St. Boniface, Man.	1000
WZOB	Ft. Payne, Ala.	1000d
WETU	Wetumpka, Ala.	1000d
KFAY	Fayetteville, Ark.	500d
KGHI	Little Rock, Ark.	1000
KHOT	Madera, Calif.	500d
KTMS	Santa Barbara, Calif.	1000
KHOK	Golden, Colo.	1000d
WNER	Live Oak, Fla.	1000d
WDAE	Tampa, Fla.	5000
WYTH	Madison, Ga.	1000d
WIZZ	Streator, Ill.	500d
WGL	Ft. Wayne, Ind.	1000
WRAY	Princeton, Ind.	1000d
KFKU	Lawrence, Kans.	5000
WREN	Topeka, Kans.	5000
WLCK	Scottsville, Ky.	500d
WARE	Ware, Mass.	1000d
WWBC	Bay City, Mich.	1000d
KGDE	Fergus Falls, Minn.	1000
KCUE	Red Wing, Minn.	1000d
WHNY	McComb, Miss.	5000
KVLV	Fallon, Nev.	1000d
WMTR	Morristown, N.J.	1000d
WIPS	Ticonderoga, N.Y.	1000d
WBRM	Marion, N.C.	1000d
WCHO	Washington Court House, Ohio	500d
WPEL	Montrose, Pa.	1000d
WCAE	Pittsburgh, Pa.	5000
WNOW	York, Pa.	1000d
WTMA	Charleston, S.C.	5000
WKBL	Covington, Tenn.	1000d
KFTV	Paris, Tex.	500d
KPAC	Port Arthur, Tex.	5000
KEXX	San Antonio, Tex.	500d
KSML	Seminole, Tex.	1000d
KVEL	Vernal, Utah	1000d
WDVA	Danville, Va.	5000
WYSR	Franklin, Va.	1000d
WNRG	Grundy, Va.	1000d
KWSC	Pullman, Wash.	5000
KTW	Seattle, Wash.	1000
WEMP	Milwaukee, Wis.	5000

1260—238.0

CFRN	Edmonton, Alta.	5000
DYBU	Cebu, P.I.	1000
WCRT	Birmingham, Ala.	1000d
KPIN	Casa Grande, Ariz.	1000d
KGIL	San Fernando, Calif.	1000
KYA	San Francisco, Calif.	5000
WWDC	Washington, D.C.	5000
WFTW	Fort Walton Beach, Florida	1000d
WMMA	Miami, Fla.	5000d
WWPF	Palatka, Fla.	1000
WHAB	Baxley, Ga.	5000d
WTJH	East Point, Ga.	5000d
KIFI	Idaho Falls, Idaho	5000
WIBV	Belleville, Ill.	1000d
WFBM	Indianapolis, Ind.	5000
KFGQ	Boone, Iowa	250d
KWHK	Hutchinson, Kans.	1000
WXOK	Baton Rouge, La.	1000d
WEZE	Boston, Mass.	5000
WALM	Albion, Mich.	1000d
WJBL	Holland, Mich.	500d
KROX	Crookston, Minn.	1000
KDUZ	Hutchinson, Minn.	1000d
WGVM	Greenville, Miss.	1000d
WNSL	Laurel, Miss.	1000d
KGBX	Springfield, Mo.	5000
WBUO	Trenton, N.J.	5000
KVSF	Santa Fe, N.Mex.	1000
WNDR	Syracuse, N.Y.	5000
WGWR	Asheboro, N.C.	1000d
WCDJ	Edenton, N.C.	1000d
WOOK	Cleveland, Ohio	5000
WNXT	Portsmouth, Ohio	5000
KWSH	Wewoka-Seminole, Oklahoma	1000
KMCM	McMinnville, Oreg.	1000
WERC	Erie, Pa.	5000
WPHB	Philipsburg, Pa.	1000d
WISO	Ponce, P.R.	1000
WMUU	Greenville, S.C.	1000d
WJOT	Lake City, S.C.	1000d
KWYR	Winner, S.Dak.	5000d
WMFS	Chattanooga, Tenn.	1000d
WMCH	Church Hill, Tenn.	1000d
WDKN	Dickson, Tenn.	1000d
WCLC	Jamestown, Tenn.	1000d
KSPL	Diboll, Tex.	1000d
KBLP	Falfurrias, Tex.	500d
KWFR	San Angelo, Tex.	1000d
KTUE	Tulia, Tex.	1000d
KTAE	Taylor, Tex.	1000d
WCHV	Charlottesville, Va.	5000
WBCR	Christiansburg, Va.	1000d
KWIQ	Moses Lake, Wash.	1000d
WVVW	Grafton, W.Va.	500d
WEKZ	Monroe, Wis.	1000d
KPOW	Powell, Wyo.	5000

1270—236.1

CHAT	Medicine Hat, Alta.	1000
CHWK	Chilliwack, B.C.	1000
CJCB	Sydney, N.S.	5000
CFGT	St. Joseph d'Alma, Quebec	1000
WGSV	Guntersville, Ala.	1000d
WAIP	Prichard, Ala.	1000d
KBYR	Anchorage, Alaska	1000
KDJI	Holbrook, Ariz.	1000d
KPAP	Redding, Calif.	1000d
KCOK	Tulare, Calif.	1000
WNOG	Naples, Fla.	500d
WHIY	Orlando, Fla.	5000d
WTAL	Tallahassee, Fla.	5000
WGBA	Columbus, Ga.	5000d
WJJC	Commerce, Ga.	1000d
KTFI	Twin Falls, Idaho	5000
WEIC	Charleston, Ill.	1000d
WHBF	Rock Island, Ill.	5000
WCMR	Elkhart, Ind.	500
WWCA	Gary, Ind.	1000
WORX	Madison, Ind.	1000d
KSCB	Liberal, Kans.	1000d
WAIN	Columbia, Ky.	1000d
WFUL	Fulton, Ky.	1000d
KVCL	Winnfield, La.	1000d
WSPR	Springfield, Mass.	1000
WXYZ	Detroit, Mich.	5000
KWEB	Rochester, Minn.	500d
WLSM	Louisville, Miss.	1000d
KUSN	St. Joseph, Mo.	1000d
WTSN	Dover, N.H.	5000
KRAC	Alamogordo, N.Mex.	1000d
WHLD	Niagara Falls, N.Y.	5000d
WDLA	Walton, N.Y.	1000d
WCGC	Belmont, N.C.	1000
WMPM	Smithfield, N.C.	1000d
KBOM	Mandan, N.Dak.	1000
WILE	Cambridge, Ohio	1000d
KWPR	Claremore, Okla.	500d
KAJO	Grants Pass, Oreg.	1000d
WLBR	Lebanon, Pa.	1000
WBHC	Hampton, S.C.	1000d
KIHO	Sioux Falls, S.Dak.	1000
WLIK	Newport, Tenn.	5000d
KIOX	Bay City, Tex.	1000
KHEM	Big Spring, Tex.	1000d
KEPS	Eagle Pass, Tex.	1000d
KFJZ	Fort Worth, Tex.	5000
WYUO	Newport News, Va.	1000d
KCVL	Colville, Wash.	1000d
WKYR	Keyser, W.Va.	5000d

1280—234.2

CJMS	Montreal, Que.	5000
CKCV	Quebec, Que.	5000
WPIO	Piedmont, Ala.	1000d
WNPT	Tuscaloosa, Ala.	5000
KHEP	Phoenix, Ariz.	1000d
KFOX	Long Beach, Calif.	1000
KJOY	Stockton, Calif.	1000
KTLN	Denver, Colo.	5000
WSUX	Seaford, Del.	1000d
WDSP	DeFuniak Springs, Florida	5000d
WQIK	Jacksonville, Fla.	1000d
WIPC	Lake Wales, Fla.	1000d
WIBB	Macon, Ga.	1000d
WMRO	Aurora, Ill.	250d
WGBF	Evansville, Ind.	5000
KCOB	Newton, Iowa	1000d
KSOK	Arkansas City, Kans.	1000
WCPM	Cumberland, Ky.	1000d
WDSU	New Orleans, La.	5000
KWCL	Oak Grove, La.	500d
WEIM	Fitchburg, Mass.	5000
WFYC	Alma, Mich.	1000d
WTCN	Minneapolis, Minn.	5000
KVOX	Moorhead, Minn.	1000
WSJC	Magee, Miss.	500d
KDKD	Clinton, Mo.	1000d
KCNI	Broken Bow, Nebr.	1000d
KTOO	Henderson, Nev.	5000d
WHBI	Newark, N.J.	2500
KZUM	Farmington, N.Mex.	5000d
KHOB	Hobbs, N.Mex.	1000d
WOV	New York, N.Y.	5000
WVET	Rochester, N.Y.	5000d
WRSA	Saratoga Sprgs., N.Y.	1000
WSAT	Salisbury, N.C.	1000
WONW	Defiance, Ohio	500
WLMJ	Jackson, Ohio	1000d
KLCO	Poteau, Okla.	1000d
KERG	Eugene, Oreg.	5000
WBRX	Berwick, Pa.	500d
WHVR	Hanover, Pa.	5000
WKST	New Castle, Pa.	5000
WCMN	Arecibo, P.R.	1000
WANS	Anderson, S.C.	1000
WJAY	Mullins, S.C.	1000d
WJGD	Columbia, Tenn.	1000d
WONT	Dayton, Tenn.	1000d
KNIT	Abilene, Tex.	500d
KWHI	Brenham, Tex.	1000d
KLTI	Longview, Tex.	1000d
KNAK	Salt Lake City, Utah	5000
WYVE	Wytheville, Va.	1000d
KIT	Yakima, Wash.	5000
WMNF	Richwood, W.Va.	1000d
WNAM	Neenah, Wis.	1000

1290—232.4

CFAM	Altona, Man.	5000
CKSL	London, Ont.	5000
WTHG	Jackson, Ala.	1000d
WMLS	Sylacauga, Ala.	1000d
KCUB	Tucson, Ariz.	1000
KDMS	El Dorado, Ark.	5000d
KUOA	Siloam Sprgs., Ark.	5000d
KHSL	Chico, Calif.	5000
KPER	Gilroy, Calif.	500d
KITO	San Bernardino, Calif.	5000
WCCC	Hartford, Conn.	500d
WTUX	Wilmington, Del.	1000d
WTMC	Ocala, Fla.	5000
WSCM	Panama City Beach, Florida	500d
WIRK	W. Palm Bch., Fla.	5000
WDEC	Americus, Ga.	1000d
WCHK	Canton, Ga.	1000d
WTOC	Savannah, Ga.	5000
KYTE	Pocatello, Idaho	1000d
WIRL	Peoria, Ill.	5000
WCBL	Benton, Ky.	1000d
KJEF	Jennings, La.	1000
WHGR	Houghton Lake, Michigan	5000d
WNIL	Niles, Mich.	500d
WOIA	Saline, Mich.	500d
KBMO	Benson, Minn.	500d
WBLE	Batesville, Miss.	1000d
KALM	Thayer, Mo.	1000d
KGVO	Missoula, Mont.	5000
KOIL	Omaha, Nebr.	5000
WKNE	Keene, N.H.	5000
KSRC	Socorro, N.M.	1000d
WNBF	Binghamton, N.Y.	5000
WHKY	Hickory, N.C.	5000
WEYE	Sanford, N.C.	1000d
WTRX	Bellaire, Ohio	1000d
WHIO	Dayton, Ohio	5000
KUMA	Pendleton, Oreg.	5000
KLIQ	Portland, Oreg.	1000d
WTRN	Tyrone, Pa.	1000d
WICE	Providence, R.I.	500d
WFIG	Sumter, S.C.	1000
WOKE	Oak Ridge, Tenn.	1000
KBLT	Big Lake, Tex.	1000d
KIVY	Crockett, Tex.	500d
KRGV	Weslaco, Tex.	5000
KTRN	Wichita Falls, Tex.	5000
WPVA	Colonial Hgts., Va.	5000d
WAGE	Leesburg, Va.	1000d
WVOW	Logan, W.Va.	5000
WMIL	Milwaukee, Wis.	1000d

Kc. *Wave Length* W.P.

(1290—232.4)
WCOW Sparta, Wis. 1000d

1300—230.6

CBAF Moncton, N.B. 5000
CJRH Richmond Hill, Ont. 500d
WTLS Tallassee, Ala. 1000d
KWCB Searcy, Ark. 1000d
KROP Brawley, Calif. 1000
KYNO Fresno, Calif. 1000
KWKW Pasadena, Calif. 1000
KVOR Colo. Sprgs., Colo. 1000
WAVZ New Haven, Conn. 1000
WWTB Tampa, Fla. 1000d
WMTM Moultrie, Ga. 5000d
WIMO Winder, Ga. 1000d
KOZE Lewiston, Idaho 5000
WTAQ LaGrange, Ill. 500
WFRX W. Frankfort, Ill. 1000d
WHLT Huntington, Ind. 500d
WMFT Terre Haute, Ind. 500d
KGLO Mason City, Iowa 5000
WBLG Lexington, Ky. 1000
WIBR Baton Rouge, La. 1000
KLUE Shreveport, La. 1000d
WFBR Baltimore, Md. 5000
WJDA Quincy, Mass. 1000d
WOOD Grand Rapids, Mich. 5000
WRBC Jackson, Miss. 5000
KMMO Marshall, Mo. 1000d
KBRL McCook, Nebr. 1000d
WTNJ Trenton, N.J. 250d
WOSC Fulton, N.Y. 1000d
WGOL Goldsboro, N.C. 1000d
WSYD Mt. Airy, N.C. 5000
WERE Cleveland, Ohio 5000
WMVO Mt. Vernon, Ohio 500
KOME Tulsa, Okla. 5000
KRMW The Dalles, Oreg. 1000d
WTIL Mayaguez, P.R. 1000
WCKI Greer, S.C. 1000d
KOLY Mobridge, S.Dak. 1000d
WMTN Morristown, Tenn. 5000d
WMAK Nashville, Tenn. 5000
KVET Austin, Tex. 1000
KTFY Brownfield, Tex. 1000d
KOL Seattle, Wash. 5000
WCLG Morgantown, W.Va. 1000d
WKLC St. Albans, W.Va. 1000d

1310—228.9

CKOY Ottawa, Ont. 5000
WHEP Foley, Ala. 1000d
WJAM Marion, Ala. 5000d
KBUZ Mesa, Ariz. 5000
KBOK Malvern, Ark. 1000d
KWBR Oakland, Calif. 1000
KTKR Taft, Calif. 500d
KFKA Greeley, Colo. 1000
WICH Norwich, Conn. 1000
WOOO Deland, Fla. 5000d
WAUC Wauchula, Fla. 500d
WSIZ Douglas, Ga. 1000d
WBRO Waynesboro, Ga. 1000d
WBMK West Point, Ga. 1000
KLIX Twin Falls, Idaho 1000
WISH Indianapolis, Ind. 5000
KOKX Keokuk, Iowa 1000
WTTL Madisonville, Ky. 500d
WDOC Prestonsburg, Ky. 5000d
KIKS Sulphur, La. 500
KUZN W. Monroe, La. 1000d
WLOB Portland, Maine 1000d
WORC Worcester, Mass. 5000
WKMH Dearborn, Mich. 5000
KRBI St. Peter, Minn. 1000d
WXXX Hattiesburg, Miss. 1000d
KFSB Joplin, Mo. 5000
KFBB Great Falls, Mont. 5000
WJLK Asbury Park, N.J. 250
WCAM Camden, N.J. 250
WVIP Mt. Kisco, N.Y. 1000d
WTLB Utica, N.Y. 1000
WISE Asheville, N.C. 5000
WKTC Charlotte, N.C. 1000
WTIK Durham, N.C. 1000
KNOX Grand Forks, N.Dak. 5000
WFAH Alliance, Ohio 1000d
KNPT Newport, Oreg. 1000
WBFD Bedford, Pa. 1000d
WGSA Ephrata, Pa. 1000d
WNAE Warren, Pa. 5000d
WDKD Kingstree, S.C. 5000d
WDOD Chattanooga, Tenn. 5000
WDXI Jackson, Tenn. 5000
KZIP Amarillo, Tex. 1000d
WRR Dallas, Tex. 5000
KOYL Odessa, Tex. 500d
WEEL Fairfax, Va. 500d
WGH Newport News, Va. 5000
KARY Prosser, Wash. 1000d
WIBA Madison, Wis. 5000

1320—227.1

CJSO Sorel, P.Q. 1000
WAGF Dothan, Ala. 1000
WEZB Homewood, Ala. 1000d
KWHN Fort Smith, Ark. 5000
KRLW Walnut Ridge, Ark. 1000d
KUDE Oceanside, Calif. 500
KCRA Sacramento, Calif. 5000
KAVI Rocky Ford, Colo. 1000d
WATR Waterbury, Conn. 1000
WGMA Hollywood, Fla. 1000d
WJHP Jacksonville, Fla. 5000
WHIE Griffin, Ga. 1000d
WNEG Toccoa, Ga. 1000d
WKAN Kankakee, Ill. 1000d
KLWN Lawrence, Kans. 500d
WBRT Bardstown, Ky. 1000d
WNGO Mayfield, Ky. 1000d
KVHL Homer, La. 1000d
WICO Salisbury, Md. 500d
WARA Attleboro, Mass. 1000
WILS Lansing, Mich. 5000
WOMJ Marquette, Mich. 1000
WCPC Houston, Miss. 5000d
WRJW Picayune, Miss. 5000d
KXLW Clayton, Mo. 1000d
KOLT Scottsbluff, Nebr. 5000
WWHG Hornell, N.Y. 5000d
WAGY Forest City, N.C. 500d
WCOG Greensboro, N.C. 5000
KQDY Minot, N.Dak. 1000d
WHOK Lancaster, Ohio 1000d
KWOE Clinton, Okla. 1000d
WKAP Allentown, Pa. 1000
WAMP Pittsburgh, Pa. 5000
WSCR Scranton, Pa. 1000
WRIO Rio Piedras, P.R. 5000
WMSC Columbia, S.C. 1000
KELO Sioux Falls, S.Dak. 5000
WKIN Kingsport, Tenn. 5000d
KVMC Colo. City, Tex. 1000d
KXYZ Houston, Tex. 5000
KDYL Salt Lake City, Utah 5000
WLLY Richmond, Va. 1000d
KXRO Aberdeen, Wash. 1000
KHIT Walla Walla, Wash. 1000d

1330—225.4

CBH Halifax, N.S. 100
WROS Scottsboro, Ala. 1000d
KMOP Tucson, Ariz. 500d
KFAC Los Angeles, Calif. 5000
WARN Ft. Pierce, Fla. 1000d
WYSE Lakeland, Fla. 1000d
WEBY Milton, Fla. 5000d
WMEN Tallahassee, Fla. 5000d
WMLT Dublin, Ga. 1000d
WEAW Evanston, Ill. 1000d
WRAM Monmouth, Ill. 1000d
WRRR Rockford, Ill. 1000d
WJPS Evansville, Ind. 5000
KWWL Waterloo, Iowa 5000
KFH Wichita, Kans. 5000
WMOR Morehead, Ky. 1000d
KVOL Lafayette, La. 1000
WASA Havre deGrace, Md. 1000d
WCRB Waltham, Mass. 5000
WBBC Flint, Mich. 1000
WLOL Minneapolis, Minn. 5000
WCRR Corinth, Miss. 500d
WJPR Greenville, Miss. 1000
WDAL Meridian, Miss. 1000d
KUKU Willow Springs, Mo. 500d
KGAK Gallup, N.Mex. 5000
WEVD New York, N.Y. 5000
WPOW New York, N.Y. 5000
WEBO Oswego, N.Y. 1000d
WHAZ Troy, N.Y. 1000
WFIN Findlay, Ohio 1000d
WKOV Wellston, Ohio 500d
KPOJ Portland, Oreg. 5000
WBLF Bellefonte, Pa. 500
WICU Erie, Pa. 5000
WLAT Conway, S.C. 1000d
WFBC Greenville, S.C. 5000
WAEW Crossville, Tenn. 1000d
WTRO Dyersburg, Tenn. 500d
KMIL Cameron, Tex. 500d
KSWA Graham, Tex. 500d
KINE Kingsville, Tex. 1000d
KDOK Tyler, Tex. 1000d
WBTM Danville, Va. 5000
WESR Tasley, Va. 1000d
KFKF Bellevue, Wash. 1000d
WETZ New Martinsville, West Virginia 1000d
WHBL Sheboygan, Wis. 1000
KOVE Lander, Wyo. 1000

1340—223.7

CFGB Goose Bay, Nfld. 250
CFSL Weyburn, Sask. 250
CFYK Yellow Knife, N.W.Terr. 250
CHAD Amos, Que. 250
CJLS Yarmouth, N.S. 250
CHRD Drummondville, Que. 250
CJQC Quebec, Que. 250
CKOX Woodstock, Ont. 250
WKUL Cullman, Ala. 250
WJOI Florence, Ala. 250
WGWC Selma, Ala. 250
WFEB Sylacauga, Ala. 250
KIBH Seward, Alaska 250
KIKO Miami, Ariz. 250
KNOG Nogales, Ariz. 250
KZOK Prescott, Ariz. 250
KBTA Batesville, Ark. 250
KBRS Springdale, Ark. 250
KENL Arcata, Calif. 250
KMAK Fresno, Calif. 250
KWSD Mt. Shasta, Calif. 250
KSFE Needles, Calif. 250
KMOR Oroville, Calif. 250
KATY San Luis Obispo, Calif. 250
KIST Santa Barbara, Calif. 250
KOMY Watsonville, Calif. 250
KDEN Denver, Colo. 250
KVRH Salida, Colo. 250
WNHC New Haven, Conn. 250
WOOK Washington, D.C. 250
WTAN Clearwater, Fla. 250
WROD Daytona Bch., Fla. 250
WDSR Lake City, Fla. 250
WTYS Marianna, Fla. 250
WQXT Palm Beach, Fla. 250
WGAU Athens, Ga. 250
WAKE Atlanta, Ga. 250
WBBQ Augusta, Ga. 250
WGAA Cedartown, Ga. 250
WDAK Columbus, Ga. 250
WTIF Tifton, Ga. 250
KPST Preston, Idaho 250
WSOY Decatur, Ill. 250
WJPF Herrin, Ill. 250
WJOL Joliet, Ill. 250
WBIW Bedford, Ind. 250
WTRC Elkhart, Ind. 250
WLBC Muncie, Ind. 250
KROS Clinton, Iowa 250
KLIL Estherville, Iowa 250
KCKN Kansas City, Kans. 250
KSEK Pittsburg, Kans. 250
WCMI Ashland, Ky. 250
WNBS Murray, Ky. 250
WEKY Richmond, Ky. 250
KGAN Bastrop, La. 250
KRMD Shreveport, La. 250
WFAU Augusta, Maine 250
WABM Houlton, Maine 250
WGAW Gardner, Mass. 250
WNBH New Bedford, Mass. 250
WBRK Pittsfield, Mass. 250
WLEW Bad Axe, Mich. 250
WLAV Grand Rap., Mich. 250
WBSE Hillsdale, Mich. 100
WMTE Manistee, Mich. 250
WAGN Menominee, Mich. 250
WMBN Petoskey, Mich. 250
WEXL Royal Oak, Mich. 250
KDLM Detroit Lakes, Minn. 250
WEVE Eveleth, Minn. 250
KROC Rochester, Minn. 250
KWLM Willmar, Minn. 250
WJMB Brookhaven, Miss. 250
WAML Laurel, Miss. 250
KXEO Mexico, Mo. 250
KSMO Salem, Mo. 250
KICK Springfield, Mo. 250
KCAP Helena, Mont. 250
KPRK Livingston, Mont. 250
KATL Miles City, Mont. 250
KBTK Missoula, Mont. 250
KFGT Fremont, Nebr. 100
KGFW Kearney, Nebr. 250
KSID Sidney, Nebr. 250
KORK Las Vegas, Nev. 250
KATO Reno, Nev. 250
WDCR Hanover, N.H. 250
WMID Atlantic City, N.J. 250
KABQ Albuquerque, N.Mex. 250
KSIL Silver City, N.Mex. 250
WMBO Auburn, N.Y. 250
WENT Gloversville, N.Y. 250
WJOC Jamestown, N.Y. 250
WUSJ Lockport, N.Y. 250
WMSA Massena, N.Y. 250
WALL Middletown, N.Y. 250
WIRY Plattsburg, N.Y. 250
WJRI Lenoir, N.C. 250
WTSB Lumberton, N.C. 250
WOXF Oxford, N.C. 250
WOOW Washington, N.C. 250
WGNI Wilmington, N.C. 250
WAIR Winston-Salem, N.C. 250
KGPC Grafton, N.D. 250
WATG Ashland, Ohio 250
WOUB Athens, Ohio 100
WIZE Springfield, Ohio 250
WSTV Steubenville, Ohio 250
KIHN Hugo, Okla. 250
KOCY Okla. City, Okla. 250
KLOO Corvallis, Ore. 250
KAGI Grants Pass, Oreg. 250
KIHR Hood River, Oreg. 250
KFIR North Bend, Oreg. 250
WFBG Altoona, Pa. 250
WCVI Connellsville, Pa. 250
WSAJ Grove City, Pa. 100
WKRZ Oil City, Pa. 250
WHAT Philadelphia, Pa. 250
WRAW Reading, Pa. 250
WBRE Wilkes-Barre, Pa. 250
WWPA Williamsport, Pa. 250
WGRF Aguadilla, P.R. 250
WHAN Charleston, S.C. 250
WRHI Rock Hill, S.C. 250
WSSC Sumter, S.C. 250
KIJV Huron, S.D. 250
KRSD Rapid City, S.Dak. 250
WBAC Cleveland, Tenn. 250
WKRM Columbia, Tenn. 250
WGRV Greenville, Tenn. 250
WKGN Knoxville, Tenn. 250
WHHM Memphis, Tenn. 250
WCDT Winchester, Tenn. 250
KWKC Abilene, Tex. 250
KAND Corsicana, Tex. 250
KSET El Paso, Tex. 250
KNAF Fredericksburg, Tex. 250
KDUB Lubbock, Tex. 250
KRBA Lufkin, Tex. 250
KVKM Monahans, Tex. 250
KPDN Pampa, Tex. 250
KOLE Port Arthur, Tex. 250
KTXL San Angelo, Tex. 250
KVIC N. of Victoria, Tex. 250
WTWN St. Johnsbury, Vt. 250
WSTA Charlotte Amalie, V.I. 250
WKEY Covington, Va. 250
WHAP Hopewell, Va. 250
WJMA Orange, Va. 250
KAGT Anacortes, Wash. 250
KPKW Pasco, Wash. 250
KAPA Raymond, Wash. 250
KMEL Wenatchee, Wash. 250
WHAR Clarksburg, W.Va. 250
WEPM Martinsburg, W.Va. 250
WMON Montgomery, W.Va. 250
WOVE Welch, W.Va. 250
WLDY Ladysmith, Wis. 250
WRIT Milwaukee, Wis. 250
WFHR Wis. Rapids, Wis. 250
KOWB Laramie, Wyo. 250
KWOR Worland, Wyo. 250

1350—222.1

CHOV Pembroke, Ont. 1000
CJDC Dawson Creek, B.C. 1000
CHGB St. Anne de la Pocatiere, Que. 1000
CKLB Oshawa, Ont. 5000
CKEN Kentville, N.S. 1000
CKTR Three Rivers, Que. 1000
WGAD Gadsden, Ala. 5000
KWFC Hot Springs, Ark. 1000
KLYD Bakersfield, Calif. 1000d
KCKC San Bernardino, Calif. 500
KSRO Santa Rosa, Calif. 1000
KGHF Pueblo, Colo. 5000
WNLK Norwalk, Conn. 500
WPCT Putnam, Conn. 1000d
WDCF Dade City, Fla. 1000d
WRPB Warner Robins, Ga. 1000d
KRLC Lewiston, Idaho 5000
WEEK Peoria, Ill. 1000
WJBD Salem, Ill. 500d
WIOU Kokomo, Ind. 1000
KRNT Des Moines, Iowa 5000
KMAN Manhattan, Kans. 500d
WLOU Louisville, Ky. 5000d
WSMB New Orleans, La. 5000
WHMI Howell, Mich. 500
KDIO Ortonville, Minn. 1000d
WCMP Pine City, Minn. 1000d
WKOZ Kosciusko, Miss. 5000d
KCHR Charleston, Mo. 1000d
WLNH Laconia, N.H. 5000d
WCBA Corning, N.Y. 1000d
WHIP Mooresville, N.C. 1000d
KQDI Bismarck, N.D. 500d
WADC Akron, Ohio 5000
WCHI Chillicothe, Ohio 500d
KRHD Duncan, Okla. 250
KTLQ Tahlequah, Okla. 500d
WORK York, Pa. 5000
WDAR Darlington, S.C. 500d
WGSW Greenwood, S.C. 1000d
KTXJ Jasper, Tex. 1000d
KCOR San Antonio, Tex. 5000
WBLT Bedford, Va. 1000d
WNVA Norton, Va. 5000d
WAVY Portsmouth, Va. 5000
WPDR Portage, Wis. 1000d

1360—220.4

WWWB Jasper, Ala. 1000d
WMFC Monroeville, Ala. 1000d
WELR Roanoke, Ala. 1000d
KRUX Glendale, Ariz. 5000
KLYR Clarksville, Ark. 500d
KFFA Helena, Ark. 1000
KFIV Modesto, Calif. 1000
KRCK Ridgecrest, Calif. 1000d
KGB San Diego, Calif. 1000
WDRC Hartford, Conn. 5000
WOBS Jacksonville, Fla. 5000d
WKAT Miami Beach, Fla. 5000
WIOD Sanford, Fla. 500d
WINT Winter Haven, Fla. 1000d
WAZA Bainbridge, Ga. 1000d
WLBK DeKalb, Ill. 500d
WVMC Mt. Carmel, Ill. 500d
KXGI Ft. Madison, Iowa 1000d
KSCJ Sioux City, Iowa 5000
KBTO El Dorado, Kans. 500d
WFLW Monticello, Ky. 1000d
KDBC Mansfield, La. 1000d
KVIM New Iberia, La. 1000d
KTLD Tallulah, La. 500d
WEBB Dundalk, Md. 5000d
WLYN Lynn, Mass. 1000d
WKMI Kalamazoo, Mich. 5000
KLRS Mountain Grove, Mo. 1000d
WNNJ Newton, N.J. 500d
WWBZ Vineland, N.J. 1000
WKOP Binghamton, N.Y. 5000
WMNS Olean, N.Y. 1000d
WCHL Chapel Hill, N.C. 1000d
KEYZ Williston, N.D. 5000
WSAI Cincinnati, Ohio 5000
KUIK Hillsboro, Oreg. 1000d
WMCK McKeesport, Pa. 1000
WPPA Pottsville, Pa. 1000
WELP Easley, S.C. 1000d
WLCM Lancaster, S.C. 1000d
WNAH Nashville, Tenn. 1000d
KRAY Amarillo, Tex. 500d
KACT Andrews, Tex. 1000d

Kc.	Wave Length	W.P.
KREL	Baytown, Tex.	1000
KRYS	Corpus Christi, Tex.	1000
KXOL	Ft. Worth, Tex.	5000
WBOB	Galax, Va.	1000d
WHBG	Harrisonburg, Va.	5000d
KMO	Tacoma, Wash.	5000
WHJC	Matawan, W.Va.	1000d
WMOV	Ravenswood, W.Va.	1000d
WBAY	Green Bay, Wis.	5000
WISV	Viroqua, Wis.	500d
WMNE	Menomonie, Wis.	1000d
KVRS	Rock Springs, Wyo.	1000

1370—218.8

WBYE	Calera, Ala.	1000d
KBUC	Corona, Calif.	1000
KEEN	San Jose, Calif.	5000
KGEN	Tulare, Calif.	1000d
WHYS	Ocala, Fla.	1000d
WCOA	Pensacola, Fla.	5000
WAXE	Vero Beach, Fla.	1000d
WBGR	Jesup, Ga.	1000d
WFDR	Manchester, Ga.	1000d
WKLE	Washington, Ga.	1000d
WPRC	Lincoln, Ill.	500d
WTTS	Bloomington, Ind.	5000
WGRY	Gary, Ind.	500d
KDTH	Dubuque, Iowa	1000
KGNO	Dodge City, Kans.	5000
KAPB	Marksville, La.	1000d
WKIK	Leonardtown, Md.	1000d
WGHN	Grand Haven, Mich.	500d
KSUM	Fairmont, Minn.	1000
WDOB	Canton, Miss.	1000d
KWRT	Boonville, Mo.	1000d
KCRV	Caruthersville, Mo.	1000d
KXLF	Butte, Mont.	5000
KAWL	York, Nebr.	500d
WFEA	Manchester, N.H.	5000
WALK	Patchogue, N.Y.	500d
WSAY	Rochester, N.Y.	5000
WLTC	Gastonia, N.C.	1000d
WTAB	Tabor City, N.C.	5000d
KFJM	Grand Forks, N.D.	1000d
WSPD	Toledo, Ohio	5000
KAST	Astoria, Oreg.	1000
WOTR	Corry, Pa.	1000d
WPAZ	Pottstown, Pa.	1000d
WKMC	Roaring Sprgs., Pa.	1000d
WIVV	Vieques, P.R.	1000
WDEF	Chattanooga, Tenn.	5000
WDXE	Lawrenceburg, Tenn.	1000d
WRGS	Rogersville, Tenn.	1000d
KOKE	Austin, Tex.	1000d
KFRO	Longview, Tex.	1000
KPOS	Post, Tex.	500d
KSOP	Salt Lake City, Utah	1000d
WBTN	Bennington, Vt.	500d
WHEE	Martinsville, Va.	1000d
WJWS	South Hill, Va.	1000d
KPOR	Quincy, Wash.	1000d
WMOD	Moundsville, W.Va.	1000d
WCCN	Neillsville, Wis.	1000d
KVWO	Cheyenne, Wyo.	1000

1380—217.3

CFDA	Victoriaville, Que.	1000
CKPC	Brantford, Ont.	1000
CKLC	Kingston, Ont.	5000
WGYV	Greenville, Ala.	1000d
KNLR	N. Little Rock, Ark.	1000d
KBVM	Lancaster, Calif.	1000d
KGMS	Sacramento, Calif.	1000
KSBW	Salinas, Calif.	1000
KFLJ	Walsenburg, Colo.	1000d
WAMS	Wilmington, Del.	1000
WQXQ	Ormond Bch., Fla.	1000d
WTSP	St. Petersburg, Fla.	5000
WAOK	Atlanta, Ga.	5000
KHON	Honolulu, Hawaii	5000
WKJG	Ft. Wayne, Ind.	5000
KCIM	Carroll, Iowa	1000
WMTA	Central City, Ky.	500d
WWKY	Winchester, Ky.	1000d
WEND	Baton Rouge, La.	500d
WTTH	Port Huron, Mich.	1000
KLIZ	Brainerd, Minn.	1000d
KAGE	Winona, Minn.	1000d
WNLA	Indianola, Miss.	500d
WTUP	Tupelo, Miss.	1000d
KUDL	Kansas City, Mo.	1000d
KWK	St. Louis, Mo.	5000
KUVR	Holdredge, Nebr.	500d
WAWZ	Zarephath, N.J.	5000
WBNX	New York, N.Y.	5000
WLOS	Asheville, N.C.	5000
WTOB	Winston-Salem, N.C.	5000
WWIZ	Lorain, Ohio	500d
WPKO	Waverly, Ohio	1000d
KSWO	Lawton, Okla.	1000
KMUS	Muskogee, Okla.	1000
KSRV	Ontario, Oreg.	1000
WACB	Kittanning, Pa.	1000d
WAYZ	Waynesboro, Pa.	1000d
WNRI	Woonsocket, R.I.	1000d
WAGS	Bishopville, S.C.	1000d
KOTA	Rapid City, S.Dak.	5000
KJET	Beaumont, Tex.	1000d
KBWD	Brownwood, Tex.	1000
KTSM	El Paso, Tex.	1000
KMUL	Muleshoe, Tex.	500d
KBOP	Pleasanton, Tex.	1000d
WSYB	Rutland, Vt.	5000
WMBG	Richmond, Va.	5000
KRKO	Everett, Wash.	1000
WBEL	Beloit, Wis.	5000d

1390—215.7

CKLN	Nelson, B.C.	1000
WHMA	Anniston, Ala.	5000
KDQN	DeQueen, Ark.	500d
KAMO	Rogers, Ark.	1000d
KGER	Long Beach, Calif.	5000
KTUR	Turlock, Calif.	1000
KFML	Denver, Colo.	1000d
WAVP	Avon Park, Fla.	1000d
WGES	Chicago, Ill.	5000
WFIW	Fairfield, Ill.	500d
WJCD	Seymour, Ind.	1000d
KCLN	Clinton, Iowa	1000d
KCBC	Des Moines, Iowa	1000
KNCK	Concordia, Kans.	500d
KNOE	Monroe, La.	5000
WCAT	Orange, Mass.	1000d
WPLM	Plymouth, Mass.	1000d
WCER	Charlotte, Mich.	1000d
KRFO	Owatonna, Minn.	500d
WROA	Gulfport, Miss.	1000d
WQIC	Meridian, Miss.	5000d
KENN	Farmington, N.Mex.	5000
WEOK	Poughkeepsie, N.Y.	1000d
WRIV	Riverhead, N.Y.	1000d
WFBL	Syracuse, N.Y.	5000
WFNC	Fayetteville, N.C.	5000
WEED	Rocky Mount, N.C.	5000
WADA	Shelby, N.C.	500d
KLPM	Minot, N.Dak.	5000
WOHP	Bellefontaine, Ohio	500d
WFMJ	Youngstown, Ohio	5000
KCRC	Enid, Okla.	1000
KSLM	Salem, Oreg.	1000
WLAN	Lancaster, Pa.	1000
WHPB	Belton, S.C.	500d
WCSC	Charleston, S.C.	5000
WTJS	Jackson, Tenn.	5000
KULP	El Campo, Tex.	500d
KBEC	Waxahachie, Tex.	500d
KLGN	Logan, Utah	1000d
WEAM	Arlington, Va.	5000
WWOD	Lynchburg, Va.	5000
KLOQ	Yakima, Wash.	1000

1400—214.2

CKBC	Bathurst, N.B.	250
CKCY	Sault Ste. Marie, Ont.	250
CKFH	Toronto, Ont.	250
CKRN	Rouyn, Que.	250
CKSW	Swift Current, Sask.	250
WMSL	Decatur, Ala.	250
WXAL	Demopolis, Ala.	250
WFPA	Ft. Payne, Ala.	250
WJLD	Homewood, Ala.	250
WJHO	Opelika, Ala.	250
KSEW	Sitka, Alaska	250
KCLF	Clifton, Ariz.	250
KONI	Phoenix, Ariz.	250
KTUC	Tucson, Ariz.	250
KVOY	Yuma, Ariz.	250
KELD	El Dorado, Ark.	250
KCLA	Pine Bluff, Ark.	250
KWYN	Wynne, Ark.	250
KRE	Berkeley, Calif.	250
KREO	Indio, Calif.	250
KSDA	Redding, Calif.	250
KCOY	Santa Maria, Calif.	250
KSPA	Santa Paula, Calif.	250
KUKI	Ukiah, Calif.	250
KONG	Visalia, Calif.	250
KRLN	Canon City, Colo.	250
KDTA	Delta, Colo.	250
KFTM	Ft. Morgan, Colo.	250
KBNZ	La Junta, Colo.	250
WSTC	Stamford, Conn.	250
WILI	Willimantic, Conn.	250
WFTL	Ft. Lauderdale, Fla.	250
WIRA	Ft. Pierce, Fla.	250
WRHC	Jacksonville, Fla.	250
WPCF	Panama City, Fla.	250
WPRY	Perry, Fla.	250
WTRR	Sanford, Fla.	250
WCOS	Alma, Ga.	250
WSGC	Elberton, Ga.	250
WNEX	Macon, Ga.	250
WMGA	Moultrie, Ga.	250
WCOH	Newnan, Ga.	250
WGSA	Savannah, Ga.	250
KART	Jerome, Idaho	250
KRPL	Moscow, Idaho	250
KSPT	Sandpoint, Idaho	250
WDWS	Champaign, Ill.	250
WGIL	Galesburg, Ill.	250
WEOA	Evansville, Ind.	250
WBAT	Marion, Ind.	250
KCOG	Centerville, Iowa	100
KVFD	Fort Dodge, Iowa	250
KVOE	Emporia, Kans.	250
KAYS	Hays, Kans.	250
WCYN	Cynthiana, Ky.	100
WIEL	Elizabethtown, Ky.	250
WFTG	London, Ky.	250
WFPR	Hammond, La.	250
KAOK	Lake Charles, La.	250
WRDO	Augusta, Maine	250
WIDE	Biddeford, Maine	250
WWIN	Baltimore, Md.	250
WALE	Fall River, Mass.	250
WLLH	Lowell, Mass.	250
WHMP	Northampton, Mass.	250
WELL	Battle Creek, Mich.	250
WJLB	Detroit, Mich.	250
WHDF	Houghton, Mich.	250
WMAB	Munising, Mich.	250
WSAM	Saginaw, Mich.	250
WSJM	St. Joseph, Mich.	250
WTCM	Traverse City, Mich.	250
KMHL	Marshall, Minn.	250
WMIN	Mpls.-St. Paul, Minn.	250
WHLB	Virginia, Minn.	250
WBIP	Booneville, Miss.	250
WNAG	Grenada, Miss.	250
WFOR	Hattiesburg, Miss.	250
WJQS	Jackson, Miss.	250
WMBC	Macon, Miss.	250
KFRU	Columbia, Mo.	250
KSIM	Sikeston, Mo.	250
KTTS	Springfield, Mo.	250
KXGN	Glendive, Mont.	250
KXLK	Great Falls, Mont.	250
KCOW	Alliance, Nebr.	250
KLIN	Lincoln, Nebr.	250
KBRX	O'Neill, Nebr.	250
KPTL	Carson City, Nev.	250
KBMI	Henderson, Nev.	250
KWNA	Winnemucca, Nev.	250
WTSL	Hanover, N.H.	250
KGFL	Roswell, N. Mex.	250
KTRC	Santa Fe, N.Mex.	250
KCHS	Truth or Consequences, New Mexico	250
KTNM	Tucumcari, N.Mex.	250
WOND	Pleasantville, N.J.	250
WABY	Albany, N.Y.	250
WBNY	Buffalo, N.Y.	250
WELM	Elmira, N.Y.	250
WSLB	Ogdensburg, N.Y.	250
WBMA	Beaufort, N.C.	250
WGBG	Greensboro, N.C.	250
WKDX	Hamlet, N.C.	250
WSIC	Statesville, N.C.	250
WLSE	Wallace, N.C.	250
WHCC	Waynesville, N.C.	250
KEYJ	Jamestown, N.Dak.	250
WPAY	Portsmouth, Ohio	250
KWON	Bartlesville, Okla.	250
KTMC	McAlester, Okla.	250
KNOR	Norman, Okla.	250
KWIN	Ashland, Oreg.	250
KOMB	Cottage Grove, Oreg.	250
KBCH	Oceanlake, Oreg.	250
WEST	Easton, Pa.	250
WJET	Erie, Pa.	250
WHGB	Harrisburg, Pa.	250
WJAC	Johnstown, Pa.	250
WKBI	St. Marys, Pa.	250
WICK	Scranton, Pa.	250
WRAK	Williamsport, Pa.	250
WHOA	San Juan, P.R.	250
WPCC	Clinton, S.C.	500
WCOS	Columbia, S.C.	250
WGTN	Georgetown, S.C.	250
WTHE	Spartanburg, S.C.	250
WJZM	Clarksville, Tenn.	250
WHUB	Cookeville, Tenn.	250
WKPT	Kingsport, Tenn.	250
WGAP	Maryville, Tenn.	250
WHAL	Shelbyville, Tenn.	250
KRUN	Ballinger, Tex.	250
KBYG	Big Spring, Tex.	100
KUNO	Corpus Christi, Tex.	250
KILE	nr. Galveston, Tex.	250
KGVL	Greenville, Tex.	250
KEBE	Jacksonville, Tex.	250
KIUN	Pecos, Tex.	250
KEYE	Perryton, Tex.	250
KVOP	Plainview, Tex.	250
KDWT	Stamford, Tex.	250
KTEM	Temple, Tex.	250
KTFS	Texarkana, Tex.	250
KVOU	Uvalde, Tex.	250
KIXX	Provo, Utah	250
WDOT	Burlington, Vt.	250
WINA	Charlottesville, Va.	250
WLOW	Portsmouth, Va.	250
WHLF	So. Boston, Va.	250
WINC	Winchester, Va.	250
KFDR	Grand Coulee, Wash.	250
KWLK	Longview, Wash.	250
KTNT	Tacoma, Wash.	250
WBOY	Clarksburg, W.Va.	250
WRON	Ronceverte, W.Va.	250
WKWK	Wheeling, W.Va.	250
WBTH	Williamson, W.Va.	250
WATW	Ashland, Wis.	250
WBIZ	Eau Claire, Wis.	250
WDUZ	Green Bay, Wis.	250
WRJN	Racine, Wis.	250
WRDB	Reedsburg, Wis.	250
WRIG	Wausau, Wis.	250
KATI	Casper, Wyo.	250
KODI	Cody, Wyo.	250

1410—212.6

CFUN	Vancouver, B.C.	1000
CHLP	Montreal, Que.	1000
WALA	Mobile, Ala.	5000
KTCS	Fort Smith, Ark.	500d
KERN	Bakersfield, Calif.	500
KTEE	Carmel, Calif.	500d
KMYC	Marysville, Calif.	5000
KCAL	Redlands, Calif.	1000d
KCOL	Ft. Collins, Colo.	1000
WPOP	Hartford, Conn.	5000
WDOV	Dover, Del.	1000d
WMYR	Fort Myers, Fla.	5000
WBIL	Leesburg, Fla.	1000d
WDAX	McRae, Ga.	1000d
WLAQ	Rome, Ga.	1000
WRMN	Elgin, Ill.	500d
WTIM	Taylorville, Ill.	1000d
KGRN	Grinnell, Iowa	500d
KLEM	LeMars, Iowa	1000d
KCLO	Leavenworth, Kans.	500d
KWBB	Wichita, Kans.	1000
WLBJ	Bowling Green, Ky.	5000
WHLN	Harlan, Ky.	5000d
KDBS	Alexandria, La.	1000d
WGRD	Grand Rap., Mich.	1000d
WBKN	Newton, Miss.	500d
WHTG	Eatontown, N.J.	500d
WDOE	Dunkirk, N.Y.	500
WEGO	Concord, N.C.	1000d
WSRC	Durham, N.C.	1000d
WING	Dayton, Ohio	5000
KPAM	Portland, Oreg.	5000d
WLSH	Lansford, Pa.	1000d
KQV	Pittsburgh, Pa.	5000
WYMB	Manning, S.C.	1000d
WCMT	Martin, Tenn.	1000d
KBUD	Athens, Tex.	250d
KVLB	Cleveland, Tex.	500
KXIT	Dalhart, Tex.	500d
KADO	Marshall, Tex.	500
KRIG	Odessa, Tex.	1000
KBAL	San Saba, Tex.	500d
KNAL	Victoria, Tex.	500
WRIS	Roanoke, Va.	5000d
WKBH	LaCrosse, Wis.	5000
KWYO	Sheridan, Wyo.	1000

1420—211.1

CJMT	Chicoutimi, Que.	1000
CKOM	Saskatoon, Sask.	5000
WACT	Tuscaloosa, Ala.	5000d
KHFH	Sierra Vista, Ariz.	1000d
KPOC	Pocahontas, Ark.	1000d
KSTN	Stockton, Calif.	1000
WLIS	Old Saybrook, Conn.	500d
WBRD	Bradenton, Fla.	1000
WDBF	Delray Beach, Fla.	500d
WSTN	St. Augustine, Fla.	1000d
WAVO	Avondale Estates, Ga.	500d
WRBL	Columbus, Ga.	5000
WLET	Toccoa, Ga.	5000d
WINI	Murphysboro, Ill.	500d
WIMS	Michigan City, Ind.	1000
WOC	Davenport, Iowa	5000
KJCK	Junction City, Kans.	1000d
WTCR	Ashland, Ky.	5000d
WHBN	Harrodsburg, Ky.	1000d
WVJS	Owensboro, Ky.	1000
KPEL	Lafayette, La.	1000
WBSM	New Bedford, Mass.	1000
WBEC	Pittsfield, Mass.	1000
WAMM	Flint, Mich.	500
KTOE	Mankato, Minn.	5000
WSUH	Oxford, Miss.	1000d
WQBC	Vicksburg, Miss.	1000
KBTN	Neosho, Mo.	500d
KOOO	Omaha, Nebr.	500d
WACK	Newark, N.J.	500
WALY	Herkimer, N.Y.	1000d
WLNA	Peekskill, N.Y.	1000d
WMYN	Mayodan, N.C.	500
WVOT	Wilson, N.C.	1000
WHK	Cleveland, Ohio	5000
KTJS	Hobart, Okla.	250d
KYNG	Coos Bay, Oreg.	1000d
WCOJ	Coatesville, Pa.	5000
WCED	DuBois, Pa.	5000
WEUC	Ponce, P.R.	1000
WCRE	Cheraw, S.C.	1000d
WEMB	Erwin, Tenn.	1000d
WKSR	Pulaski, Tenn.	1000
KFYN	Bonham, Tex.	250d
KTRE	Lufkin, Tex.	1000
KGNB	New Braunfels, Tex.	1000d
KPEP	San Angelo, Tex.	1000d
WWSR	St. Albans, Vt.	1000d
WDDY	Gloucester, Va.	1000d
WKTF	Warrenton, Va.	5000d
KITI	Chehalis, Wash.	1000d
KUJ	Walla Walla, Wash.	5000
WPLY	Plymouth, Wis.	500d

1430—209.7

WFHK	Pell City, Ala.	1000d
KHBM	Monticello, Ark.	1000d
KAMP	El Centro, Calif.	1000d
KARM	Fresno, Calif.	5000
KALI	Pasadena, Calif.	5000d
KOSI	Aurora, Colo.	5000
WSDB	Homestead, Fla.	500d
WLAK	Lakeland, Fla.	5000
WGFS	Covington, Ga.	1000d
WRCD	Dalton, Ga.	1000d
WWGS	Tifton, Ga.	5000d
WCMY	Ottawa, Ill.	500d
WIRE	Indianapolis, Ind.	5000
KASI	Ames, Iowa	1000d
WKIC	Hazard, Ky.	1000d
KMRC	Morgan City, La.	500d
WNAV	Annapolis, Md.	1000
WHIL	Medford, Mass.	5000d
WION	Ionia, Mich.	500d
WBRB	Mt. Clemens, Mich.	500d
WIL	St. Louis, Mo.	5000
KRGI	Grand Island, Nebr.	1000
WNJR	Newark, N.J.	5000
WENE	Endicott, N.Y.	5000
WMNC	Morganton, N.C.	5000d

Kc. Wave Length W.P.

(1430—209.7)

WRXO	Roxboro, N.C.	1000d
WFOB	Fostoria, Ohio	1000
WCLT	Newark, Ohio	500d
KALV	Alva, Okla.	500
KTUL	Lookout Mountain, Oklahoma	5000
KGAY	Salem, Oreg.	5000d
WVAM	Altoona, Pa.	1000
WFRA	Franklin, Pa.	500d
WBLR	Batesburg, S.C.	5000d
WATP	Marion, S.C.	1000d
KBRK	Brookings, S.Dak.	500d
WENO	Madison, Tenn.	5000d
WHER	Memphis, Tenn.	1000
KSTB	Breckenridge, Tex.	1000d
KSIJ	Gladewater, Tex.	1000d
KCOH	Houston, Tex.	1000d
KLO	Ogden, Utah	5000
KBRC	Mt. Vernon, Wash.	5000
WEIR	Weirton, W.Va.	1000
WBEV	Beaver Dam, Wis.	1000d

1440—208.2

WHHY	Montgomery, Ala.	5000
KPOK	Scottsdale, Ariz.	5000d
KOKY	Little Rock, Ark.	5000d
KVON	Napa, Calif.	500
KPRO	Riverside, Calif.	1000
WBIS	Bristol, Conn.	500d
WABR	Winter Park, Fla.	5000
WWCC	Bremen, Ga.	500d
WGIG	Brunswick, Ga.	5000
WXLI	Dublin, Ga.	1000d
WRAJ	Anna, Ill.	500d
WPRS	Paris, Ill.	500d
WGEM	Quincy, Ill.	1000
WROK	Rockford, Ill.	1000
WPGW	Portland, Ind.	500d
KCHE	Cherokee, Iowa	500d
KJAY	Topeka, Kans.	5000
WKLX	Paris, Ky.	1000d
KMLB	Monroe, La.	5000
WAAB	Worcester, Mass.	5000
WBCM	Bay City, Mich.	1000
WCHB	Inkster, Mich.	1000d
KEVE	Minneapolis, Minn.	5000d
WMVB	Millville, N.J.	1000d
WBAB	Babylon, N.Y.	500d
WJJL	Niagara Falls, N.Y.	1000d
WBLA	Elizabethtown, N.C.	1000d
WBUY	Lexington, N.C.	5000d
KILO	Grand Forks, N.D.	1000
WHHH	Warren, Ohio	5000
KMED	Medford, Oreg.	5000
KODL	The Dalles, Oreg.	1000
WCDL	Carbondale, Pa.	5000d
WGCB	Red Lion, Pa.	1000d
WQOK	Greenville, S.C.	5000
WZYX	Cowan, Tenn.	1000d
WHDM	McKenzie, Tenn.	500d
KFDA	Amarillo, Tex.	5000
KEYS	Corpus Christi, Tex.	1000
KDNT	Denton, Tex.	1000
KETX	Livingston, Tex.	1000d
WKLV	Blackstone, Va.	5000d
KITN	Olympia, Wash.	500d
WHIS	Bluefield, W.Va.	5000
WJPG	Green Bay, Wis.	5000

1450—206.8

CBG	Gander, Nfld.	250
CFAB	Windsor, N.S.	250
CFJR	Brockville, Ont.	250
CHEF	Granby, P.Q.	250
CJOY	Guelph, Ont.	250
WDNG	Anniston, Ala.	250
WENN	Bessemer, Ala.	250
WDIG	Dothan, Ala.	250
WFUN	Huntsville, Ala.	250
WLAY	Muscle Shoals City, Ala.	250
KLAM	Cordova, Alaska	250
KHCD	Clifton, Ariz.	250
KAWT	Douglas, Ariz.	250
KNOT	Prescott, Ariz.	250
KOLD	Tucson, Ariz.	250
KHOG	Fayetteville, Ark.	250
KENA	Mena, Ark.	250
KYOR	Blythe, Calif.	250
KOWN	Escondido, Calif.	250
KPAL	Palm Springs, Calif.	250
KTIP	Porterville, Calif.	250
KSAN	San Francisco, Calif.	250
KROG	Sonora, Calif.	250
KVEN	Ventura, Calif.	250
KAGR	Yuba City, Calif.	100
KGIW	Alamosa, Colo.	250
KYOU	Greeley, Colo.	250
WNAB	Bridgeport, Conn.	250
WILM	Wilmington, Del.	250
WOL	Washington, D.C.	250
WWJB	Brooksville, Fla.	250
WMFJ	Daytona Beach, Fla.	250
WSKP	Miami, Fla.	250
WBSR	Pensacola, Fla.	250
WSPB	Sarasota, Fla.	250
WSTU	Stuart, Fla.	250
WTNT	Tallahassee, Fla.	250
WGPC	Albany, Ga.	250
WBHF	Cartersville, Ga.	250
WCON	Cornelia, Ga.	250
WKEU	Griffin, Ga.	250
WMVG	Milledgeville, Ga.	250
WCCP	Savannah, Ga.	250
KEOK	Payette, Idaho	250
KEEP	Twin Falls, Idaho	250
WHFC	Cicero, Ill.	250
WKEI	Kewanee, Ill.	100
WCVS	Springfield, Ill.	250
WANE	Ft. Wayne, Ind.	250
WASK	Lafayette, Ind.	250
WAOV	Vincennes, Ind.	250
KPIG	Cedar Rapids, Iowa	250
KWBW	Hutchinson, Kans.	250
WTCO	Campbellsville, Ky.	250
WPAD	Paducah, Ky.	250
KSIG	Crowley, La.	250
KNOC	Natchitoches, La.	250
WNPS	New Orleans, La.	250
WAGM	Presque Isle, Maine	250
WRKD	Rockland, Maine	250
WKTQ	South Paris, Maine	250
WTBO	Cumberland, Md.	250
WMAS	Springfield, Mass.	250
WATZ	Alpena Township, Mich.	250
WHTC	Holland, Mich.	250
WMIQ	Iron Mtn., Mich.	250
WIBM	Jackson, Mich.	250
WKLA	Ludington, Mich.	250
WHLS	Port Huron, Mich.	250
KATE	Albert Lea, Minn.	250
KBUN	Bemidji, Minn.	250
KBMW	Breckenridge, Minn.	250
WELY	Ely, Minn.	250
KDMA	Montevideo, Minn.	100
KFAM	St. Cloud, Minn.	250
WROX	Clarksdale, Miss.	250
WCJU	Columbia, Miss.	250
WJXN	Jackson, Miss.	250
WOKK	Meridian, Miss.	250
WNAT	Natchez, Miss.	250
WROB	West Point, Miss.	250
WMBH	Joplin, Mo.	250
KIRX	Kirksville, Mo.	250
KOKO	Warrensburg, Mo.	250
KWPM	West Plains, Mo.	250
KXLQ	Bozeman, Mont.	250
KUDI	Great Falls, Mont.	250
KXLL	Missoula, Mont.	250
KWBE	Beatrice, Nebr.	250
KCSR	Chadron, Nebr.	250
KONE	Reno, Nev.	250
WKXL	Concord, N.H.	250
WFPG	Atlantic City, N.J.	250
WCTC	New Brunswick, N.J.	250
KLOS	Albuquerque, N.Mex.	250
KLMX	Clayton, N.Mex.	250
KOBE	Las Cruces, N.Mex.	250
KENM	Portales, N.Mex.	250
WHDL	Allegany, N.Y.	250
WCLI	Corning, N.Y.	250
WWSC	Glen Falls, N.Y.	250
WHDL	Olean, N.Y.	250
WKIP	Poughkeepsie, N.Y.	250
WKAL	Rome, N.Y.	250
WATA	Boone, N.C.	250
WGNC	Gastonia, N.C.	250
WHVH	Henderson, N.C.	250
WHKP	Hendersonville, N.C.	250
WHIT	New Bern, N.C.	250
WJER	Dover, Ohio	250
WMOH	Hamilton, Ohio	250
WLEC	Sandusky, Ohio	250
KWHW	Altus, Okla.	250
KGFF	Shawnee, Okla.	250
KSIW	Woodward, Okla.	250
KWRO	Coquille, Oreg.	250
KORE	Eugene, Oreg.	250
KFLW	Klamath Falls, Oreg.	250
KLBM	La Grande, Oreg.	250
KBPS	Portland, Oreg.	250
WLEU	Erie, Pa.	250
WGET	Gettysburg, Pa.	250
WDAD	Indiana, Pa.	250
WPAM	Pottsville, Pa.	250
WMPT	So. Williamsport, Pa.	250
WMAJ	State College, Pa.	250
WJPA	Washington, Pa.	250
WNEL	Caguas, P.R.	250
WWRI	W. Warwick, R.I.	250
WQSN	Charleston, S.C.	250
WCRS	Greenwood, S.C.	250
WMYB	Myrtle Beach, S.C.	250
WHSC	Hartsville, S.C.	250
KYNT	Yankton, S.Dak.	250
WLAR	Athens, Tenn.	250
WAGC	Chattanooga, Tenn.	250
WDSG	Dyersburg, Tenn.	250
WLAF	LaFollette, Tenn.	100
WGNS	Murfreesboro, Tenn.	250
KRIC	Beaumont, Tex.	250
KBEN	Carrizo Sprgs., Tex.	250
KCTI	Gonzales, Tex.	250
KMBL	Junction, Tex.	250
KCYL	Lampasas, Tex.	250
KMHT	Marshall, Tex.	250
KCMR	McCamey, Tex.	250
KNET	Palestine, Tex.	250
KSNY	Snyder, Tex.	250
KURA	Moab, Utah	250
KEYY	Provo, Utah	250
KDXU	St. George, Utah	250
WTSA	Brattleboro, Vt.	250
WFTR	Front Royal, Va.	250
WREL	Lexington, Va.	250
WMVA	Martinsville, Va.	250
WLPM	Suffolk, Va.	250
KBKW	Aberdeen, Wash.	250
KCLX	Colfax, Wash.	250
KRSC	Othello, Wash.	100
KONP	Port Angeles, Wash.	250
KAYE	Puyallup, Wash.	250
WPAR	Parkersburg, W.Va.	250
WHAW	Weston, W.Va.	250
KFIZ	Fond du Lac, Wis.	250
WDLB	Marshfield, Wis.	250
WPFP	Park Falls, Wis.	250
WRCO	Richland Center, Wis.	250
KBBS	Buffalo, Wyo.	250
KWRL	Riverton, Wyo.	250

1460—205.4

CJNB	N. Battleford, Sask.	10000
WFMH	Cullman, Ala.	5000d
WPNX	Phenix City, Ala.	5000
KTYM	Inglewood, Calif.	1000d
KDON	Salinas, Calif.	5000
KYSN	Colo. Sprgs., Colo.	1000
WBAR	Bartow, Fla.	1000d
WFNM	DeFuniak Springs, Florida	1000d
WMBR	Jacksonville, Fla.	5000
WDMF	Buford, Ga.	1000d
WROY	Carmi, Ill.	1000d
WKAM	Goshen, Ind.	500d
WOCH	North Vernon, Ind.	500d
KSO	Des Moines, Iowa	5000
KCRB	Chanute, Kans.	1000d
WRVK	Mt. Vernon, Ky.	500d
WAIL	Baton Rouge, La.	5000
KBSF	Springhill, La.	1000d
WBET	Brockton, Mass.	1000
WBRN	Big Rapids, Mich.	1000d
WPON	Pontiac, Mich.	500
KADY	St. Charles, Mo.	5000d
KRNY	Kearney, Nebr.	5000d
KENO	Las Vegas, Nev.	1000
WOKO	Albany, N.Y.	5000
WWES	New Rochelle, N.Y.	500d
WHEC	Rochester, N.Y.	5000
WFVG	Fuquay Sprgs., N.C.	1000d
WMMH	Marshall, N.C.	500d
WBNS	Columbus, Ohio	5000
WPVL	Painesville, Ohio	500d
KPLK	Dallas, Oreg.	500d
WMBA	Ambridge, Pa.	500d
WCMB	Harrisburg, Pa.	5000
WBCU	Union, S.C.	1000
WJAK	Jackson, Tenn.	1000d
KBRZ	Freeport, Tex.	500d
KLLL	Lubbock, Tex.	1000d
WACO	Waco, Tex.	1000
WPRW	Manassas, Va.	500d
WRAD	Radford, Va.	5000
KIMA	Yakima, Wash.	5000
WRAC	Racine, Wis.	500d

1470—204.0

CHOW	Welland, Ontario	500d
WBLO	Evergreen, Ala.	1000d
KBLO	Hot Springs, Ark.	1000d
KBMX	Coalinga, Calif.	500d
KUTY	Palmdale, Calif.	1000d
KXOA	Sacramento, Calif.	1000
WMMW	Meriden, Conn.	1000d
WDCL	Tarpon Sprgs., Fla.	5000d
WAAG	Adel, Ga.	1000d
WDOL	Athens, Ga.	1000d
WCLA	Claxton, Ga.	1000
WRGA	Rome, Ga.	5000
WMBD	Peoria, Ill.	5000
WCBC	Anderson, Ind.	1000d
KTRI	Sioux City, Iowa	5000
KWVY	Waverly, Iowa	1000d
KARE	Atchison, Kans.	1000
WSAC	Radcliff, Ky.	1000d
KPLC	Lake Charles, La.	5000
WLAM	Lewiston, Maine	5000
WJDY	Salisbury, Md.	5000d
WTTR	Westminster, Md.	1000d
WNBP	Newburyport, Mass.	500d
WKMF	Flint, Mich.	1000
WKLZ	Kalamazoo, Mich.	500d
KANO	Anoka, Minn.	1000d
WCHJ	Brookhaven, Miss.	1000d
WNAU	New Albany, Miss.	500d
KGHM	Brookfield, Mo.	500d
KTCB	Malden, Mo.	1000d
WTKO	Ithaca, N.Y.	1000d
WPDM	Potsdam, N.Y.	1000d
WBIG	Greensboro, N.C.	5000
WPNC	Plymouth, N.C.	1000d
WTOE	Spruce Pine, N.C.	1000d
WOHO	Toledo, Ohio	1000
KVLH	Pauls Valley, Okla.	250d
KVIN	Vinita, Okla.	500d
WSAN	Allentown, Pa.	5000
WFAR	Farrell, Pa.	1000d
WOIC	Columbia, S.C.	5000d
WEAG	Alcoa, Tenn.	1000d
WHER	Memphis, Tenn.	1000d
WVOL	Nashville, Tenn.	1000d
KRBC	Abilene, Tex.	5000
KWRD	Henderson, Tex.	500d
KCNY	San Marcos, Tex.	250d
KELA	Centralia, Wash.	5000
KSEM	Moses Lake, Wash.	5000
WPLH	Huntington, W.Va.	5000d
WBKV	West Bend, Wis.	500d
KSPR	Casper, Wyo.	5000

1480—202.6

WABB	Mobile, Ala.	5000
KHAT	Phoenix, Ariz.	500
KGLU	Safford, Ariz.	1000
KTCN	Berryville, Ark.	1000
KIEM	Eureka, Calif.	5000
KYOS	Merced, Calif.	5000
KWIZ	Santa Ana, Calif.	1000
WAPG	Arcadia, Fla.	1000d
WEZY	Cocoa, Fla.	1000d
WTHR	Panama Beach, Fla.	500d
WYZE	Atlanta, Ga.	5000d
WRDW	Augusta, Ga.	5000
WTHI	Terre Haute, Ind.	1000
WRSW	Warsaw, Ind.	500
KLEE	Ottumwa, Iowa	500d
KBKC	Mission, Kans.	500d
KLEO	Wichita, Kans.	5000
WKOA	Hopkinsville, Ky.	1000d
WNKY	Neon, Ky.	1000d
KANV	Jonesville, La.	500d
KJOE	Shreveport, La.	1000d
WSAR	Fall River, Mass.	5000
WMAX	Grand Rapids, Michigan	1000d
KAUS	Austin, Minn.	1000
KGCX	Sidney, Mont.	5000
KLMS	Lincoln, Nebr.	1000
KWEW	Hobbs, N.Mex.	1000
WLEA	Hornell, N.Y.	1000d
WHOM	New York, N.Y.	5000
WREM	Remsen, N.Y.	1000d
WWOK	Charlotte, N.C.	1000d
WAGR	Lumberton, N.C.	1000
WMSJ	Sylva, N.C.	5000d
WHBC	Canton, Ohio	5000
WCIN	Cincinnati, Ohio	1000d
WTRA	Latrobe, Pa.	500d
WDAS	Philadelphia, Pa.	1000
WISL	Shamokin, Pa.	1000
WLOK	Memphis, Tenn.	5000d
KBOX	Dallas, Tex.	5000
KLVL	Pasadena, Tex.	1000
WCFR	Springfield, Vt.	1000d
WBBL	Richmond, Va.	5000
WLEE	Richmond, Va.	5000
WBLU	Salem, Va.	1000d
KPVA	Camas, Wash.	1000d
WISC	Madison, Wis.	1000

1490—201.2

CFRC	Kingston, Ont.	100
CKCR	Kitchener, Ont.	250
CKBM	Montaquy, Que.	250
WANA	Anniston, Ala.	250
WAJF	Decatur, Ala.	250
WRLD	Lanett, Ala.	250
WHBB	Selma, Ala.	250
KYCA	Prescott, Ariz.	250
KAIR	Tucson, Ariz.	250
KXAR	Hope, Ark.	250
KTLO	Mtn. Home, Ark.	250
KDRS	Paragould, Ark.	250
KOTN	Pine Bluff, Ark.	250
KXRJ	Russellville, Ark.	250
KMAP	Bakersfield, Calif.	250
KPAS	Banning, Calif.	250
KBLA	Burbank, Calif.	250
KICO	Calexico, Calif.	250
KOWL	Lake Tahoe, Calif.	250
KAFP	Petaluma, Calif.	250
KBLF	Red Bluff, Calif.	250
KDB	Santa Barbara, Calif.	250
KSYC	Yreka, Calif.	250
KBOL	Boulder, Colo.	250
KCMS	Manitou Sprgs., Colo.	100
KOLO	Sterling, Colo.	250
WNLC	New London, Conn.	250
WTOR	Torrington, Conn.	250
WTRL	Bradenton, Fla.	250
WJBS	DeLand, Fla.	250
WMET	Miami Beach, Fla.	250
WRGR	Starke, Fla.	250
WTTB	Vero Beach, Fla.	250
WSIR	Winter Haven, Fla.	250
WMOG	Brunswick, Ga.	250
WMJM	Cordele, Ga.	250
WMRE	Monroe, Ga.	250
WSFB	Quitman, Ga.	250
WSNT	Sandersville, Ga.	250
WSYL	Sylvania, Ga.	250
KTOH	Lihue, Hawaii	250
KCID	Caldwell, Idaho	250
WKRO	Cairo, Ill.	250
WDAN	Danville, Ill.	250
WAMV	East St. Louis, Ill.	250
WOPA	Oak Park, Ill.	250
WKBV	Richmond, Ind.	250
WNDU	South Bend, Ind.	250
KBUR	Burlington, Iowa	250
WDBQ	Dubuque, Iowa	250
KRIB	Mason City, Iowa	250
KTOP	Topeka, Kans.	250
WFKY	Frankfort, Ky.	250
WKAY	Glasgow, Ky.	250
WOMI	Owensboro, Ky.	250
WSIP	Paintsville, Ky.	250
WIKC	Bogalusa, La.	250
KEUN	Eunice, La.	250
KCIL	Houma, La.	250
KRUS	Ruston, La.	250
WPOR	Portland, Maine	250
WTVL	Waterville, Maine	250
WARK	Hagerstown, Md.	250
WHAV	Haverhill, Mass.	250
WMRC	Milford, Mass.	100
WTXL	W. Springfield, Mass.	250
WABJ	Adrian, Mich.	250
WBFC	Fremont, Mich.	250
WMDN	Midland, Mich.	250
KXRA	Alexandria, Minn.	250
KOZY	Grand Rapids, Minn.	250

Kc.	Wave Length	W.P.
KLGR	Redwd. Falls, Minn.	100
WLOX	Biloxi, Miss.	250
WCLD	Cleveland, Miss.	250
WHOC	Philadelphia, Miss.	250
WELO	Tupelo, Miss.	250
WVIM	Vicksburg, Miss.	250
KDMO	Carthage, Mo.	250
KTTR	Rolla, Mo.	250
KDRO	Sedalia, Mo.	250
KBOW	Butte, Mont.	250
KVCK	Wolf Point, Mont.	250
KBON	Omaha, Nebr.	250
WLDB	Atlantic City, N.J.	250
KRSN	Los Alamos, N.Mex.	250
KRTN	Raton, N.Mex.	250
WCSS	Amsterdam, N.Y.	250
WBTA	Batavia, N.Y.	250
WKNY	Kingston, N.Y.	250
WICY	Malone, N.Y.	250
WDLC	Port Jervis, N.Y.	250
WOLF	Syracuse, N.Y.	250
WSSB	Durham, N.C.	250
WFLB	Fayetteville, N.C.	250
WLOE	Leaksville, N.C.	250
WRNB	New Bern, N.C.	250
WSTP	Salisbury, N.C.	250
KNDC	Hettinger, N.Dak.	250
KOVC	Valley City, N.Dak.	250
WBEX	Chillicothe, Ohio	250
WSRS	Cleveland Hghts., Ohio	250
WOHI	E. Liverpool, Ohio	250
WMOA	Marietta, Ohio	250
WMRN	Marion, Ohio	250
KWRW	Guthrie, Okla.	100
KBIX	Muskogee, Okla.	250
KBKR	Baker, Oreg.	250
KRNR	Roseburg, Oreg.	250
KBZY	Salem, Oreg.	250
WESB	Bradford, Pa.	250
WAZL	Hazleton, Pa.	250
WARD	Johnstown, Pa.	250
WGAL	Lancaster, Pa.	250
WBCB	Levittown, Pa.	250
WMRF	Lewiston, Pa.	250
WMGW	Meadville, Pa.	250
WNBT	Wellsboro, Pa.	250
WMDD	Fajardo, P.R.	250
WGCD	Chester, S.C.	250
WMRB	Greenville, S.C.	250
KORN	Mitchell, S.Dak.	250
WOPI	Bristol, Tenn.	250
WDXB	Chattanooga, Tenn.	250
WJJM	Lewisburg, Tenn.	250
WDXL	Lexington, Tenn.	250
WATO	Oak Ridge, Tenn.	250
KNOW	Austin, Tex.	250
KIBL	Beeville, Tex.	250
KBST	Big Spring, Tex.	250
KHUZ	Borger, Tex.	250
KNEL	Brady, Tex.	250
KSAM	Huntsville, Tex.	250
KVOZ	Laredo, Tex.	250
KVOW	Littlefield, Tex.	250
KPLT	Paris, Tex.	250
KGKB	Tyler, Tex.	250
KVWC	Vernon, Tex.	250
KVOG	Ogden, Utah	250
WIKE	Newport, Vt.	250
WCVA	Culpeper, Va.	250
WVEC	Hampton, Va.	250
WAYB	Waynesboro, Va.	250
KBRO	Bremerton, Wash.	250
KLOG	Kelso, Wash.	250
KENE	Toppenish, Wash.	250
KTEL	Walla Walla, Wash.	250
WHMS	Charleston, W.Va.	250
WTCS	Fairmont, W.Va.	250
WLOH	Princeton, W.Va.	250
WGEZ	Beloit, Wis.	250
WLCX	LaCrosse, Wis.	250
WIGM	Medford, Wis.	250
WOSH	Oshkosh, Wis.	250
KIML	Gillette, Wyo.	250
KRTR	Thermopolis, Wyo.	250
KGOS	Torrington, Wyo.	250

1500—199.9

Kc.	Wave Length	W.P.
CHUC	Port Hope, Ont.	1000
KXRX	San Jose, Calif.	1000
WTOP	Washington, D.C.	50000
WJBK	Detroit, Mich.	10000
KSTP	St. Paul, Minn.	50000
KTXO	Sherman, Tex.	250

1510—199.1

Kc.	Wave Length	W.P.
CKOT	Tillsonburg, Ont.	1000d
KASK	Ontario, Calif.	250d
KTIM	San Rafael, Calif.	1000d
KUDY	Littleton, Colo.	1000
WKAI	Macomb, Ill.	250d
WMEX	Boston, Mass.	5000
KIMO	Independence, Mo.	1000d
WLAC	Nashville, Tenn.	50000
KCTX	Childress, Tex.	250d
KSTV	Stephenville, Tex.	250d
KGA	Spokane, Wash.	50000
WAUX	Waukesha, Wis.	250d

1520—197.4

Kc.	Wave Length	W.P.
KACY	Port Hueneme, Calif.	250
WHOW	Clinton, Ill.	1000d
KSIB	Creston, Iowa	1000d
WKBW	Buffalo, N.Y.	50000
WKIT	Mineola, N.Y.	250d
KOMA	Okla. City, Okla.	50000
KGON	Oregon City, Oreg.	10000
WWWW	Rio Piedras, P.R.	250

1530—196.1

Kc.	Wave Length	W.P.
KFBK	Sacramento, Calif.	50000
WCKY	Cincinnati, Ohio	50000
KGBT	Harlingen, Tex.	50000

1540—195.0

Kc.	Wave Length	W.P.
ZNS	Nassau, B.W.I.	5000
KPOL	Los Angeles, Calif.	10000
WSMI	Litchfield, Ill.	1000d
WBNL	Boonville, Ind.	250d
WLOI	LaPorte, Ind.	250d
KXEL	Waterloo, Iowa	50000
KNEX	McPherson, Kans.	250d
KLKC	Parsons, Kans.	250d
WDON	Wheaton, Md.	250d
WPTR	Albany, N.Y.	50000
WIFM	Elkin, N.C.	250d
WJMO	Cleveland, Ohio	1000d
WJMJ	Philadelphia, Pa.	1000d
WPTS	Pittston, Pa.	1000d
WPME	Punxsutawney, Pa.	1000d
WADK	Newport, R.I.	1000d
KCUL	Ft. Worth, Tex.	10000
KGBC	Galveston, Tex.	1000
KIWW	San Antonio, Tex	250d
WTKM	Hartford, Wis.	500d

1550—193.5

Kc.	Wave Length	W.P.
CBE	Windsor, Ont.	10000
WAAY	Huntsville, Ala.	5000
KOBY	San Fran., Calif.	10000
KENT	Shreveport, La.	1000
KRES	St. Joseph, Mo.	5000
WLOA	Braddock, Pa.	1000d
WBSC	Bennetsville, S.C.	10000

1560—192.3

Kc.	Wave Length	W.P.
CFRS	Simcoe, Ont.	250d
KPMC	Bakersfield, Calif.	10000
WBYS	Canton, Ill.	250d
KSWI	Council Bluffs, Iowa	500d
WQXR	New York, N.Y.	50000
WTNS	Coshocton, Ohio	1000d
WTOD	Toledo, Ohio	1000d
KWCO	Chickasha, Okla.	1000
WENA	Bayamon, P.R.	250
KHBR	Hillsboro, Tex.	250d

1570—191.1

Kc.	Wave Length	W.P.
CHUB	Nanaimo, B.C.	10000
CFRY	Portage la Prairie, Manitoba	250d
CBI	Sidney, N.S.	1000
CFOR	Orillia, Ont.	10000
WCRL	Oneonta, Ala.	250d
WRWJ	Selma, Ala.	1000d
KCVR	Lodi, Calif.	1000d
KACE	Riverside, Calif.	1000d
KLOV	Loveland, Colo.	250d
WTWB	Auburndale, Fla.	1000d
WFBF	Fernandina Beach, Florida	1000d
WJOE	Ward Ridge, Fla.	250d
WOKZ	Alton, Ill.	1000d
WFRL	Freeport, Ill.	1000d
WBEE	Harvey, Ill.	1000d
WTAY	Robinson, Ill.	250d
WILO	Frankfort, Ind.	250d
WAWK	Kendallville, Ind.	250d
WLRP	New Albany, Ind.	1000d
KMCD	Fairfield, Iowa	250d
KJFJ	Webster City, Iowa	250d
KNDY	Marysville, Kans.	250d
KWSK	Pratt, Kans.	250d
WKKS	Vanceburg, Ky.	250d
WABL	Amite, La.	500d
KLLA	Leesville, La.	250d
KMAR	Winnsboro, La.	500d
WAQE	Towson, Md.	1000d
WPEP	Taunton, Mass.	1000d
WDEW	Westfield, Mass.	1000d
WMRP	Flint, Mich.	1000d
WFUR	Grand Rapids, Michigan	1000d
KMRS	Morris, Minn.	1000d
KLEX	Lexington, Mo.	250d
WFLR	Dundee, N.Y.	1000d
WBUZ	Fredonia, N.Y.	250d
WNCA	Siler City, N.C.	1000d
WHOT	Campbell, Ohio	250d
WCLW	Mansfield, Ohio	250d
WPTW	Piqua, Ohio	250d
KTAT	Frederick, Okla.	250d
KOLS	Pryor, Okla.	1000d
KRWC	Forest Grove, Oreg.	1000d
KOHU	Hermiston, Oreg.	1000d
WBUX	Doylestown, Pa.	1000d
WAKU	Latrobe, Pa.	1000d
WMLP	Milton, Pa.	1000d
WFGN	Gaffney, S.C.	250d
WLSC	Loris, S.C.	1000d
WHLP	Centerville, Tenn.	1000d
WCLE	Cleveland, Tenn.	1000d
WTRB	Ripley, Tenn.	250d
KZOL	Muleshoe, Tex.	250d
KTER	Terrell, Tex.	250d
WKIC	Salt Lake City, Utah	500d
WYTI	Rocky Mount, Va.	500d
WEER	Warrenton, W.Va.	500d
WAPL	Appleton, Wis.	1000d

1580—189.2

Kc.	Wave Length	W.P.
CBJ	Chicoutimi, Que.	10000
WJHB	Talladega, Ala.	1000d
KPCA	Marked Tree, Ark.	250d
KWIP	Merced, Calif.	500d
KDAY	Santa Monica, Calif.	10000d
KPIK	Colorado Sprgs., Colo.	5000d
WWIL	Ft. Lauderdale, Fla.	1000
WIOK	Mount Dora, Fla.	1000d
WCLS	Columbus, Ga.	1000d
WLBA	Gainesville, Ga.	5000d
WDQN	DuQuoin, Ill.	250d
WBBA	Pittsfield, Ill.	250d
WKID	Urbana, Ill.	250d
WCNB	Connersville, Ind.	250d
WJVA	South Bend, Ind.	250d
WAMW	Washington, Ind.	250d
KCHA	Charles City, Iowa	250d
WFMA	Davenport, Iowa	500d
KDSN	Denison, Iowa	500d
WGOR	Georgetown, Ky.	250d
WWXL	Manchester, Ky.	250d
WPKY	Princeton, Ky.	250d
KLUV	Haynesville, La.	250d
KLOU	Lake Charles, La.	1000
WPGC	Bradbury Hgts., Md.	10000d
WFGM	Fitchburg, Mass.	1000d
WAMY	Amory, Miss.	5000d
WGLC	Centreville, Miss.	250d
WESY	Leland, Miss.	1000
WPMP	Pascagoula, Miss.	1000d
KBIA	Columbia, Mo.	250d
KNIM	Maryville, Mo.	250d
WCRV	Washington, N.J.	500d
KHAM	Albuquerque, N.Mex.	1000d
WPAC	Patchogue, N.Y.	5000d
KZKY	Albemarle, N.C.	250d
WTYN	Tryon, N.C.	250d
WVKO	Columbus, Ohio	1000d
KLTR	Blackwell, Okla.	250d
WCOY	Columbia, Pa.	500d
WANB	Waynesburg, Pa.	250d
WYCL	York, S.C.	250d
WMSR	Manchester, Tenn.	1000d
WTUC	Union City, Tenn.	250d
KGAF	Gainesville, Tex.	250d
KIRT	Mission, Tex.	1000d
KTLU	Rusk, Tex.	500d
KWED	Seguin, Tex.	1000d
KEVA	Shamrock, Tex.	250d
WILA	Danville, Va.	500d
WPUV	Pulaski, Va.	5000d
WTTN	Watertown, Wis.	250d

1590—188.7

Kc.	Wave Length	W.P.
WATM	Atmore, Ala.	1000d
WVNA	Tuscumbia, Ala.	5000d
KPBA	Pine Bluff, Ark.	1000d
KSJO	San Jose, Calif.	1000
KUDU	Ventura, Calif.	1000
WBRY	Waterbury, Conn.	5000
WILZ	St. Petersburg Beach, Florida	1000d
WDAT	S. Daytona Bch., Fla.	1000d
WALB	Albany, Ga.	1000
WLFA	Lafayette, Ga.	5000d
WNMP	Evanston, Ill.	1000d
WQUB	Galesburg, Ill.	5000d
WGEE	Indianapolis, Ind.	5000d
WPCO	Mt. Vernon, Ind.	500d
KWBG	Boone, Iowa	1000
KVGB	Great Bend, Kans.	5000
WLBN	Lebanon, Ky.	1000d
KEVL	White Castle, La.	1000d
WTVB	Coldwater, Mich.	5000
WDOG	Marine City, Mich.	1000d
WISK	So. St. Paul, Minn.	5000d
WOKJ	Jackson, Miss.	5000d
KDEX	Dexter, Mo.	1000d
KPRS	Kansas City, Mo.	1000d
KMAM	Tularosa, N.Mex.	1000d
WEHH	Elmira Heights-Horseheads, N.Y.	500d
WNYS	Salamanca, N.Y.	1000d
WGTC	Greenville, N.C.	5000d
WNOS	High Point, N.C.	1000d
WAKR	Akron, Ohio	5000
WSRW	Hillsboro, Ohio	500d
KHEN	Henryetta, Okla.	500d
KTIL	Tillamook, Oreg.	250
WXRF	Guayama, P.R.	1000
WCBG	Chambersburg, Pa.	5000d
WDRF	Chester, Pa.	1000
WABV	Abbeville, S.C.	1000d
WACA	Camden, S.C.	1000d
WDBL	Springfield, Tenn.	1000d
KGAS	Carthage, Tex.	1000d
KERC	Eastland, Tex.	500d
KYOK	Houston, Tex.	5000
KCBD	Lubbock, Tex.	1000
KBUS	Mexia, Tex.	500d
KANN	Sinton, Tex.	1000d
WEZL	Richmond, Va.	5000d
KTIX	Seattle, Wash.	5000d
WSWW	Platteville, Wis.	1000d
WTRW	Two Rivers, Wis.	1000d

1600—187.5

Kc.	Wave Length	W.P.
CHVC	Niagara Falls, Ont.	5000
WEUP	Huntsville, Ala.	1000d
WAPX	Montgomery, Ala.	1000
KGST	Fresno, Calif.	1000d
KWOW	Pomona, Calif.	1000
KUBA	Yuba City, Calif.	1000
KLAK	Lakewood, Colo.	1000
WKEN	Dover, Del.	500d
WKTX	Atlantic Beach, Fla.	1000d
WKWF	Key West, Fla.	500
WGOA	Winter Garden, Fla.	1000d
WGKA	Atlanta, Ga.	1000d
WMCW	Harvard, Ill.	500d
WBTO	Linton, Ind.	500d
WARU	Peru, Ind.	1000d
KLGA	Algona, Iowa	5000d
KCRG	Cedar Rapids, Iowa	5000
KMDO	Ft. Scott, Kans.	500d
WNES	Central City, Ky.	500d
WSTL	Eminence, Ky.	500d
KFNV	Ferriday, La.	1000d
KLFT	Golden Meadow, La.	1000d
KLVI	Vivian, La.	500d
WINX	Rockville, Md.	1000
WBOS	Brookline, Mass.	5000
WTYM	East Longmeadow, Mass.	5000d
WHRV	Ann Arbor, Mich.	1000
WTRU	Muskegon, Mich.	5000
WKDL	Clarksdale, Miss.	1000d
WLAU	Laurel, Miss.	5000d
KATZ	St. Louis, Mo.	5000
KTTN	Trenton, Mo.	500d
WONG	Oneida, N.Y.	1000d
WWRL	Woodside, N.Y.	5000
WGIV	Charlotte, N.C.	1000d
WIDU	Fayetteville, N.C.	1000d
WFRC	Reidsville, N.C.	1000
WBLY	Springfield, Ohio	1000d
KUSH	Cushing, Okla.	1000d
KASH	Eugene, Oreg.	1000
WHOL	Allentown, Pa.	500d
WEZN	Elizabethtown, Pa.	500d
WFIS	Fountain Inn, S.C.	1000d
WGUS	N. Augusta, S.C.	500
WKBJ	Milan, Tenn.	1000d
KBBB	Borger, Tex.	500d
KBOR	Brownsville, Tex.	1000
KWEL	Midland, Tex.	1000
KCFH	Cuero, Tex.	500d
KMAE	McKinney, Tex.	1000d
KOGT	Orange, Tex.	1000
KBBC	Centerville, Utah	1000d
WBOF	Virginia Bch., Va.	1000d
WHLL	Wheeling, W.Va.	5000d
WCWC	Ripon, Wis.	5000d

U. S. and Canadian AM Stations by Location

Abbreviations: C.L., call letters; Kc., frequency in kilocycles; N.A., network affiliation—A: American Broadcasting Co., C: Columbia Broadcasting System, Inc.; M: Mutual Broadcasting System; N: National Broadcasting Co., Inc.

Location	C.L.	Kc.	N.A.
Abbeville, La.	KROF	960	
Abbeville, S.C.	WABV	1590	
Aberdeen, Md.	WAMD	970	
Aberdeen, Miss.	WMPA	1240	
Aberdeen, S.Dak.	KABR	1220	
	KSDN	930	A
Aberdeen, Wash.	KBKW	1450	
	KXRO	1320	M
Abilene, Tex.	KRBC	1470	A
	KNIT	1280	
	KWKC	1340	M
Abingdon, Va.	WBBI	1230	
Ada, Okla.	KADA	1230	A
Adel, Ga.	WAAG	1470	
Adrian, Mich.	WABJ	1490	A
Agana, Guam	KUAM	610	N
Aguadilla, P.R.	WABA	850	
	WGRF	1340	
Ahoskie, N.C.	WRCS	970	
Aiken, S.C.	WAKN	990	
Akron, Ohio	WAKR	1590	A
	WADC	1350	C
	WCUE	1150	
	WHKK	640	M
Alamogordo, N.M.	KALG	1230	M
	KRAC	1270	
Alamosa, Colo.	KGIW	1450	M
Albany, Ga.	WALB	1590	A
	WGPC	1450	C
	WJAZ	1050	
Albany, Minn.	KASM	1150	
Albany, N.Y.	WABY	1400	
	WOKO	1460	M
	WPTR	1540	A
	WROW	590	C
Albany, Oreg.	KWIL	790	M
Albemarle, N.C.	WABZ	1010	
	WZKY	1580	
Albert Lea, Minn.	KATE	1450	A
Albertville, Ala.	WAVU	630	
Albion, Mich.	WALM	1260	
Albuquerque, N.M.	KABQ	1340	
	KDEF	1150	
	KGGM	610	C
	KOB	1030	N
	KQEO	920	M
	KLOS	1450	
	KHAM	1580	A
Alcoa, Tenn.	WEAG	1470	
Alexander City, Ala.	WRFS	1050	
Alexandria, La.	KALB	580	A
	KDBS	1410	
	KSYL	970	N
Alexandria, Minn.	KXRA	1490	A
Alexandria, Va.	WPIK	730	
Algona, Iowa	KLGA	1600	
Alice, Tex.	KOPY	1070	
Allentown, Pa.	WHOL	600	
	WAEB	790	
	WKAP	1320	
	WSAN	1470	C
Alliance, Nebr.	KCOW	1400	
Alliance, Ohio	WFAH	1310	
Alma, Ga.	WCOS	1400	
Alma, Mich.	WFYC	1280	
Alpena Township, Mich.	WATZ	1450	
Alpine, Tex.	KVLF	1240	M
Alton, Ill.	WOKZ	1570	
Altona, Man.	CFAM	1290	
Altoona, Pa.	WFBG	1340	N
	WRTA	1240	A
	WVAM	1430	C
Alturas, Calif.	KCNO	570	
Altus, Okla.	KWHW	1450	
Alva, Okla.	KALV	1430	
Amarillo, Tex.	KAMQ	1010	M
	KFDA	1440	A
	KGNC	710	N
	KLYN	940	C
	KRAY	1360	
	KZIP	1310	
Ambridge, Pa.	WMBA	1460	
Americus, Ga.	WDEC	1290	
Ames, Iowa	KSAI	1430	
	WOI	640	
Amherst, N.S.	CKDH	1400	
Amite, La.	WABL	1570	
Amory, Miss.	WAMY	1580	
Amos, Que.	CHAD	1340	
Amsterdam, N.Y.	WCSS	1490	
Anaconda, Mont.	KANA	1230	
Anacortes, Wash.	KAGT	1340	
Anchorage, Alaska	KBYR	1270	
	KFQD	730	C-A
	KENI	550	A-M-N
Andalusia, Ala.	WCTA	920	
Anderson, Ind.	WCBC	1470	
	WHBU	1240	C
Anderson, S.C.	WAIM	1230	C
	WANS	1280	M
Andrews, Tex.	KACT	1360	
Annapolis, Md.	WANN	1190	
	WABW	810	
	WNAV	1430	
Ann Arbor, Mich.	WHRV	1600	A
	WPAG	1050	
Anna, Ill.	WRAJ	1440	
Anniston, Ala.	WANA	1490	
	WDNG	1450	A
	WHMA	1390	
Anoka, Minn.	KANO	1470	
Ansonia, Conn.	WAOS	690	
Antigo, Wis.	WATK	900	
Artesia, N.M.	KSVP	990	M
Antigonish, N.S.	CJFX	580	
Apollo, Pa.	WAVL	910	
Apple Valley, Cal.	KAVR	960	
Appleton, Wis.	WAPL	1570	
	WHBY	1230	M
Arcadia, Fla.	WAPG	1480	
Arcata, Calif.	KENL	1340	
Ardmore, Okla.	KVSO	1240	A
Arecibo, P.R.	WCMN	1280	
	WMIA	1070	
	WNIK	1230	
Arkadelphia, Ark.	KVRC	1240	M
Arkan. City, Kans.	KSOK	1280	
Arlington, Fla.	WPEG	1220	
Arlington, Va.	WARL	780	
	WEAM	1390	
Artesia, N.M.	KSVP	990	M
Asbury Park, N.J.	WJLK	1310	
Asheboro, N.C.	WGWR	1260	
Asheville, N.C.	WISE	1310	
	WLOS	1380	N-M-A
	WSKY	1230	
	WWNC	570	C
Ashland, Ky.	WCMI	1340	C
	WTCR	1420	
Ashland, Ohio	WATG	1340	
Ashland, Oreg.	KWIN	1400	M
Ashland, Wis.	WATW	1400	
Ashtabula, Ohio	WICA	970	
Astoria, Oreg.	KAST	1370	M
	KIAL	1230	
Atchison, Kans.	KARE	1470	
Athens, Ala.	WJMW	730	
Athens, Ga.	WGAU	1340	C
	WDOL	1470	
	WRFC	960	
Athens, Ohio	WATH	970	
	WOUB	1340	
Athens, Tenn.	WLAR	1450	M
Athens, Tex.	KBUD	1410	
Atlanta, Ga.	WAGA	590	C
	WAKE	1340	
	WAOK	1380	
	WERD	860	
	WGKA	1600	
	WGST	920	A
	WQXI	790	
	WSB	750	N
	WYZE	1480	M
Atlanta, Tex.	KALT	900	
Atlantic, Iowa	KJAN	1220	
Atlantic Beach, Fla.	WKTX	1600	
Atlantic City, N.J.	WFPG	1450	C
	WLDB	1490	M
	WMID	1840	A
Atmore, Ala.	WATM	1590	
Attleboro, Mass.	WARA	1320	
Auburn, Ala.	WAUD	1230	A
Auburn, Calif.	KAHI	950	
Auburn, N.Y.	WMBO	1340	M
Auburndale, Fla.	WTWB	1570	
Augusta, Ga.	WAUG	1050	
	WBBQ	1340	M
	WBIA	1230	N
	WGAC	580	A
	WRDW	1480	C
Augusta, Maine	WRDO	1400	N
	WFAU	1340	M
Aurora, Colo.	KOSI	1430	
Aurora, Ill.	WMRO	1280	
Austin, Minn.	KAUS	1480	M
Austin, Tex.	KNOW	1490	A
	KTBC	590	C
	KOKE	1370	
	KVET	1300	M
Avalon, Calif.	KBIG	740	
Avon Park, Fla.	WAVP	1390	
Avondale Estates, Ga.	WAVO	1420	
Babylon, N.Y.	WBAB	1440	
Bad Axe, Mich.	WLEW	1340	
Bainbridge, Ga.	WMGR	930	
	WAZA	1360	
Baker, Oreg.	KBKR	1490	
Bakersfield, Calif.	KAFY	550	M
	KBIS	970	
	KERN	1410	C
	KGEE	1230	
	KLYD	1350	
	KMAP	1490	
	KPMC	1560	A
Ballinger, Tex.	KRUN	1400	
Baltimore, Md.	WBAL	1090	N
	WBMD	750	
	WCAO	600	
	WCBM	680	C
	WFBR	1300	
	WITH	1230	
	WSID	1010	
	WWIN	1400	A-M
Bamberg, S.C.	WWBD	790	
Bangor, Maine	WABI	910	A-M
	WGUY	1230	C
	WLBZ	620	N
Banning, Calif.	KPAS	1490	
Barboursville, Ky.	WBVL	950	
Bardstown, Ky.	WBRT	1320	
Barnesboro, Pa.	WNCC	950	
Barnwell, S.C.	WBAW	740	
Barrie, Ont.	CKBB	950	
Barstow, Calif.	KWTC	1230	A
Bartlesville, Okla.	KWON	1400	M
Bartow, Fla.	WBAR	1460	
Bastrop, La.	KTRY	730	
	KGAN	1340	
Batavia, N.Y.	WBTA	1490	M
Batesburg, S.C.	WBLR	1430	
Batesville, Ark.	KBTA	1340	
Batesville, Miss.	WBLE	1290	
Bath, Maine	WMMS	730	
Bathurst, N.B.	CKBC	1400	
Baton Rouge, La.	WAIL	1460	M
	WEND	1380	
	WIBR	1300	
	WJBO	1150	N
	WLCS	910	
	WXOK	1260	
Battle Creek, Mich.	WBCK	930	
	WELL	1400	A
Baxley, Ga.	WHAB	1260	
Bay City, Mich.	WBCM	1440	A
	WWBC	1250	
Bay City, Tex.	KIOX	1270	M
Bay Minette, Ala.	WBCA	1150	
Bayamon, P.R.	WENA	1560	
Baytown, Tex.	KRCT	650	
	KREL	1360	
Beatrice, Nebr.	KWBE	1450	
Beaufort, N.C.	WBMA	1400	
Beaufort, S.C.	WBEU	960	
Beaumont, Tex.	KFDM	560	A
	KJET	1380	
	KRIC	1450	
	KTRM	990	
Beaver Dam, Wis.	WBEV	1430	
Beaver Falls, Pa.	WBVP	1230	
Beckley, W. Va.	WJLS	560	C
	WWNR	620	
Bedford, Ind.	WBIW	1340	
Bedford, Pa.	WBFD	1310	
Bedford, Va.	WBLT	1350	
Beeville, Tex.	KIBL	1490	
Bellaire, Ohio	WTRX	1290	M
Bellefontaine, Ohio	WOHP	1390	
Bellefonte, Pa.	WBLF	1330	
Belle Glade, Fla.	WSWN	900	
Belleville, Ont.	CJBQ	800	
Belleville, Ill.	WIBV	1260	
Bellevue, Wash.	KFKF	1330	
Bellingham, Wash.	KPUG	1170	M
	KVOS	790	A
Bellingham-Ferndale, Wash.	KENY	930	
Belmont, N.C.	WCGC	1270	M-A
Beloit, Wis.	WBEL	1380	
	WGEZ	1490	M
Belton, S.C.	WHPB	1390	
Bemidji, Minn.	KBUN	1450	M
Bend, Oreg.	KBND	1110	M
Bennetsville, S.C.	WBSC	1550	M
Bennington, Vt.	WBTN	1370	
Benson, Minn.	KBMO	1290	
Benton, Ark.	KBBA	690	
Benton, Ky.	WCBL	1290	
Benton Harbor, Mich.	WHFB	1060	
Berkeley, Calif.	KRE	1400	
Berlin, N.H.	WKCB	1230	
Berryville, Ark.	KTCN	1480	
Berwick, Pa.	WBRX	1280	
Bessemer, Ala.	WENN	1450	
Bethesda, Md.	WUST	1120	
Bethlehem, Pa.	WGPA	1100	
Biddeford, Maine	WIDE	1400	M
Big Lake, Tex.	KBLT	1290	
Big Rapids, Mich.	WBRN	1460	
Big Sprg., Tex.	KBST	1490	A
	KHEM	1270	
	KBYG	1400	M
Big Stone Gap, Va.	WLSD	1220	
Bijou, Calif.	KOWL	1490	
Biloxi, Miss.	WLOX	1490	M
	WVMI	570	
Billings, Mont.	KBMY	1240	M
	KGHL	790	N
	KOOK	970	C
	KOYN	910	
Binghamton, N.Y.	WINR	680	N
	WKOP	1360	M
	WNBF	1290	C
Birmingham, Ala.	WAPI	1070	N
	WBRC	960	C
	WCRT	1260	A
	WEDR	1220	
	WATV	900	
	WSGN	610	
	WYDE	850	
	WVOK	690	
Bisbee, Ariz.	KSUN	1230	M
Bishop, Calif.	KIBS	1230	
Bishopville, S.C.	WAGS	1380	
Bismarck, N.Dak.	KFYR	550	N
	KQDI	1350	
Bismarck-Mandan, N.Dak.	KBOM	1270	
Blackfoot, Idaho	KBLI	690	
Blackstone, Va.	WKLV	1440	
Blackwell, Okla.	KLTR	1580	
Blind River, Ont.	CJNR	730	
Bloomington, Ill.	WJBC	1230	A
Bloomington, Ind.	WTTS	1370	A
Bloomsburg, Pa.	WCNR	930	
	WHLM	550	
Bluefield, W.Va.	WHIS	1440	N
	WKOY	1240	M
Blythe, Calif.	KYOR	1450	A
Blytheville, Ark.	KLCN	910	
Bogalusa, La.	WIKC	1490	N
	WHXY	920	
Boise, Idaho	KBOI	950	C
	KGEM	1140	M
	KIDO	630	N
	KYME	740	
Bonham, Tex.	KFYN	1420	
Boone, Iowa	KFGQ	1260	
	KWBG	1590	
Boone, N.C.	WATA	1450	
Boonville, Ind.	WBNL	1540	
Boonville, Mo.	KWRT	1370	
Booneville, Miss.	WBIP	1400	
Boonville, N.Y.	WBRV	900	
Borger, Tex.	KHUZ	1490	M
	KBBB	1600	
Bossier City, La.	KBCL	1220	
Boston, Mass.	WBZ	1030	
	WCOP	1150	
	WILD	1090	
	WNAC	680	M-N
	WEZE	1260	N
	WEEI	590	C
	WHDH	850	
	WMEX	1510	
	WORL	950	
Boulder, Colo.	KBOL	1490	
Bowling Green, Kentucky	WKCT	930	A
	WLBJ	1410	M
Bowl. Green, Ohio	WTLG	730	
Bozeman, Mont.	KXLQ	1450	N
	KBMN	1230	
Bradbury Hgts., Md.	WPGC	1580	
Braddock, Pa.	WLOA	1550	
Bradenton, Fla.	WTRL	1490	
	WBRD	1420	
Bradford, Pa.	WESB	1490	M
Brady, Tex.	KNEL	1490	
Brainerd, Minn.	KLIZ	1380	
Brampton, Ont.	CFJB	1090	
Brandon, Man.	CKX	1150	
Branson, Mo.	KBHM	1220	
Brantford, Ont.	CKPC	1380	
Brattleboro, Vt.	WTSA	1450	
Brawley, Calif.	KROP	1300	A
Breckenridge, Minn.	KBMW	1450	
Breckenridge, Tex.	KSTB	1430	
Bremen, Ga.	WWCC	1440	
Bremerton, Wash.	KBRO	1490	
Brenham, Tex.	KWHI	1280	
Brevard, N.C.	WPNF	1240	M-N
Brewton, Ala.	WEBJ	1240	M
Bridgeport, Conn.	WICC	600	M
	WNAB	1450	A
Bridgeton, N.J.	WSNJ	1240	
Bridgewater, N.S.	CKBW	1000	
Brigham City, Utah	KBUH	800	
Brighton, Colo.	KHIL	800	
Bristol, Conn.	WBIS	1440	
Bristol, Tenn.	WOPI	1490	N
Bristol, Va.	WCYB	690	A
	WFHG	980	M
Brockton, Mass.	WBET	1460	
Brockville, Ont.	CFJR	1450	
Broken Bow, Nebr.	KCNI	1280	
Brookfield, Mo.	KGHM	1470	
Brookhaven, Miss.	WCHJ	1470	
	WJMB	1340	M
Brookings, Oreg.	KURY	910	
Brookings, S.Dak.	KBRK	1430	
Brookline, Mass.	WBOS	1600	
Brooklyn, N.Y.	WPOW	1330	
Brooksville, Fla.	WWJB	1450	
Brownfield, Tex.	KTFY	1300	
Brownsville, Tex.	KBOR	1600	A
Brownwood, Tex.	KBWD	1380	M
	KEAN	1240	
Brunswick, Ga.	WGIG	1440	A
	WMOG	1490	
Brunswick, Maine	WCME	900	
Bryan, Tex.	KORA	1240	M
	WTAW	1150	
Buffalo, N.Y.	WBEN	930	C
	WBNY	1400	
	WEBR	970	M
	WGR	550	A
	WKBW	1520	N
	WWOL	1120	
Buffalo, Wyo.	KBBS	1450	
Buford, Ga.	WDMF	1460	
Burbank, Calif.	KBLA	1490	
Burley, Idaho	KBAR	1230	A-M
Burlington, Iowa	KBUR	1490	A
Burlington, N.C.	WBBB	920	M
	WFNS	1150	
Burlington, Vt.	WCAX	620	C

Location	C.L.	Kc.	N.A.
	WDOT	1400	
	WJOY	1230	A
Burns, Oreg.	KRNS	1230	
Butler, Pa.	WBUT	1050	
	WISR	680	
Butte, Mont.	KBOW	1490	C
	KOPR	550	M
	KXLF	1370	N
Cadillac, Mich.	WATT	1240	M
Caguas, P.R.	WNEL	1450	
	WRDL	1450	
	WVJP	1110	
Cairo, Ga.	WGRA	790	
Cairo, Ill.	WKRO	1490	
Caldwell, Idaho	KCID	1490	
Calera, Ala.	WBYE	1370	
Calexico, Calif.	KICO	1490	
Calgary, Alta.	CFAC	960	
	CFCN	1060	
	CKXL	1140	
Calhoun, Ga.	WCGA	900	
Camas, Wash.	KPVA	1480	
Cambridge, Md.	WCEM	1240	
Cambridge, Mass.	WTAO	740	A
Cambridge, Ohio	WILE	1270	
Camden, Ark.	KAMD	910	
Camden, N.J.	WCAM	1310	
	WKDN	800	
Camden, S. C.	WACA	1590	
Camden, Tenn.	WFWL	1220	
Cameron, Tex.	KMIL	1330	
Camilla, Ga.	WCLB	1220	
Campbell, Ohio	WHOT	1570	
Campbellsville, Ky.	WTCO	1450	
Campbellton, N.B.	CKNB	950	
Camrose, Alta.	CFCW	1230	
Canon City, Colo.	KRLN	1400	M
Canonsburg, Pa.	WCNG	540	
Canton, Ga.	WCHK	1290	
Canton, Ill.	WBYS	1560	
Canton, Miss.	WDOB	1370	
Canton, N.C.	WWIT	970	
Canton, Ohio	WAND	900	
	WCMW	1060	
	WHBC	1480	A
Cape Girardeau, Mo.			
	KFVS	960	
	KGMO	1220	
Carbondale, Ill.	WCIL	1020	
Carbondale, Pa.	WCDL	1440	
Caribou, Maine	WFST	600	
Carlisle, Pa.	WHYL	960	
Carlsbad, N.Mex.	KAVE	1240	C
	KPBM	740	
Carmel, Calif.	KTEE	1410	
Carmi, Ill.	WROY	1460	
Carrizo Springs, Tex.			
	KBEN	1450	
Carroll, Iowa	KCIM	1380	
Carrollton, Ala.	WRAG	590	
Carrollton, Ga.	WLBB	1100	
Carson City, Nev.	KPTL	1400	
Cartersville, Ga.	WBHF	1450	M
Carthage, Ill.	WCAZ	990	
Carthage, Mo.	KDMO	1490	
Carthage, Tex.	KGAS	1590	
Caruthersville, Mo.	KCRV	1370	
Casa Grande, Ariz.	KPIN	1260	
Casper, Wyo.	KSPR	1470	C
	KATI	1400	
	KVOC	1230	A-M
Cayce, S.C.	WCAY	620	
Cedar City, Utah	KSUB	590	C
Cedar Rapids, Iowa	KCRG	1600	M
	KPIG	1450	
	WMT	600	C
Cedartown, Ga.	WGAA	1340	
Center, Tex.	KDET	930	
Centerville, Iowa	KCOG	1400	
Centerville, Tenn.	WHLP	1570	
Centerville, Utah	KBBC	1600	
Central City, Ky.	WNES	1600	
	WMTA	1380	
Centralia, Ill.	WCNT	1210	
Centralia & Chehalis, Wash.	KELA	1470	
Centreville, Miss.	WGLC	1580	
Chadron, Nebr.	KCSR	1450	
Chambersburg, Pa.	WCHA	800	
	WCBG	1590	
Champaign, Ill.	WDWS	1400	C
Chanute, Kans.	KCRB	1460	
Chapel Hill, N.C.	WCHL	1360	
Charleroi, Pa.	WESA	940	
Charles City, Iowa	KCHA	1580	
Charleston, Ill.	WEIC	1270	
Charleston, Mo.	KCHR	1350	
Charleston, S.C.	WCSC	1390	C
	WHAN	1340	A-M
	WPAL	730	
	WQSN	1450	
	WTMA	1250	N
Charleston, W.Va.	WCAW	1400	
	WCHS	580	C
	WHMS	1490	A
	WKAZ	950	N
	WTIP	1240	M
Charlotte, Mich.	WCER	1390	
Charlotte, N.C.	WBT	1110	C
	WAYS	610	A
	WGIV	1600	
	WKTC	1310	
	WIST	930	M
	WSOC	1240	N
	WWOK	1480	
Charlotte Amalie, V.I.			
	WSTA	1340	
Charlottesville, Va.			
	WCHV	1260	A
	WELK	1010	
	WINA	1400	M
Charlottetown, P.E.I.			
	CFCY	630	
Chatham, Ont.	CFCO	630	
Chattanooga, Tenn.	WAGC	1450	M
	WAPO	1150	A
	WDEF	1370	N
	WDOD	1310	C
	WDXB	1490	
	WMFS	1260	
Cheboygan, Mich.	WCBY	1240	
Cheektowaga, N.Y.	WNIA	1230	
Chehalis, Wash.	KITI	1420	
Chelan, Wash.	KOZI	1220	
Cheraw, S.C.	WCRE	1420	
Cherokee, Iowa	KCHE	1440	
Chester, Pa.	WDRF	1590	
	WVCH	740	
Chester, S.C.	WGOD	1490	
Cheyenne, Wyo.	KFBC	1240	A
	KVWO	1370	M
Chicago, Ill.	WAAF	950	
	WAIT	820	
	WBBM	780	C
	WCBD	820	
	WCFL	1000	
	WCRW	1240	
	WEDC	1240	
	WGES	1390	
	WGN	720	M
	WIND	560	
	WJJD	1160	
	WLS	890	A
	WMAQ	670	N
	WMBI	1110	
	WSBC	1240	
Chickasha, Okla.	KWCO	1560	
Chico, Calif.	KHSL	1290	C
	KPAY	1060	
Chicopee, Mass.	WACE	730	
Chicoutimi, Que.	CBJ	1580	
	CJMT	1420	
Childress, Tex.	KCTX	1510	
Chillicothe, Mo.	KCHI	1010	
Chillicothe, Ohio	WBEX	1490	A
	WCHI	1350	
Chilliwack, B.C.	CHWK	1270	
Chipley, Fla.	WBGC	1240	
Chippewa Falls, Wis.			
	WAXX	1150	
Christiansburg, Va.	WBCR	1260	
Christiansted, V.I.	WIVI	1040	
Church Hill, Tenn.	WMCH	1260	
Cicero, Ill.	WHFC	1450	
Cincinnati, Ohio	WCKY	1530	
	WCIN	1480	
	WCPO	1230	
	WKRC	550	C
	WLW	700	N-A
	WSAI	1360	
Clanton, Ala.	WKLF	980	
Claremore, Okla.	KWPR	1270	
Claremont, N.H.	WTSV	1230	
Clarksburg, W.Va.	WBOY	1400	N
	WHAR	1340	M
	WPDX	750	
Clarksdale, Miss.	WROX	1450	M
	WKDL	1600	
Clarksville, Ark.	KLYR	1360	
Clarksville, Tenn.	WJZM	1400	M
	WDXN	540	
Clarksville, Tex.	KCAR	1350	
Claxton, Ga.	WCLA	1470	
Clayton, Mo.	KXLW	1320	
	KFUO	850	
Clayton, N.Mex.	KLMX	1450	
Clearfield, Pa.	WCPA	900	
Clearwater, Fla.	WTAN	1340	
Cleburne, Tex.	KCLE	1120	
Cleveland, Miss.	WCLD	1490	
Cleveland, Ohio	KYW	1100	
	WDOK	1260	M
	WERE	1300	
	WGAR	1220	C
	WHK	1420	
	WJMO	1540	
	WJW	850	A-N
Cleveland, Tenn.	WBAC	1340	M
	WCLE	1570	
Cleveland, Tex.	KVLB	1410	
Cleve. Hgts., Ohio	WSRS	1490	A
Clifton, Ariz.	KCLF	1400	A
	KHCD	1450	
Clifton Forge, Va.	WCFV	1230	
Clinton, Ill.	WHOW	1520	
Clinton, Iowa	KCLN	1390	
	KROS	1340	M
Clinton, Mo.	KDKD	1280	
Clinton, N.C.	WRRZ	880	A
Clinton, Okla.	KWOE	1320	
Clinton, S.C.	WPCC	1400	
Cloquet, Minn.	WKLK	1230	
Clovis, N.Mex.	KCLV	1240	
	KICA	980	
Coachella, Calif.	KCHV	970	
Coalinga, Calif.	KBMX	1470	
Coatesville, Pa.	WCOJ	1420	
Cocoa, Fla.	WKKO	860	
	WEZY	1480	
Cody, Wyo.	KODI	1400	A
Coeur d'Alene, Idaho			
	KVNI	1240	M
	KZIN	1050	
Coffeyville, Kans.	KGGF	690	A
Colby, Kans.	KXXX	790	
Coldwater, Mich.	WTVB	1590	
Coleman, Tex.	KSTA	1000	
Colfax, Wash.	KCLX	1450	
Colonial Heights, Va.			
	WPVA	1290	
Colorado City, Tex.	KVMC	1320	
Colo. Sprgs., Colo.	KRDO	1240	
	KPIK	1580	
	KVOR	1300	C
	KWBY	740	
	KYSN	1460	M
Columbia, Ky.	WAIN	1270	
Columbia, Miss.	WCJU	1450	M
Columbia, Mo.	KFRU	1400	A
	KBIA	1580	
Columbia, Pa.	WCOY	1580	
Columbia, S.C.	WCOS	1400	A
	WIS	560	N
	WMSC	1320	C
	WNOK	1230	
	WOIC	1470	
Columbia, Tenn.	WJGD	1280	
	WKRM	1340	
Columbus, Ga.	WDAK	1340	N
	WRBL	1420	C
	WGBA	1270	M
	WCLS	1580	
Columbus, Ind.	WCSI	1010	
Columbus, Miss.	WACR	1050	
	WCBI	550	M
Columbus, Nebr.	KJSK	900	
Columbus, Ohio	WBNS	1460	C
	WCOL	1230	A
	WMNI	920	
	WOSU	820	
	WTVN	610	
	WVKO	1580	
Colville, Wash.	KCVL	1270	
Commerce, Ga.	WJJC	1270	
Concord, N.H.	WKXL	1450	C
Concord, N.C.	WEGO	1410	
Concordia, Kans.	KNCK	1390	
	KFRM	550	A
Connellsville, Pa.	WCVI	1340	
Connersville, Ind.	WCNB	1580	
Conroe, Tex.	KMCO	900	
Conway, Ark.	KCON	1230	
Conway, N.H.	WBNC	1050	
Conway, S.C.	WLAT	1330	M
Cookeville, Tenn.	WHUB	1400	C
Coolidge, Ariz.	KCKY	1150	C
Coos Bay, Oreg.	KOOS	1230	M
	KYNG	1420	
Coquille, Oreg.	KWRO	1450	
Coral Gables, Fla.	WVCG	1070	
Corbin, Ky.	WCTT	680	M
Cordele, Ga.	WMJM	1490	M
Cordova, Alaska	KLAM	1450	
Corinth, Miss.	WCMA	1230	
	WCRR	1330	
Cornelia, Ga.	WCON	1450	
Corner Brook, Nfld.	CBY	790	
Corning, N.Y.	WCBA	1350	
	WCLI	1450	A
Cornwall, Ont.	CKSF	1220	
Corona, Calif.	KBUC	1370	
Corpus Christi, Tex.			
	KATR	1030	
	KCCT	1150	
	KEYS	1440	
	KRYS	1360	N
	KSIX	1230	A-C
	KUNO	1400	
Corry, Pa.	WOTR	1370	
Corsicana, Tex.	KAND	1340	
Cortez, Colo.	KVFC	740	
Cortland, N.Y.	WKRT	920	
Corvallis, Oreg.	KOAC	550	
	KFLY	1240	
	KLOO	1340	
Coshocton, Ohio	WTNS	1560	
Cottage Grove, Oreg.			
	KOMB	1400	
Coudersport, Pa.	WFRM	600	
Council Bluffs, Iowa			
	KSWI	1560	M-A
Covington, Ga.	WGFS	1430	
Covington, Ky.	WZIP	1050	M
Covington, La.	WARB	730	
Covington, Tenn.	WKBL	1250	
Covington, Va.	WKEY	1340	A
Cowan, Tenn.	WZYX	1440	
Craig, Colo.	KRAI	550	
Cranbrook, B.C.	CKEK	570	
Crescent City, Calif.			
	KCRE	1240	
Creston, Iowa	KSIB	1520	
Crestview, Fla.	WCNU	1010	
	WJSB	1050	
Crewe, Va.	WSVS	800	
Crockett, Tex.	KIVY	1290	
Crookston, Minn.	KROX	1260	
Crossett, Ark.	KAGH	800	
Crossville, Tenn.	WAEW	1330	
Crowley, La.	KSIG	1450	
Cuero, Tex.	KCFH	1600	
Cullman, Ala.	WFMH	1460	
	WKUL	1340	
Culpeper, Va.	WCVA	1490	M
Cumberland, Ky.	WCPM	1280	
Cumberland, Md.			
	WCUM	1230	C
	WTBO	1450	
Cushing, Okla.	KUSH	1600	
Cypress Gardens, Fla.			
	WGTO	540	
Cynthiana, Ky.	WCYN	1400	
Dade City, Fla.	WDCF	1350	
Dalhart, Tex.	KXIT	1410	
Dallas, Oreg.	KPLK	1460	
Dallas, Tex.	KRLD	1080	C
	KIXL	1040	
	KSKY	660	
	KLIF	1190	
	WFAA	570	A
	WFAA	820	N
	KBOX	1480	
	WRR	1310	M
The Dalles, Oreg.	KRMW	1300	
	KODL	1440	A
Dalton, Ga.	WBLJ	1230	M
	WRCD	1430	
Danbury, Conn.	WLAD	800	
Danville, Ill.	WDAN	1490	C
	WITY	980	
Danville, Ky.	WHIR	1230	M
Danville, Va.	WBTM	1330	A
	WDVA	1250	M
	WILA	1580	
Darlington, S.C.	WDAR	1350	
Dauphin, Man.	CKDM	1050	
Davenport, Iowa	WOC	1420	N
	KFMA	1580	
	KSTT	1170	M
Dawson, Ga.	WDWD	990	
Dawson Creek, B.C.	CJDC	1350	
Dayton, Ohio	WHIO	1290	C
	WING	1410	
	WONE	980	
	WAVI	1210	
Dayton, Tenn.	WDNT	1280	
Daytona Beach, Fla.			
	WNDB	1150	M-A
	WMFJ	1450	
	WROD	1340	
Deadwood, S.Dak.	KDSJ	980	
Dearborn, Mich.	WKMH	1310	
Decatur, Ala.	WHOS	800	
	WAJF	1490	
	WMSL	1400	M
Decatur, Ga.	WEAS	1010	
	WIIN	970	
Decatur, Ill.	WDZ	1050	
	WSOY	1340	C
Decorah, Iowa	KDEC	1240	
	KWLC	1240	
Defiance, Ohio	WONW	1280	
De Funiak Springs, Fla.			
	WDSP	1280	
	WFNM	1460	
De Kalb, Ill.	WLBK	1360	
De Land, Fla.	WJBS	1490	
	WOOO	1310	
Delano, Calif.	KCHJ	1010	
Delray Bch., Fla.	WDBF	1420	
Del Rio, Tex.	KDLK	1230	
Delta, Colo.	KDTA	1400	
Deming, N.Mex.	KOTS	1230	
Demopolis, Ala.	WXAL	1400	M
Denison, Iowa	KDSN	1580	
Denison, Tex.	KDSX	950	
Denton, Tex.	KDNT	1440	
Denver, Colo.	KDEN	1340	
	KFML	1390	
	KHOW	630	A
	KIMN	950	M
	KLIR	990	
	KLZ	560	C
	KMYR	710	
	KOA	850	N
	KPOF	910	
	KFSC	1220	
	KTLN	1280	
De Queen, Ark.	KDQN	1390	
DeRidder, La.	KDLA	1010	
Des Moines, Iowa	KCBC	1390	A
	KIOA	940	
	KRNT	1350	C
	KSO	1460	
	KWDM	1150	M
	WHO	1040	N
Detroit, Mich.	WCAR	1130	
	WJBK	1500	
	WJLB	1400	
	WJR	760	
	WWJ	950	N
	WXYZ	1270	A
Detroit Lakes, Minn.			
	KDLM	1340	
Devils Lake, N.Dak.			
	KDLR	1240	M
Dexter, Mo.	KDEX	1590	
Diboll, Tex.	KSPL	1260	
Dickinson, N.Dak.	KDIX	1230	
Dickson, Tenn.	WDKN	1260	
Dillon, Mont.	KDBM	800	
Dillon, S.C.	WDSC	800	A
Dinuba, Calif.	KRDU	1240	
Dodge City, Kans.	KGNO	1370	M
Dothan, Ala.	WAGF	1320	
	WDIG	1450	M
	WOOF	560	
Douglas, Ariz.	KAWT	1450	M
	KAPR	930	
Douglas, Ga.	WDMG	860	
	WSIZ	1310	
Douglas, Wyo.	KWIV	1050	
Dover, Del.	WDOV	1410	
	WKEN	1600	
Dover, N.H.	WTSN	1270	
Dover, Ohio	WJER	1450	
Doylestown, Pa.	WBUX	1570	
Drumheller, Alta.	CJDV	910	
Drummondville, Que.			
	CHRD	1340	
Dublin, Ga.	WMLT	1330	
	WXLI	1440	
Du Bois, Pa.	WCED	1420	C

Location	C.L.	Kc.	N.A.
Dubuque, Iowa	KDTH	1370	A
	WDBQ	1490	M
Duluth, Minn.	KDAL	610	C
	WEBC	560	N
	WREX	1080	
Dumas, Tex.	KDDD	800	
Duncan, Okla.	KRHD	1350	M
Dundalk, Md.	WAYE	860	
	WEBB	1360	
Dundee, N.Y.	WFLR	1570	
Dunkirk, N.Y.	WDOE	1410	
Dunn, N.C.	WCKB	780	
Du Quoin, Ill.	WDQN	1580	
Durango, Colo.	KIUP	930	
	KDGO	1240	
Durant, Okla.	KSEO	750	
Durham, N.C.	WDNC	620	C
	WSRC	1410	
	WSSB	1490	
	WTIK	1310	A
Dyersburg, Tenn.	WDSG	1450	
	WTRO	1330	
Eagle Pass, Tex.	KEPS	1270	
Easley, S.C.	WELP	1360	
Eastland, Tex.	KERC	1590	
E. Lansing, Mich.	WKAR	870	
E. Liverpool, Ohio	WOHI	1490	A
East Longmeadow, Mass.	WTYM	1600	
E. Point, Ga.	WTJH	1260	
E. St. Louis, Ill.	WAMV	1490	M
Easton, Pa.	WEEX	1230	
	WEST	1400	N
Eatontown, N.J.	WHTG	1410	
Eau Claire, Wis.	WEAU	790	N
	WBIZ	1400	M
	WECL	1050	
Eau Gallie, Fla.	WMEG	920	
Edenton, N.C.	WCDJ	1260	
Edinburg, Tex.	KURV	710	
Edmonds, Wash.	KGDN	630	
Edmonton, Alta.	CBX	1010	
	CBXA	740	
	CFRN	1260	
	CHED	1080	
	CHFA	680	
	CJCA	930	
	CKUA	580	
Edmundston, N.C.	CJEM	570	
Effingham, Ill.	WCRA	1090	
Elberton, Ga.	WSGC	1400	
El Cajon, Calif.	KDEO	910	A
El Campo, Tex.	KULP	1390	
El Centro, Calif.	KXO	1230	M
	KAMP	1430	
El Dorado, Ark.	KDMS	1290	
	KELD	1400	A
Eldorado, Kans.	KBTO	1360	
Elgin, Ill.	WRMN	1410	
Elizabeth City, N.C.	WCNC	1240	
	WGAI	560	
Elizabethton, Tenn.	WBEJ	1240	
Elizabethtown, Ky.	WIEL	1400	
Elizabethtown, N.C.	WBLA	1450	M
Elizabethtown, Pa.	WEZN	1600	
Elk City, Okla.	KASA	1240	A
Elkhart, Ind.	WTRC	1340	N
	WCMR	1270	
Elkin, N.C.	WIFM	1540	
Elkins, W.Va.	WDNE	1240	
Elko, Nev.	KELK	1240	M
Ellensburg, Wash.	KXLE	1240	
Elmira, N.Y.	WELM	1400	A-C
	WENY	1230	N
Elmira Heights-Horseheads, N.Y.	WEHH	1590	M
El Paso, Tex.	KROD	600	C
	KELP	920	
	KHEY	690	
	KOYE	1150	
	KSET	1340	M
	KTSM	1380	N
Ely, Minn.	WELY	1450	
Ely, Nev.	KELY	1230	
Elyria, Ohio	WEOL	930	
Eminence, Ky.	WSTL	1600	
Emporia, Kans.	KVOE	1400	
Emporia, Va.	WEVA	860	
Emporium, Pa.	WLEM	1250	
Endicott, N.Y.	WENE	1430	A
Englewood, Colo.	KGMC	1150	
Enid, Okla.	KCRC	1390	A
	KGWA	960	M
Enterprise, Ala.	WIRB	600	
Ephrata, Pa.	WGSA	1310	
Ephrata, Wash.	KULF	730	
Erie, Pa.	WERC	1260	A
	WICU	1330	N
	WJET	1400	
	WLEU	1450	
Erwin, Tenn.	WEMB	1420	
Escanaba, Mich.	WDBC	680	M
Escondido, Calif.	KOWN	1450	
Estherville, Iowa	KLIL	1340	
Etowah, Tenn.	WCPH	1220	
Eufaula, Ala.	WULA	1240	M
Eugene, Oreg.	KORE	1450	M
	KASH	1600	A
	KERG	1280	C
	KUGN	590	N
Eunice, La.	KEUN	1490	M
Eureka, Calif.	KINS	980	C

Location	C.L.	Kc.	N.A.
	KDAN	790	
	KIEM	1480	M
Eustis, Fla.	WLCO	1240	
Evanston, Ill.	WEAW	1330	
	WNMP	1590	
Evanston, Wyo.	KLUK	1240	
Evansville, Ind.	WEOA	1400	C
	WGBF	1280	N
	WIKY	820	
	WJPS	1330	A
Eveleth, Minn.	WEVE	1340	M
Everett, Wash.	KRKO	1380	
	KQTY	1230	
Evergreen, Ala.	WBLO	1470	
Fairbanks, Alaska	KFAR	660	A-M-N
	KFRB	900	C-A
Fairfax, Va.	WEEL	1310	
Fairfield, Ill.	WFIW	1390	
Fairfield, Iowa	KMCD	1570	
Fairmont, Minn.	KSUM	1370	M
Fairmont, N.C.	WFMO	860	
Fairmont, W.Va.	WMMN	920	C
	WTCS	1490	A
Fajardo, P.R.	WMDD	1490	
Falfurrias, Tex.	KPSO	1260	
Fallon, Nev.	KULV	1250	
Fall River, Mass.	WALE	1400	M
	WSAR	1480	A
Falls Church, Va.	WFAX	1220	
Falls City, Nebr.	KTNC	1230	
Fargo, N.Dak.	WDAY	970	N
	KFNW	900	
	KXGO	790	A
Faribault, Minn.	KDHL	920	
Farmington, Mo.	KREI	800	
Farmington, N.M.	KENN	1390	
	KWYK	960	
	KZUM	1280	
Farmville, Va.	WFLO	870	
Farrell, Pa.	WFAR	1470	
Fayette, Ala.	WWWF	990	
Fayetteville, Ark.	KHOG	1450	
	KFAY	1250	M
Fayetteville, N.C.	WFAI	1230	C
	WFNC	1390	M
	WFLB	1490	A
	WIDU	1600	
Fayetteville, Tenn.	WEKR	1240	M
Fergus Falls, Minn.	KGDE	1250	M
Fernandina Beach, Fla.	WFBF	1570	
Ferriday, La.	KFNV	1600	
Festus, Mo.	KJCF	1010	
Findlay, Ohio	WFIN	1330	
Fisher, W.Va.	WELD	690	A
Fitchburg, Mass.	WEIM	1280	M
	WFGM	1580	
Fitzgerald, Ga.	WBHB	1240	M
Flagstaff, Ariz.	KCLS	600	N
	KVNA	690	M
Flat River, Mo.	KFMO	1240	M
Flin Flon, Man.	CFAR	590	
Flint, Mich.	WFDF	910	N
	WBBC	1330	M
	WAMM	1420	
	WMRP	1570	
	WKMF	1470	
	WTAC	600	A
Flomaton, Ala.	WTCB	990	
Florence, Ala.	WJOI	1340	M
	WOWL	1240	A
Florence, S.C.	WJMX	970	A
	WOLS	1230	
Floydada, Tex.	KFLD	900	
Foley, Ala.	WHEP	1310	
Fond du Lac, Wis.	KFIZ	1450	M
Forest, Miss.	WMAG	860	
Forest City, N.C.	WBBO	780	
	WAGY	1320	
Forest Grove, Oreg.	KRWC	1570	
Forrest City, Ark.	KXJK	950	
Ft. Bragg, Calif.	KDAC	1230	
Ft. Collins, Colo.	KCOL	1410	
Ft. Dodge, Iowa	KVFD	1400	M
	KWMT	540	A
Ft. Frances, Ont.	CFOB	800	
Ft. Lauderdale, Fla.	WFTL	1400	
	WWIL	1580	
Ft. Lupton, Colo.	KHIL	800	
Ft. Madison, Iowa	KXGI	1360	
Ft. Morgan, Colo.	KFTM	1400	
Ft. Myers, Fla.	WINK	1240	C
	WMYR	1410	
Ft. Payne, Ala.	WFPA	1400	
	WZOB	1250	
Ft. Pierce, Fla.	WARN	1330	
	WIRA	1400	
Ft. Scott, Idaho	KMDO	1600	
Ft. Smith, Ark.	KFPW	1230	C
	KFSA	950	A
	KTCS	1410	M
	KWHN	1320	
Ft. Stockton, Tex.	KFST	860	
Ft. Valley, Ga.	WFPM	1150	
Ft. Walton Beach, Fla.	WFBS	950	
	WFTW	1260	
Ft. Wayne, Ind.	WGL	1250	A
	WOWO	1190	
	WANE	1450	C
	WKJG	1380	N
Ft. William, Ont.	CKPR	580	
Ft. Worth, Tex.	KJIM	870	
	KCUL	1540	
	KFJZ	1270	

Location	C.L.	Kc.	N.A.
	KNOK	970	
	WBAP	570	A
	WBAP	820	N
	KXOL	1360	
Fostoria, Ohio	WFOB	1430	
Fountain Inn, S.C.	WFIS	1600	
Framingham, Mass.	WKOX	1190	
Frankfort, Ind.	WILO	1570	
Frankfort, Ky.	WFKY	1490	M
Franklin, Ky.	WFKN	1220	
Franklin, N.C.	WFSC	1050	
Franklin, Pa.	WFRA	500	
Franklin, Tenn.	WAGG	950	
Franklin, Va.	WYSR	1250	
Frederick, Md.	WFMD	930	C
Frederick, Okla.	KTAT	1570	
Fredericksburg, Tex.	KNAF	1340	M
Fredericksburg, Va.	WFVA	1230	A
Fredericton, N.B.	CFNB	550	
Fredonia, N.Y.	WBUZ	1570	
Freeport, Ill.	WFRL	1570	
Freeport, N.Y.	WGBB	1240	
Freeport, Tex.	KBRZ	1460	
Fremont, Mich.	WBFC	1490	
Fremont, Nebr.	KHUB	1340	
Fremont, Ohio	WFRO	900	
Fresno, Calif.	KARM	1430	A
	KBIF	900	
	KEAP	980	
	KFRE	940	C
	KGST	1600	
	KMAK	1340	
	KMJ	580	N
	KYNO	1300	
Front Royal, Va.	WFTR	1450	M
Fulton, Ky.	WFUL	1270	
Fulton, Mo.	KFAL	900	
Fulton, N.Y.	WOSC	1300	
Fuquay Sprgs., N.C.	WFVG	1460	
Gadsden, Ala.	WGAD	1350	A
	WETO	930	M
	WCAS	570	
Gaffney, S.C.	WFGN	1570	
Gainesville, Fla.	WDVH	980	
	WGGG	1230	A
	WRUF	850	M
Gainesville, Ga.	WGGA	550	M
	WDUN	1240	
	WLBA	1580	
Gainesville, Tex.	KGAF	1580	
Galax, Va.	WBOB	1360	M
Galesburg, Ill.	WGIL	1400	
	WQUB	1590	
Gallatin, Tenn.	WHIN	1010	
Gallipolis, Ohio	WJEH	990	
Gallup, N. Mex.	KGAK	1330	A
Galt, Ont.	CKGR	1110	
Galveston, Tex.	KILE	1400	
	KGBC	1540	
Gander, Nfld.	CBG	1450	
Garden City, Kans.	KNCO	1050	
	KIUL	1240	M
Gardner, Mass.	WGAW	1340	
Gary, Ind.	WWCA	1270	
	WGRY	1370	
Gastonia, N.C.	WGNC	1450	A
	WLTC	1370	
Gaylord, Mich.	WATC	900	
Geneva, Ala.	WGEA	1150	
Geneva, N.Y.	WGVA	1240	A
Georgetown, Del.	WJWL	900	
Georgetown, Ky.	WGOR	1580	
Georgetown, S.C.	WGTN	1400	M
Gettysburg, Pa.	WGET	1450	
Gillette, Wyo.	KIML	1490	
Gilroy, Calif.	KPER	1290	
Gladewater, Tex.	KSIJ	1430	
Glasgow, Ky.	WKAY	1490	
Glasgow, Mont.	KLTZ	1240	
Glendale, Ariz.	KRUX	1360	
Glendale, Calif.	KIEV	870	
Glendive, Mont.	KXGN	1400	
Glen Falls, N.Y.	WWSC	1450	A
Glenwood Sprgs., Colo.	KGLN	980	M
Globe, Ariz.	KWJB	1240	M
Gloucester, Va.	WDDY	1420	
Gloversville-Johnston, N.Y.	WENT	1340	C
Golden, Colo.	KHOK	1250	
Golden Meadow, La.	KLFT	1600	
Goldsboro, N.C.	WFMC	730	
	WGBR	1150	A
	WGOL	1300	
Gonzales, Tex.	KCTI	1450	
Goodland, Kans.	KBLR	730	M
Goshen, Ind.	WKAM	1460	
Grafton, N.D.	KGPC	1340	
Grafton, W.Va.	WVVW	1260	
Graham, Tex.	KSWA	1330	
Granby, Que.	CHEF	1450	
Grand Coulee, Wash.	KFDR	1400	
Grand Falls, Nfld.	CBT	990	
Grand Forks, N.Dak.	KFJM	1370	
	KILO	1440	C
	KNOX	1310	M
Grand Haven, Mich.	WGHN	1370	
Grand Island, Nebr.	KMMJ	750	A
	KRGI	1430	
Grand Junction, Colo.	KREX	920	M
	KEXO	1230	

Location	C.L.	Kc.	N.A.
	KSTR	620	
Grande Prairie, Alta.	CFGP	1050	
Grand Prairie, Tex.	KBCS	730	
Grand Rapids, Mich.	WJEF	1230	C
	WFUR	1570	
	WGRD	1410	
	WLAV	1340	A
	WMAX	1480	
	WOOD	1300	N
Grand Rapids, Minn.	KOZY	1490	M
Grangeville, Idaho	KORT	1230	
Grants, N.Mex.	KMIN	980	
Grants Pass, Oreg.	KAGI	1340	M
	KAJO	1270	
Gravelbourg, Sask.	CFGR	1230	
	CFRG	710	
Gt. Barrington, Mass.	WSBS	860	
Gt. Bend, Kans.	KVGB	1590	N
Gt. Falls, Mont.	KFBB	1310	C
	KUDI	1450	
	KMON	560	M
	KXLK	1400	N
Greeley, Colo.	KFKA	1310	
	KYOU	1450	
Green Bay, Wis.	WBAY	1360	C
	WJPG	1440	
	WDUZ	1400	A
Greeneville, Tenn.	WGRV	1340	
Greenfield, Mass.	WHAI	1240	M
Greensboro, N.C.	WBIG	1470	C
	WCOG	1320	A
	WGBG	1400	M
	WPET	950	
Greensburg, Pa.	WHJB	620	
Greenville, Ala.	WGYV	1380	
Greenville, Miss.	WJPR	1330	
	WDDT	900	
	WGVM	1260	
Greenville, N.C.	WGTC	1590	M
Greenville, S.C.	WESC	660	
	WFBC	1330	N
	WMRB	1490	A-M
	WMUU	1260	
	WQOK	1440	C
Greenville, Tex.	KGVL	1400	
Greenwood, Miss.	WABG	960	
	WGRM	1240	N
Greenwood, S.C.	WCRS	1450	N
	WGSW	1350	
Greer, S.C.	WEAB	800	
	WCKI	1300	
Grenada, Miss.	WNAG	1400	M
Gresham, Oreg.	KGRO	1230	
Gretna, Va.	WMNA	730	
Griffin, Ga.	WKEU	1450	M
	WHIE	1320	
Grinnell, Iowa	KGRN	1410	
Groton, Conn.	WSUB	980	
Grove City, Pa.	WSAJ	1340	
Grundy, Va.	WNRG	1250	
Guayama, P.R.	WXRF	1590	
Guelph, Ont.	CJOY	1450	
Gulfport, Miss.	WROA	1390	
	WGCM	1240	A
Guntersville, Ala.	WGSV	1270	
Guthrie, Okla.	KWRW	1490	
Guymon, Okla.	KGYN	1220	
Hagerstown, Md.	WARK	1490	C
	WJEJ	1240	A-M
Haleyville, Ala.	WJBB	1230	M
Halifax, N.S.	CBH	1330	
	CHNS	960	
	CJCH	920	
Hamilton, Ala.	WERH	970	
Hamilton, Ohio	WMOH	1450	
Hamilton, Ont.	CHML	900	
	CKOC	1150	
Hamilton, Tex.	KCLW	900	
Hamlet, N.C.	WKDX	1400	
Hammond, Ind.	WJOB	1230	
Hammond, La.	WFPR	1400	
Hampton, S.C.	WBHC	1270	
Hampton, Va.	WVEC	1490	
Hancock, Mich.	WMPL	920	
Hanford, Calif.	KNGS	620	
Hannibal, Mo.	KHMO	1070	
Hanover, N.H.	WTSL	1400	
	WDCR	1340	
Hanover, Pa.	WHVR	1280	
Harlan, Ky.	WHLN	1410	
Harlingen, Tex.	KGBT	1530	
Harriman, Tenn.	WHBT	1230	
Harrisburg, Ill.	WEBQ	1240	
Harrisburg, Pa.	WHGB	1400	A
	WCMB	1460	M
	WHP	580	C
	WKBO	1230	N
Harrison, Ark.	KHOZ	900	
Harrisonburg, Va.	WHBG	1360	
	WSVA	550	N
Harrodsburg, Ky.	WHBN	1420	
Hartford, Conn.	WDRC	1360	C
	WCCC	1290	
	WPOP	1410	M-A
	WTIC	1080	N
Hartford, Wis.	WTKM	1540	
Hartselle, Ala.	WHRT	860	
Hartsville, S.C.	WHSC	1450	M
Hartwell, Ga.	WKLY	980	
Harvard, Ill.	WMCW	1600	
Harvey, Ill.	WBEE	1570	
Hastings, Mich.	WBCH	1220	
Hastings, Nebr.	KHAS	1230	

Location	C.L.	Kc.	N.A.
Hattiesburg, Miss.	WBKH	950	
	WFOR	1400	N
	WHSY	1230	A
	WXXX	1310	
Haverhill, Mass.	WHAV	1490	
Havre, Mont.	KOJM	610	M
Havre de Grace, Md.	WASA	1330	
Hawkinsville, Ga.	WCEH	610	
Haynesville, La.	KLUV	1580	
Hays, Kans.	KAYS	1400	
Hayward, Wis.	WHSM	910	
Hazard, Ky.	WKIC	1430	M
Hazlehurst, Miss.	WMDC	1220	
Hazleton, Pa.	WAZL	1490	N-M
Helena, Ark.	KFFA	1360	M
Helena, Mont.	KCAP	1340	M
	KXLJ	1240	N
Hempstead, N.Y.	WHLI	1100	
Henderson, Ky.	WSON	860	
Henderson, Nev.	KBMI	1400	
	KTOO	1280	
Henderson, N.C.	WHNC	890	M
	WHVH	1450	
Henderson, Tex.	KGRI	1000	
	KWRD	1470	
Hendersonville, N.C.	WHKP	1450	A
Henryetta, Okla.	KHEN	1590	
Hereford, Tex.	KPAN	860	
Herkimer, N.Y.	WALY	1420	
Hermiston, Oreg.	KOHU	1570	
Herrin, Ill.	WJPF	1340	M
Hettinger, N.Dak.	KNDC	1490	
Hibbing, Minn.	WMFG	1240	N
Hickory, N.C.	WHKY	1290	A
	WIRC	630	
High Point, N.C.	WMFR	1230	A
	WNOS	1590	
	WHPE	1070	
Hillsboro, Ohio	WSRW	1590	
Hillsboro, Oreg.	KUIK	1360	
Hillsboro, Tex.	KHBR	1560	
Hillsdale, Mich.	WBSE	1340	
Hilo, Hawaii	KHBC	970	C
	KIPA	1110	
	KILA	850	M
Hobart, Okla.	KTJS	1420	
Hobbs, N.Mex.	KWEW	1480	M
	KHOB	1280	
Holbrook, Ariz.	KDJI	1270	
Holdredge, Nebr.	KUVR	1380	
Holland, Mich.	WHTC	1450	
	WJBL	1260	
Hollywood, Fla.	WGMA	1320	
Holyoke, Mass.	WREB	930	
Homer, La.	KVHL	1320	
Homestead, Fla.	WSDB	1430	
Homestead, Pa.	WAMO	860	
Homewood, Ala.	WEZB	1320	M
	WJLD	1400	
Honolulu, Hawaii	KGMB	590	C
	KHON	1380	
	KIKI	830	
	KGU	760	N
	KHVH	1040	
	KPOA	630	M
	KULA	690	A
Hood River, Oreg.	KIHR	1340	
Hope, Ark.	KXAR	1490	
Hopewell, Va.	WHAP	1340	
Hopkinsville, Ky.	WHOP	1230	C
	WKOA	1480	
Hornell, N.Y.	WWHG	1320	
	WLEA	1480	M
Hot Springs, Ark.	KWFC	1350	A
	KBHS	590	
	KBLO	1470	M
Houghton, Mich.	WHDF	1400	
Houghton Lake, Mich.	WHGR	1290	
Houlton, Maine	WABM	1340	
Houma, La.	KCIL	1490	N
Houston, Miss.	WCPC	1320	
Houston, Tex.	KCOH	1430	
	KILT	610	
	KNUZ	1230	
	KPRC	950	N
	KTHT	790	
	KTRH	740	C
	KXYZ	1320	A
	KYOK	1590	
Howell, Mich.	WHMI	1350	
Hudson, N.Y.	WHUC	1230	
Hugo, Okla.	KIHN	1340	
Hull, Que.	CKCH	970	
Humacao, P.R.	WALO	1240	
Humboldt, Tenn.	WIRJ	740	
Huntingdon, Pa.	WHUN	1150	
Huntington, Ind.	WHLT	1300	
Huntington, N.Y.	WGSM	740	
Huntington, W.Va.	WPLH	1470	M
	WHTN	800	M-A
	WSAZ	930	N
Huntsville, Ala.	WBHP	1230	M
	WEUP	1600	
	WFUN	1450	
	WAAY	1550	A
Huntsville, Ont.	CKAR	590	
Huntsville, Tex.	KSAM	1490	
Huron, S.Dak.	KIJV	1340	
Hutchinson, Kan.	KWBW	1450	N
	KWHK	1260	
Hutchinson, Minn.	KDUZ	1260	
Idabel, Okla.	KBEL	1240	
Idaho Falls, Idaho	KID	590	C
	KIFI	1260	A-M
	KUPI	980	

Location	C.L.	Kc.	N.A.
Independence, Kans.	KIND	1010	M
Independence, Mo.	KIMO	1510	
Indiana, Pa.	WDAD	1450	C
Indianapolis, Ind.	WFBM	1260	A-M
	WGEE	1590	
	WIBC	1070	
	WIRE	1430	N
	WISH	1310	C
	WXLW	950	
Indianola, Miss.	WNLA	1380	
Indio, Calif.	KREO	1400	A
Inglewood, Calif.	KTYM	1460	
Inkster, Mich.	WCHB	1440	
Ionia, Mich.	WION	1430	
Iowa City, Iowa	KXIC	800	
	WSUI	910	
Iron Mtn., Mich.	WMIQ	1450	A
Iron River, Mich.	WIKB	1230	M
Ironton, Ohio	WIRO	1230	M
Ironwood, Mich.	WJMS	630	M
Ishpeming, Mich.	WJPD	1240	
Ithaca, N.Y.	WHCU	870	C
	WTKO	1470	
Jackson, Ala.	WTHG	1290	M
Jackson, Mich.	WIBM	1450	A
	WKHM	970	M
Jackson, Miss.	WJDX	620	N
	WJQS	1400	C
	WJXN	1450	
	WOKJ	1590	
	WRBC	1300	M
	WSLI	930	
Jackson, Ohio	WLMJ	1280	
Jackson, Tenn.	WDXI	1310	
	WJAK	1460	
	WTJS	1390	A
Jacksonville, Fla.	WJAX	930	
	WZOK	1320	A
	WIVY	1050	
	WMBR	1460	C
	WOBS	1360	
	WPDQ	600	
	WQIK	1280	
	WRHC	1400	
Jacksonville, Ill.	WLDS	1180	
Jacksonville, N.C.	WJNC	1240	M
	WLAS	910	
Jacksonville, Tex.	KEBE	1400	
Jacksonville Bch., Fla.	WZRO	1010	
Jamestown, N.Dak.	KEYJ	1400	M
	KSJB	600	C
Jamestown, N.Y.	WJTN	1240	A
	WJOC	1340	M
Jamestown, Tenn.	WCLC	1260	
Janesville, Wis.	WCLO	1230	M
Jasper, Ala.	WWWB	1360	
	WARF	1240	
Jasper, Ind.	WITZ	990	
Jasper, Tex.	KTXJ	1350	
Jefferson City, Mo.	KLIK	950	
	KWOS	1240	M
Jennings, La.	KJEF	1290	
Jerome, Idaho	KART	1400	
Jesup, Ga.	WBGR	1370	
Johnson City, Tenn.	WIHL	910	C
	WETB	790	M
Johnstown, Pa.	WJAC	1400	N
	WARD	1490	C
	WCRO	1230	M
Joliet, Ill.	WJOL	1340	
Jonesboro, Ark.	KBTM	1230	M
	KNEA	970	
Jonesville, La.	KANV	1480	
Jonquiere, Que.	CKRS	590	
Joplin, Mo.	WMBH	1450	M
	KFSB	1310	
	KODE	1230	C
Junction, Tex.	KMBL	1450	
Junc. City, Kans.	KJCK	1420	
Juneau, Alaska	KINY	800	C-A
	KJNO	630	A-M-N
Kailua, Hawaii	KANI	1240	
Kaimuki, Hawaii	KAIM	870	
Kalamazoo, Mich.	WKZO	590	C
	WKLZ	1470	
	WKMI	1360	
Kalispell, Mont.	KGEZ	600	M
	KOFI	930	
Kamloops, B.C.	CFJC	910	
Kane, Pa.	WADP	960	
Kankakee, Ill.	WKAN	1320	
Kannapolis, N.C.	WGTL	870	
Kans. City, Kans.	KCKN	1340	
Kansas City, Mo.	KCMO	810	C
	KMBC	980	A
	KPRS	1590	
	KUDL	1380	
	WDAF	610	N
	WHB	710	
Kearney, Nebr.	KGFW	1340	M
	KRNY	1460	
Keene, N.H.	WKNE	1290	C
Kelowna, B.C.	CKOV	630	
Kelso, Wash.	KLOG	1490	
Kendallville, Ind.	WAWK	1570	
Kenedy, Tex.	KAML	990	
Kenmore, N.Y.	WINE	1080	
Kennett, Mo.	KBOA	830	
Kennewick-Pasco-Richland, Wash.	KEPR	610	C
Kenora, Ont.	CJRL	1220	
Kenosha, Wis.	WLIP	1050	
Kentville, N.S.	CKEN	1350	
Keokuk, Iowa	KOKX	1310	
Kermit, Tex.	KERB	600	

Location	C.L.	Kc.	N.A.
Kerrville, Tex.	KERV	1230	
Ketchikan, Alaska	KTKN	930	C-A
Kewanee, Ill.	WKEI	1450	
Keyser, W.Va.	WKYR	1270	
Key West, Fla.	WKWF	1600	M
Kilgore, Tex.	KOCA	1240	
Killeen, Tex.	KLEN	1050	M
Kingman, Ariz.	KAAA	1230	
Kings Mountain, N.C.	WKMT	1220	
Kingsport, Tenn.	WKIN	1320	
	WKPT	1400	N
Kingston, N.Y.	WKNY	1490	M
Kingston, Ont.	CFRC	1490	
	CKLC	1380	
	CKWS	960	
Kingstree, S.C.	WDKD	1310	
Kingsville, Tex.	KINE	1330	
Kinston, N.C.	WELS	1010	
	WFTC	960	A
	WISP	1230	M
Kirkland, Wash.	KNBX	1050	
Kirkland Lake, Ont.	CJKL	560	
Kirksville, Mo.	KIRX	1450	A
Kitchener, Ont.	CKCR	1490	
Kissimmee, Fla.	WRWB	1220	
Kittanning, Pa.	WACB	1380	
Klamath Falls, Oreg.	KFJI	1150	M
	KFLW	1450	A-C
	KLAD	900	
Knoxville, Tenn.	WBIR	1240	A
	WIVK	860	
	WATE	620	N
	WKGN	1340	M
	WKXV	900	
	WNOX	990	C
Kokomo, Ind.	WIOU	1350	C
Kosciusko, Miss.	WKOZ	1350	
Laconia, N.H.	WLNH	1350	
LaCrosse, Wis.	WKBH	1410	N
	WLCX	1490	
	WKTY	580	A
Ladysmith, Wis.	WLDY	1340	
Lafayette, Ga.	WLFA	1590	
Lafayette, Ind.	WASK	1450	M
	WBAA	920	
Lafayette, La.	KPEL	1420	A
	KVOL	1330	N
LaFollette, Tenn.	WLAF	1450	
LaGrande, Oreg.	KLBM	1450	
LaGrange, Ga.	WLAG	1240	M
	WTRP	620	
LaGrange, Ill.	WTAQ	1300	
LaJunta, Colo.	KBNZ	1400	M
Lake Charles, La.	KLOU	1580	
	KPLC	1470	N
	KAOK	1400	M
Lake City, Fla.	WDSR	1340	
Lake City, S.C.	WJOT	1260	
Lakeland, Fla.	WLAK	1430	N
	WONN	1230	M
	WYSE	1330	
Lake Providence, La.	KLPL	1050	
Lake Tahoe, Calif.	KOWL	1490	
Lakeview, Oreg.	KQIK	1230	
Lake Wales, Fla.	WIPC	1280	
Lakewood, Colo.	KLAK	1600	
Lamar, Colo.	KLMR	920	M
Lamesa, Tex.	KPET	690	
Lampasas, Tex.	KCYL	1450	
Lancaster, Calif.	KAVL	610	
	KBVM	1380	
Lancaster, Ohio	WHOK	1320	
Lancaster, Pa.	WGAL	1490	N
	WLAN	1390	A-M
Lancaster, S.C.	WLCM	1360	
Lander, Wyo.	KOVE	1330	M
Lanett, Ala.	WRLD	1490	A
Lansford, Pa.	WLSH	1410	
Lansing, Mich.	WILS	1320	
	WJIM	1240	A-N
Lapeer, Mich.	WMPC	1230	
LaPorte, Ind.	WLOI	1540	
Laramie, Wyo.	KOWB	1340	M
Laredo, Tex.	KVOZ	1490	M
LaSalle, Ill.	WLPO	1220	
LaSarre, Que.	CKLS	1240	
LasCruces, N.Mex.	KOBE	1450	
	KGRT	570	
Las Vegas, Nev.	KENO	1460	A
	KLAS	1230	C
	KORK	1340	M
	KRAM	920	
	KRBO	1050	
Las Vegas, N.Mex.	KFUN	1230	A
Latrobe, Pa.	WAKU	1570	M
	WTRA	1480	
Laurel, Miss.	WAML	1340	N
	WLAU	1600	A
	WNSL	1260	
Laurens, S.C.	WLBG	860	
Laurinburg, N.C.	WEWO	1080	
Lawrence, Kans.	KFKU	1250	
	KLWN	1320	
Lawrence, Mass.	WCCM	800	
Lawrenceburg, Tenn.	WDXE	1370	
Lawton, Okla.	KSWO	1380	A
	KCCO	1050	
Leadville, Colo.	KLVC	1230	
Leaksville, N.C.	WLOE	1490	M
Leamington, Ont.	CJSP	710	
Leavenworth, Kans.	KCLO	1410	
Lebanon, Ky.	WLBN	1590	
Lebanon, Mo.	KLWT	1230	

Location	C.L.	Kc.	N.A.
Lebanon, Oreg.	KGAL	920	
Lebanon, Pa.	WLBR	1270	
Lebanon, Tenn.	WCOR	900	
Leesburg, Fla.	WLBE	790	M
	WBIL	1410	
Leesburg, Va.	WAGE	1290	
Leesville, La.	KLLA	1570	
Leland, Miss.	WESY	1580	
LeMars, Iowa	KLEM	1410	
Lenoir, N.C.	WJRI	1340	M
Lenoir, Tenn.	WLIL	730	
Leonardtown, Md.	WKIK	1370	
Lethbridge, Alta.	CJOC	1220	
Levelland, Tex.	KLVT	1230	
Levittown, Pa.	WBCB	1490	
Lewisburg, Pa.	WITT	1010	
Lewisburg, Tenn.	WJJM	1490	M
Lewiston, Idaho	KRLC	1350	M
	KOZE	1300	
Lewiston, Maine	WCOU	1240	M
	WLAM	1470	A
Lewistown, Mont.	KXLO	1230	M
Lewistown, Pa.	WKVA	920	
	WMRF	1490	N
Lexington, Ky.	WLAP	630	A
	WBLG	1300	
	WVLK	590	M
Lexington, Mo.	KLEX	1570	
Lexington, Nebr.	KRVN	1010	
Lexington, N.C.	WBUY	1440	
Lexington, Tenn.	WDXL	1490	
Lexington, Va.	WREL	1450	N
Lexington Pk., Md.	WPTX	920	
Libby, Mont.	KOLL	1230	M
Liberal, Kans.	KSCB	1270	
Liberty, N.Y.	WVOS	1240	
Lihue, T.H.	KTOH	1490	
Lima, Ohio	WIMA	1150	A
Lincoln, Ill.	WPRC	1370	
Lincoln, Nebr.	KFOR	1240	A
	KLIN	1400	
	KLMS	1480	
Lincolnton, N.C.	WLON	1050	
Lindsay, Ont.	CKLY	910	
Linton, Ind.	WBTO	1600	
Litchfield, Ill.	WSMI	1540	
Little Falls, Minn.	KLTF	960	
Little Falls, N.Y.	WLFH	1230	
Littlefield, Tex.	KVOW	1490	
Little Rock, Ark.	KARK	920	N
	KGHI	1250	M
	KLRA	1010	A
	KOKY	1440	
	KTHS	1090	C
	KVLC	1050	
Littleton, Colo.	KUDY	1510	
Live Oak, Fla.	WNER	1250	
Livingston, Mont.	KPRK	1340	M
Livingston, Tenn.	WLIV	920	
Livingston, Tex.	KETX	1440	
	KTET	1220	
Lloydminster, Alta.	CKSA	1150	
Lock Haven, Pa.	WBPZ	1230	M
Lockport, N.Y.	WUSJ	1340	
Lodi, Calif.	KCVR	1570	
Logan, Utah	KVNU	610	M
	KLGN	1390	
Logan, W.Va.	WLOG	1230	M
	WVOW	1290	
Logansport, Ind.	WSAL	1230	M
Lompoc, Calif.	KNEZ	960	
London, Ky.	WFTG	1400	
London, Ont.	CFPL	980	
	CKSL	1290	
Long Beach, Calif.	KFOX	1280	
	KGER	1390	
Longmont, Colo.	KLMO	1050	
Longview, Tex.	KFRO	1370	A
	KLTI	1280	
Longview, Wash.	KEDO	1400	M
	KBAM	1270	
Lorain, Ohio	WWIZ	1380	
Loris, S.C.	WLSC	1570	
Los Alamos, N.Mex.	KRSN	1490	A
Los Angeles, Calif.	KABC	790	A
	KFI	640	N
	KHJ	930	M
	KFSG	1150	
	KFWB	980	
	KGFJ	1230	
	KFAC	1330	
	KLAC	570	
	KMPC	710	
	KNX	1070	C
	KPOL	1540	
	KPOP	1020	
	KRKD	1150	
Louisville, Ky.	WAVE	970	N
	WGRC	790	M
	WHAS	840	C
	WKLO	1080	A
	WINN	1240	
	WKYW	900	
	WLOU	1350	
	WTMT	620	
Louisville, Miss.	WLSM	1270	
Loveland, Colo.	KLOV	1570	
Lovington, N.Mex.	KLEA	630	
Lowell, Mass.	WCAP	980	
	WLLH	1400	M
Lubbock, Tex.	KCBD	1590	M-N
	KDAV	580	

Location	C.L.	Kc.	N.A.
	KDUB	1340	
	KFYD	790	C
	KLLL	1460	M
	KSEL	950	A
Ludington, Mich.	WKLA	1450	A
Lufkin, Tex.	KRBA	1340	A
	KTRE	1420	M
Lumberton, N.C.	WAGR	1480	
	WTSB	1340	M
Lynchburg, Va.	WLVA	590	A
	WWOD	1390	M-N
	WBRG	1050	
Lynn, Mass.	WLYN	1360	
Macomb, Ill.	WKAI	1510	
Macon, Ga.	WBML	1240	
	WCRY	900	
	WIBB	1280	
	WMAZ	940	C
	WNEX	1400	A-M
Macon, Miss.	WMBC	1400	
Madera, Calif.	KHOT	1250	
Madison, Fla.	WMAF	1230	
Madison, Ga.	WYTH	1250	
Madison, Ind.	WORX	1270	
Madison, Wis.	WHA	970	
	WIBA	1310	N
	WISC	1480	A-M
	WKOW	1070	C
Madison, Tenn.	WENO	1430	
Madisonville, Ky.	WFMW	730	
	WTTL	1310	
Magee, Miss.	WSJC	1280	
Magnolia, Ark.	KVMA	630	M
Malden, Mo.	KTCB	1470	
Malone, N.Y.	WICY	1490	M
Malvern, Ark.	KBOK	1310	
Manassas, Va.	WPRW	1460	
Manchester, Conn.	WINF	1230	
Manchester, Ga.	WFDR	1370	
Manchester, Ky.	WWXL	1580	
Manchester, N.H.	WFEA	1370	
	WGIR	610	C
	WKBR	1240	
Manchester, Tenn.	WMSR	1580	
Manhattan, Kans.	KSAC	580	
	KMAN	1350	
Manila, P.I.	DZPI	1800	M-C
	DZRH	710	N
Manistee, Mich.	WMTE	1340	
Manitou Springs, Colo.	KCMS	1490	
Manitowoc, Wis.	WCUB	980	
	WOMT	1240	M
Mankato, Minn.	KYSM	1230	N
	KTOE	1420	A
Manning, S.C.	WYMB	1410	
Mansfield, La.	KDBC	1360	
Mansfield, Ohio	WMAN	1400	A
	WCLW	1570	
Marianna, Fla.	WTYS	1340	M
	WTOT	980	
Marietta, Ga.	WFOM	1230	
	WBIE	1050	
Marietta, Ohio	WMOA	1490	M
Marine City, Mich.	WDOG	1590	
Marinette, Wis.	WMAM	570	N
Marion, Ala.	WJAM	1310	
Marion, Ill.	WGGH	1150	
Marion, Ind.	WBAT	1400	C
	WMRI	860	
Marion, N.C.	WBRM	1250	
Marion, Ohio	WMRN	1490	A
Marion, S.C.	WATP	1430	
Marion, Va.	WMEV	1010	A
Marked Tree, Ark.	KPCA	1580	
Marksville, La.	KAPB	1370	
Marlin, Tex.	KMLW	1010	
Marquette, Mich.	WDMJ	1320	M
Marshall, Minn.	KMHL	1400	A
Marshall, Mo.	KMMO	1300	
Marshall, N.C.	WMMH	1460	
Marshall, Tex.	KMHT	1450	
	KADO	1410	
Marshalltown, Iowa	KFJB	1230	
Marshfield, Wis.	WDLB	1450	
Martin, Tenn.	WCMT	1410	
Martinsburg, W.Va.	WEPM	1340	
Martinsville, Va.	WHEE	1370	
	WMVA	1450	N
Marysville, Calif.	KMYC	1410	M
Marysville, Kans.	KNDY	1570	
Maryville, Mo.	KNIM	1580	
Maryville, Tenn.	WGAP	1400	
Mason City, Iowa	KGLO	1300	C
	KRIB	1490	
	KSMN	1010	
Massena, N.Y.	WMSA	1340	A
Massillon, Ohio	WTIG	990	
Matane, Que.	CKBL	1250	
Matawan, W.Va.	WHJC	1360	
Mattoon, Ill.	WLBH	1170	
Mayaguez, P.R.	WAEL	600	
	WKJB	710	
	WORA	1150	
	WPRA	990	
	WTIL	1300	
Mayfield, Ky.	WKTM	1050	
	WNGO	1320	
Mayodan, N.C.	WMYN	1420	
Maysville, Ky.	WFTM	1240	M
McAlester, Okla.	KTMC	1400	
	KNED	1150	
McAllen, Tex.	KRIO	910	M
McCamey, Tex.	KCMR	1450	
McComb, Miss.	WHNY	1250	A
	WAPF	980	
McCook, Nebr.	KBRL	1300	M
McGehee, Ark.	KVSA	1220	
McKeesport, Pa.	WEDO	810	C
	WMCK	1360	
McKenzie, Tenn.	WHDM	1440	
McKinney, Tex.	KMAE	1600	
McMinnville, Oreg.	KMCM	1260	
McMinnville, Tenn.	WBMC	960	
	WMMT	1230	M
McPherson, Kans.	KNEX	1540	
McRae, Ga.	WDAX	1410	
Meadville, Pa.	WMGW	1490	
Medford, Mass.	WHIL	1430	
Medford, Oreg.	KMED	1440	N
	KBOY	730	
	KYJC	1230	A-C
Medford, Wis.	WIGM	1490	M
Medicine Hat, Alta.	CHAT	1270	
Melbourne, Fla.	WMMB	1240	M
Memphis, Tenn.	WHBQ	560	M
	WHER	1430	
	WMC	790	N
	WDIA	1070	
	WMPS	680	
	WHHM	1340	A
	WLOK	1480	
	WREC	600	C
	KWEM	990	
Mena, Ark.	KENA	1450	
Menominee, Mich.	WAGN	1340	A
Menomonie, Wis.	WMNE	1360	
Merced, Calif.	KYOS	1480	M
	KWIP	1580	
Meriden, Conn.	WMMW	1470	
Meridian, Miss.	WCOC	910	C
	WDAL	1330	
	WMOX	1240	
	WOKK	1450	A
	WQIC	1390	
Mesa, Ariz.	KBUZ	1310	
Metropolis, Ill.	WMOK	920	
Mexia, Tex.	KBUS	1590	
Mexico, Mo.	KXEO	1340	M
Mexico, Pa.	WJUN	1220	
Miami, Ariz.	KIKO	1340	
Miami, Fla.	WGBS	710	C
	WCKR	610	N
	WFFC	1220	
	WAME	1260	
	WMIE	1140	
	WQAM	560	
	WSKP	1450	
	WINZ	940	
Miami, Okla.	KGLC	910	
Miami Beach, Fla.	WMET	1490	
	WKAT	1360	M-A
	WMBM	800	
Michigan City, Ind.	WIMS	1420	
Middlesboro, Ky.	WMIK	560	
Middletown, Conn.	WCNX	1150	
Middletown, N.Y.	WALL	1340	
Middletown, Ohio	WPFB	910	
Midland, Mich.	WMDN	1490	
Midland, Tex.	KCRS	550	A
	KJBC	1150	
	KWEL	1600	
Milan, Tenn.	WKBJ	1600	
Miles City, Mont.	KATL	1340	M
Milford, Del.	WKSB	930	
Milford, Mass.	WMRC	1490	
Milledgeville, Ga.	WMVG	1450	M
Millington, Tenn.	WHEY	1220	
Millville, N.J.	WMVB	1440	
Milton, Fla.	WEBY	1330	M
Milton, Pa.	WMLP	1570	
Milwaukee, Wis.	WEMP	1250	
	WFOX	860	M
	WRIT	1340	
	WISN	1150	A
	WMIL	1290	
	WOKY	920	
	WTMJ	620	N
Minden, La.	KASO	1240	
Mineral Wells, Tex.	KORC	1140	
Mineola, N.Y.	WKIT	1520	
Minneapolis, Minn.	KEVE	1440	
	WCCO	830	C
	WLOL	1330	
	WMIN	1400	
	WDGY	1130	
	WPBC	980	
	WTCN	1280	A
	KTIS	900	
	KUOM	770	
Minot, N.Dak.	KLPM	1390	M
	KQDY	1320	
	KCJB	910	C
Mission, Kans.	KBKC	1480	
Mission, Tex.	KIRT	1580	
Missoula, Mont.	KGVO	1290	C
	KXLL	1450	N
	KBTK	1340	M
Mitchell, S.Dak.	KORN	1490	M
Moab, Utah	KURA	1450	
Moberly, Mo.	KNCM	1230	
Mobile, Ala.	WALA	1410	N
	WABB	1480	A
	WKAB	840	
	WKRG	710	C
	WMOZ	960	
Mobridge, S.Dak.	KOLY	1300	
Modesto, Calif.	KTRB	860	
	KBEE	970	
	KFIV	1360	A
Moline, Ill.	WQUA	1230	A
Monahans, Tex.	KVKM	1340	M
Moncton, N.B.	CBAF	1300	
	CKCW	1220	
Monett, Mo.	KRMD	990	
Monmouth, Ill.	WRAM	1330	
Monroe, Ga.	WMRE	1490	
Monroe, La.	KMLB	1440	A-N
	KLIC	1230	M
	KNOE	1390	
Monroe, Mich.	WMIC	560	
Monroe, N.C.	WMAP	1060	
Monroe, Wis.	WEKZ	1260	
Monroeville, Ala.	WMFC	1360	
Monterey, Calif.	KIDD	630	
	KMBY	1240	C
Montevideo, Minn.	KDMA	1450	A
Monte Vista, Colo.	KSLV	1240	
Montgomery, Ala.	WBAM	740	
	WCOV	1170	C
	WAPX	1600	A
	WHHY	1440	N
	WMGY	800	
	WRMA	950	
Montgomery, W.Va.	WMON	1340	M
Monticello, Ark.	KHBM	1430	
Monticello, Ky.	WFLW	1360	
Montmagny, Que.	CKBM	1490	
Montpelier-Barre, Vt.	WSKI	1240	A
Montreal, Que.	CBF	690	
	CBM	940	N
	CFCF	600	A
	CHLP	1410	
	CJAD	800	
	CJMS	1280	
	CKAC	730	C
Montrose, Colo.	KUBC	580	
Montrose, Pa.	WPEL	1250	
Mooresville, N.C.	WHIP	1350	
Moorhead, Minn.	KVOX	1280	M
Moosejaw, Sask.	CHAB	800	
Morehead, Ky.	WMOR	1330	
Morehead City, N.C.	WMBL	740	
Morgan City, La.	KMRC	1430	
Morganton, N.C.	WMNC	1430	
Morgantown, W.Va.	WAJR	1440	N
	WCLG	1300	
Morrilton, Ark.	KVOM	800	
Morris, Minn.	KMRS	1570	
Morristown, N.J.	WMTR	1250	
Morristown, Tenn.	WCRK	1150	M
	WMTN	1300	
Moscow, Idaho	KRPL	1400	
Moses Lake, Wash.	KSEM	1470	
	KWIQ	1260	
Moultrie, Ga.	WMGA	1400	A
	WMTM	1300	
Moundsville, W.Va.	WMOD	1370	
Mountain Grove, Mo.	KLRS	1360	
Mountain Home, Ark.	KTLO	1490	
Mt. Airy, N.C.	WPAQ	740	
	WSYD	1300	M
Mt. Carmel, Ill.	WVMC	1360	
Mt. Clemens, Mich.	WBRB	1430	
Mt. Dora, Fla.	WIOK	1580	
Mt. Jackson, Va.	WSIG	790	
Mt. Kisco, N.Y.	WVIP	1310	
Mt. Pleasant, Mich.	WCEN	1150	
Mt. Pleasant, Tex.	KIMP	960	
Mt. Shasta, Calif.	KWSD	620	
Mt. Sterling, Ky.	WMST	1150	
Mt. Vernon, Ill.	WMIX	940	
Mt. Vernon, Ind.	WPCO	1590	
Mt. Vernon, Ky.	WRVK	1460	
Mt. Vernon, Ohio	WMVO	1300	
Mt. Vernon, Wash.	KBRC	1430	
Muleshoe, Tex.	KMUL	1380	
	KZOL	1570	
Mullins, S.C.	WJAY	1280	
Muncie, Ind.	WLBC	1340	C
Munfordville, Ky.	WLOC	1150	
Munising, Mich.	WMAB	1400	
Murfreesboro, Tenn.	WGNS	1450	
	WMTS	860	
Murphysboro, Ill.	WINI	1420	
Murray, Ky.	WNBS	1340	
Murray, Utah	KMUR	1230	
Muscatine, Iowa	KWPC	860	
Muscle Shoals City, Alabama	WLAY	1450	
Muskegon, Mich.	WKBZ	850	A
	WTRU	1600	
	WMUS	1090	
Muskogee, Okla.	KBIX	1490	A
	KMUS	1380	
Myrtle Beach, S.C.	WMYB	1450	
Nacogdoches, Tex.	KEEE	1230	A
	KSFA	860	
Nampa, Idaho	KFXD	580	
Nanaimo, B.C.	CHUB	1570	
Nanticoke, Pa.	WNAK	730	
Napa, Calif.	KVON	1440	
Naples, Fla.	WNOG	1270	
Narrows, Va.	WNRV	990	
Nashua, N.H.	WOTW	900	
	WSMN	1590	
Nashville, Tenn.	WKDA	1240	
	WLAC	1510	C
	WMAK	1300	
	WNAH	1360	M
	WSIX	980	A
	WSM	650	N
	WVOL	1470	
Natchez, Miss.	WMIS	1240	N
	WNAT	1450	M
Natchitoches, La.	KNOC	1450	M
Needles, Calif.	KSFE	1340	
Neenah, Wis.	WNAM	1280	
Neillsville, Wis.	WCCN	1370	
Nelson, B.C.	CKLN	1390	
Neon, Ky.	WNKY	1480	
Neosho, Mo.	KBTN	1420	
Nevada, Mo.	KNEM	1240	
New Albany, Ind.	WLRP	1570	
New Albany, Miss.	WNAU	1470	
Newark, N.J.	WNTA	970	
	WACK	1420	
	WHBI	1280	
	WNJR	1430	
	WVNJ	620	
Newark, Ohio	WCLT	1430	
New Bedford, Mass.	WBSM	1420	
	WNBH	1340	M
New Bern, N.C.	WHIT	1450	M
	WRNB	1490	
Newberry, S.C.	WKDK	1240	
New Braunfels, Tex.	KGNB	1420	
New Britain, Conn.	WHAY	910	
	WKNB	840	
New Brunswick, N.J.	WCTC	1450	
Newburgh, N.Y.	WGNY	1220	
Newburyport, Mass.	WNBP	1470	
New Carlisle, Que.	CHNC	610	
Newcastle, N.B.	CKMR	790	
New Castle, Pa.	WKST	1280	M
Newcastle, Wyo.	KASL	1240	
New Glasgow, N.S.	CKEC	1230	
New Haven, Conn.	WAVZ	1300	
	WELI	960	
	WNHC	1340	A
New Iberia, La.	KANE	1240	
	KVIM	1360	
New Kensington, Pa.	WKPA	1150	
New London, Conn.	WNLC	1490	M
New Martinsville, W.Va.	WETZ	1330	M
Newnan, Ga.	WCOH	1400	M
New Orleans, La.	WDSU	1280	N
	WJBW	1230	
	WJMR	990	
	WBOK	800	
	WNOE	1060	
	WSMB	1350	A
	WNPS	1450	
	WTIX	690	
	WWL	870	C
	WYFE	600	
	WYLD	940	M
Newport, Ark.	KNBY	1280	
Newport, Ky.	WNOP	740	
Newport, Oreg.	KNPT	1310	
Newport, R.I.	WADK	1540	
Newport, Tenn.	WLIK	1270	
Newport, Vt.	WIKE	1490	
Newport News, Va.	WGH	1310	A
	WYUO	1270	
New Rochelle, N.Y.	WWES	1460	
New Smyrna Beach, Fla.	WSBB	1230	M
Newton, Iowa	KCOB	1280	
Newton, Kans.	KJRG	950	
Newton, Miss.	WBKN	1410	
Newton, N.J.	WNNJ	1360	
Newton, N.C.	WNNC	1230	
New Ulm, Minn.	KNUJ	860	
New Westminster, B.C.	CKNW	980	
New York, N.Y.	WABC	770	A
	WBNX	1380	
	WCBS	880	C
	WEVD	1330	
	WHOM	1480	
	WINS	1010	
	WLIB	1190	
	WMCA	570	
	WMGM	1050	
	WNEW	1130	
	WNYC	830	
	WOR	710	M
	WOV	1280	
	WPOW	1330	
	WQXR	1560	
	WRCA	660	N
Niagara Falls, N.Y.	WHLD	1270	
	WJJL	1440	
Niagara Falls, Ont.	CHVC	1600	
Niles, Mich.	WNIL	1290	
Nogales, Ariz.	KNOG	1340	C
Norfolk, Nebr.	WJAG	780	
Norfolk, Va.	WTAR	790	C
	WCMS	1050	
	WNOR	1230	
	WRAP	850	
Norman, Okla.	WNAD	640	
	KNOR	1400	
Norristown, Pa.	WNAR	1110	
N. Adams, Mass.	WMNB	1230	
N. Augusta, S.C.	WGUS	1600	
N. Battleford, Sask.	CJNB	1460	
North Bay, Ont.	CFCH	600	
North Bend, Oreg.	KFIR	1340	C
Northfield, Minn.	WCAL	770	
Northampton, Mass.	WHMP	1400	M
N. Little Rock, Ark.	KNLR	1380	
	KXLR	1150	

Location	C.L.	Kc.	N.A.
	KVLC	1050	
North Platte, Nebr.	KJLT	970	
	KODY	1240	N
No. Vancouver, B.C.	CKLG	730	
N. Vernon, Ind.	WOCH	1460	
No. Wilkesboro, N.C.	WKBC	810	
Norton, Va.	WNVA	1350	M
Norwalk, Conn.	WNLK	1350	
Norwich, Conn.	WICH	1310	
Norwich, N.Y.	WCHN	970	
Oakdale, La.	KREH	900	
Oak Grove, La.	KWCL	1280	
Oak Hill, W.Va.	WOAY	860	
Oakland, Calif.	KLX	910	
	KROW	960	
	KWBR	1310	
Oak Park, Ill.	WOPA	1490	
Oak Ridge, Tenn.	WATO	1490	M
	WOKE	1290	
Oakville, Ont.	CHWO	1250	
Ocala, Fla.	WMOP	900	
	WTMC	1290	N
	WHYS	1370	
Oceanside, Calif.	KUDE	1320	
Odessa, Tex.	KECK	920	
	KOSA	1230	C
	KOYL	1310	
	KRIG	1410	M
Oelwein, Iowa	KOEL	950	
Ogallala, Nebr.	KOGA	930	
Ogden, Utah	KLO	1430	M
	KKOG	730	
	KVOG	1490	
Ogdensburg, N.Y.	WSLB	1400	M
Oil City, Pa.	WKRZ	1340	
Okla. City, Okla.	KBYE	890	A
	KLPR	1140	
	KOCY	1340	
	KOMA	1520	N
	KTOK	1000	C
	KTOW	800	
	WKY	930	
Okmulgee, Okla.	KHBG	1240	
Old Saybrook, Conn.	WLIS	1420	
Olean, N.Y.	WMNS	1360	
	WHDL	1450	A
Olney, Ill.	WVLN	740	
Olympia, Wash.	KGY	1240	M
	KITN	1440	
Omaha, Nebr.	KBON	1490	
	KFAB	1110	N
	KOIL	1290	
	KODO	1420	
	KOWH	660	
	KSWI	1560	M-A
	WOW	590	C
Omak, Wash.	KOMW	680	
Oneida, N.Y.	WONG	1600	
O'Neill, Nebr.	KBRX	1400	
Oneonta, Ala.	WCRL	1570	
Oneonta, N.Y.	WDOS	730	
Ontario, Calif.	KASK	1510	
Ontario, Oreg.	KSRV	1380	
Opelika, Ala.	WPHO	1400	M
Opelousas, La.	KSLO	1230	A
Opp, Ala.	WAMI	860	
Opportunity, Wash.	KZUN	630	
Orange, Mass.	WCAT	1390	
Orange, Tex.	KOGT	1600	
Orange, Va.	WJMA	1340	
Orangeburg, S.C.	WDIX	1150	A
	WTND	920	
Oregon City, Oreg.	KGON	1520	N
Orillia, Ont.	CFOR	1570	
Orlando, Fla.	WDBO	580	C
	WHOO	990	M
	WHIY	1270	
	WLOF	950	
	WKIS	740	N
Ormond Bch., Fla.	WQXQ	1380	
Orofino, Idaho	KLER	950	
Oroville, Calif.	KMOR	1340	
Ortonville, Minn.	KDIO	1350	
Osage Bch., Mo.	KRMS	1150	
Osceola, Ark.	KOSE	860	
Oshawa, Ont.	CKLB	1350	
Oshkosh, Wis.	WOSH	1490	A
Oskaloosa, Iowa	KBOE	740	
Othello, Wash.	KRSC	1450	
Ottawa, Ill.	WCMY	1430	
Ottawa, Kans.	KOFO	1220	
Ottawa, Ont.	CBO	910	
	CFRA	560	
	CKOY	1310	
Ottumwa, Iowa	KBIZ	1240	A
	KLEE	1480	
Owatonna, Minn.	KRFO	1390	
Owego, N.Y.	WEBO	1330	
Owensboro, Ky.	WOMI	1490	M
	WVJS	1420	A
Owen Sound, Ont.	CFOS	560	
Owosso, Mich.	WOAP	1080	
Oxford, Miss.	WSUH	1420	
Oxford, N.C.	WOXF	1340	
Oxnard, Calif.	KOXR	910	
Ozark, Ala.	WOZK	900	
Paducah, Ky.	WKYB	570	N-M
	WPAD	1450	C
Painesville, Ohio	WPVL	1460	
Paintsville, Ky.	WSIP	1490	M
Palatka, Fla.	WWPF	1260	
	WSUZ	800	
Palestine, Tex.	KNET	1450	
Palm Bch., Fla.	WQXT	1340	A
Palm Sprgs., Calif.	KCMJ	1010	C
	KDES	920	

Location	C.L.	Kc.	N.A.
	KPAL	1450	
Palmdale, Calif.	KUTY	1470	
Palo Alto, Calif.	KIBE	1220	
Pampa, Tex.	KPDN	1340	M
	KHHH	1230	
Panama City, Fla.	WDLP	590	
	WPCF	1400	M
Panama City Beach, Fla.	WTHR	1480	
	WSCM	1290	
Paragould, Ark.	KDRS	1490	
Paris, Ill.	WPRS	1440	
Paris, Ky.	WKLX	1440	
Paris, Tenn.	WTPR	710	
Paris, Tex.	KPLT	1490	A
	KFTV	1250	
Parkersburg, W.Va.	WCEF	1050	
	WPAR	1450	C
	WCOM	1230	A
Park Falls, Wis.	WPFP	1450	
Parsons, Kans.	KLKC	1540	
Pasadena, Calif.	KALI	1430	
	KPPC	1240	
	KXLA	1110	
	KWKW	1300	
Pasadena, Tex.	KLVL	1480	
Pascagoula, Miss.	WPMP	1580	A
Pasco, Wash.	KORD	910	
	KPKW	1340	
Paso Robles, Calif.	KPRL	1230	M
Patchogue, L.I., N.Y.	WALK	1370	
	WPAC	1580	
Paterson, N.J.	WPAT	930	
Pauls Valley, Okla.	KVLH	1470	
Pawtucket, R.I.	WPAW	550	A
Payette, Idaho	KEOK	1450	
Peace River, Alta.	CKYL	630	
Pecos, Tex.	KIUN	1400	M
Peekskill, N.Y.	WLNA	1420	
Pekin, Ill.	WSIV	1140	
Pell City, Ala.	WFHK	1430	
Pembroke, Ont.	CHOV	1350	
Pendleton, Oreg.	KWRC	1240	A
	KUBE	1050	
	KUMA	1290	
Pensacola, Fla.	WBOP	980	
	WBSR	1450	C
	WNVY	1230	A
	WCOA	1370	N
	WPFA	790	
Penticton, B.C.	CKOK	800	
Peoria, Ill.	WEEK	1350	N
	WMBD	1470	C
	WIRL	1290	M
	WPEO	1020	
Perry, Fla.	WPRY	1400	
Perry, Ga.	WBBN	980	
Perryton, Tex.	KEYE	1400	M
Peru, Ind.	WARU	1600	
Petaluma, Calif.	KAFP	1490	
Peterborough, Ont.	CHEX	980	
Petersburg, Va.	WSSV	1240	M
Petoskey, Mich.	WMBN	1340	
Phenix City, Ala.	WPNX	1460	A
Philadelphia, Miss.	WHOC	1490	
Philadelphia, Pa.	WCAU	1210	C
	WDAS	1480	
	WFIL	560	A
	WHAT	1340	
	WIBG	990	
	WIP	610	M
	WJMJ	1540	
	WPEN	950	
	WRCV	1060	N
	WTEL	860	
Philipsburg, Pa.	WPHB	1260	
Phoenix, Ariz.	KIFN	860	
	KONI	1400	
	KHAT	1480	
	KHEP	1280	
	KOY	550	A
	KOOL	960	C
	KPHO	910	A
	KUEQ	740	
	KRIZ	1230	
	KTAR	620	N
Picayune, Miss.	WRJW	1320	
Piedmont, Ala.	WPID	1280	
Pierre, S.Dak.	KGFX	630	
Pikeville, Ky.	WLSI	900	
	WPKE	1240	M
Pine Bluff, Ark.	KCLA	1400	
	KOTN	1490	M
	KPBA	1590	
Pine City, Minn.	WCMP	1350	
Pineville, Ky.	WMLF	1230	
Pineville, W.Va.	WWYO	970	
Pipestone, Minn.	KLOH	1050	
Piqua, Ohio	WPTW	1570	
Pittsburg, Calif.	KKIS	990	
Pittsburg, Kans.	KOAM	860	N
	KSEK	1340	
Pittsburgh, Pa.	KDKA	1020	
	KQV	1410	C
	WCAE	1250	
	WEEP	1080	
	WAMP	1320	N
	WPIT	730	
	WWSW	970	
Pittsfield, Ill.	WBBA	1580	
Pittsfield, Mass.	WBEC	1420	A
	WBRK	1340	M
Pittston, Pa.	WPTS	1540	
Plainview, Tex.	KVOP	1400	M
Plant City, Fla.	WPLA	910	
Platteville, Wis.	WSWW	1590	
Plattsburg, N.Y.	WEAV	960	A

Location	C.L.	Kc.	N.A.
	WIRY	1340	M
Pleasanton, Tex.	KBOP	1380	
Pleasantville, N.J.	WOND	1400	
Plymouth, Mass.	WPLM	1390	
Plymouth, Wis.	WPLY	1420	
Pocahontas, Ark.	KPOC	1420	
Pocatello, Idaho	KSEI	930	N
	KWIK	1240	M
	KYTE	1290	
Pocomoke City, Md.	WDVM	540	
Pomona, Calif.	KWOW	1600	
Ponca City, Okla.	WBBZ	1230	M
Ponce, P.R.	WPRP	910	
	WEUC	1420	
	WPAB	550	
	WLEO	1170	
	WISO	1260	
Pontiac, Mich.	WPON	1460	
Poplar Bluff, Mo.	KWOC	930	
Portage, Wis.	WPDR	1350	
Portage la Prairie, Man.	CFRY	1570	
Port Alberni, B.C.	CJAV	1240	
Portales, N.Mex.	KENM	1450	
Port Angeles, Wash.	KONP	1450	
Port Arthur, Ont.	CFPA	1230	
Port Arthur, Tex.	KOLE	1340	
	KPAC	1250	M
Porterville, Calif.	KTIP	1450	A
Port Hope, Ont.	CHUC	1500	
Port Hueneme, Calif.	KACY	1520	
Port Huron, Mich.	WHLS	1450	
	WTTH	1380	A
Port Jervis, N.Y.	WDLC	1490	
Portland, Ind.	WPGW	1440	
Portland, Maine	WCSH	970	N
	WGAN	560	C
	WLOB	1310	
	WPOR	1490	A-M
Portland, Oreg.	KBPS	1450	
	KLIQ	1290	
	KEX	1190	
	KGW	620	A
	KOIN	970	C
	KPAM	1410	
	KPDQ	800	
	KPOJ	1330	M
	KWJJ	1080	
	KXL	750	
Portsmouth, N.H.	WHEB	750	
Portsmouth, Ohio	WPAY	1400	C
	WNXT	1260	A
Portsmouth, Va.	WLOW	1400	M
	WAVY	1350	N
Post, Tex.	KPOS	1370	
Poteau, Okla.	KLCO	1280	
Potsdam, N.Y.	WPDM	1470	
Pottstown, Pa.	WPAZ	1370	
Pottsville, Pa.	WPAM	1450	
	WPPA	1360	M
Poughkeepsie, N.Y.	WEOK	1390	
	WKIP	1450	A
Powell, Wyo.	KPOW	1260	M
Poynette, Wis.	WIBU	1240	
Prairie du Chien, Wis.	WPRE	980	
Pratt, Kans.	KWSK	1570	
Prescott, Ariz.	KYCA	1490	N
	KNOT	1450	
	KZOK	1340	
Presque Isle, Me.	WAGM	1450	
Preston, Idaho	KPST	1340	
Prestonsburg, Ky.	WPRT	960	
	WDOC	1310	
Price, Utah	KOAL	1230	M
Prichard, Ala.	WAIP	1270	
Prince Albert, Sask.	CKBI	900	
Prince George, B.C.	CKPG	550	
Prince Rupert, B.C.	CFPR	1240	
Princeton, Ind.	WRAY	1250	
Princeton, Ky.	WPKY	1580	
Princeton, W.Va.	WLOH	1490	A
Prineville, Oreg.	KRCO	690	
Prosser, Wash.	KARY	1310	
Providence, R.I.	WEAN	790	M
	WHIM	1110	
	WICE	1290	
	WJAR	920	N
	WPRO	630	C
	WRIB	1220	
Provo, Utah	KIXX	1400	A
	KEYY	1450	
	KOVO	960	M
Pryor, Okla.	KOLS	1570	
Pueblo, Colo.	KDZA	1230	
	KFEL	970	
	KGHF	1350	A-M
	KCSJ	590	
Pulaski, Tenn.	WKSR	1420	A
Pulaski, Va.	WPUV	1580	
Pullman, Wash.	KWSC	1250	
	KOFE	1150	
Punxsutawney, Pa.	WPME	1540	
Putnam, Conn.	WPCT	1350	
Puyallup, Wash.	KAYE	1450	
Quanah, Tex.	KOLJ	1150	
Quebec, Que.	CBV	980	
	CHRC	800	
	CJQC	1340	
	CKCV	1280	
Quesnel, B.C.	CKCQ	570	
Quincy, Fla.	WCNH	1230	M
Quincy, Ill.	WGEM	1440	A
	WTAD	930	C
Quincy, Mass.	WJDA	1300	
Quincy, Wash.	KPOR	1370	
Quitman, Ga.	WSFB	1490	
Racine, Wis.	WRAC	1460	

Location	C.L.	Kc.	N.A.
	WRJN	1400	A
Radcliff, Ky.	WSAC	1470	
Radford, Va.	WRAD	1460	
Raleigh, N.C.	WKIX	850	A
	WPTF	680	N
	WMSN	570	
	WRAL	1240	
Rapid City, S.Dak.	KOTA	1380	C
	KRSD	1340	
Raton, N.Mex.	KRTN	1490	A
Ravenswood, W.Va.	WMOV	1360	
Rawlins, Wyo.	KRAL	1240	M
Raymond, Wash.	KAPA	1340	
Raymondville, Tex.	KSOX	1240	
Rayville, La.	KCLP	990	
Reading, Pa.	WEEU	850	A
	WHUM	1240	C
	WRAW	1340	N
Redding, Calif.	KRDG	1230	M
	KPAP	1270	
	KSDA	1400	
	KVCV	600	C
	KVIP	540	
Red Bluff, Calif.	KBLF	1490	
Red Deer, Alta.	CKRD	850	
Redlands, Calif.	KCAL	1410	
Red Lion, Pa.	WGCB	1440	
Redmond, Oreg.	KPRB	1240	
Red Wing, Minn.	KCUE	1250	
Redwood Falls, Minn.	KLGR	1490	
Reedsburg, Wis.	WRDB	1400	
Regina, Sask.	CBK	540	
	CKCK	620	
	CKRM	980	
Reidsville, N.C.	WFRC	1600	A
	WREV	1220	
Remsen, N.Y.	WREM	1480	
Reno, Nev.	KOH	630	N
	KATO	1340	M
	KOLO	920	C
	KONE	1450	
	KDOT	1230	
Renton, Wash.	KQDE	910	
Rexburg, Idaho	KRXK	1230	
Rhinelander, Wis.	WOBT	1240	
Rice Lake, Wis.	WJMC	1240	
Richfield, Utah	KSVC	980	
Richland, Wash.	KALE	960	
Richland, Wis.	WRCO	1450	
Richlands, Va.	WRIC	540	
Richmond, Ind.	WKBV	1490	A
Richmond, Ky.	WEKY	1340	M
Richmond, Va.	WANT	990	
	WBBL	1480	
	WEZL	1590	
	WLEE	1480	N
	WLLY	1320	
	WMBG	1380	A
	WRNL	910	M
	WRVA	1140	C
	WXGI	950	
Richmond Hill, Ont.	CJRH	1300	
Richwood, W.Va.	WMNF	1280	
Ridgecrest, Calif.	KRCK	1360	
	KRKS	1240	
Rimouski, Que.	CJBR	900	
Rio Piedras, P.R.	WRIO	1320	
	WWWW	1520	
Ripley, Tenn.	WTRB	1570	
Ripon, Wis.	WCWC	1600	
Riverhead, N.Y.	WRIV	1390	
Riverside, Calif.	KPRO	1440	
	KACE	1570	
Riverton, Wyo.	KWRL	1450	M
Riviere du Loup, Que.	CJFP	1400	
Roanoke, Ala.	WELR	1360	
Roanoke, Va.	WDBJ	960	C
	WRIS	1410	M
	WHYE	910	
	WROV	1240	A
	WSLS	610	N
Roanoke Rapids, N.C.	WCBT	1230	M
Roaring Sprgs., Pa.	WKMC	1370	
Roberval, Que.	CHRL	910	
Robinson, Ill.	WTAY	1570	
Rochester, Minn.	KROC	1340	N
	KWEB	1270	
Rochester, N.H.	WWNH	930	
Rochester, N.Y.	WBBF	950	M
	WHAM	1180	N
	WHEC	1460	C
	WRVM	680	
	WSAY	1370	
	WVET	1280	A
Rockford, Ill.	WROK	1440	A
	WRRR	1330	
Rock Hill, S.C.	WRHI	1340	M
	WTYC	1150	
Rockingham, N.C.	WAYN	900	
Rock Island, Ill.	WHBF	1270	C
Rockland, Maine	WRKD	1450	A
Rock Springs, Wyo.	KVRS	1360	M
Rockville, Md.	WINX	1600	
Rockwood, Tenn.	WRKH	580	
Rocky Ford, Colo.	KAVI	1320	
Rocky Mount, N.C.	WCEC	810	
	WEED	1390	A
Rocky Mount, Va.	WYTI	1570	
Rogers, Ark.	KAMO	1390	
Rogers City, Mich.	WHAK	960	
Rogersville, Tenn.	WRGS	1370	
Rolla, Mo.	KTTR	1490	
Rome, Ga.	WLAQ	1410	A

Location	C.L.	Kc.	N.A.
	WRGA	1470	M
	WROM	710	
Rome, N.Y.	WKAL	1450	M
Ronceverte, W.Va.	WRON	1400	
Roseburg, Oreg.	KRNR	1490	C
	KRXL	1240	M
Rosenberg, Tex.	KFRD	980	
Roswell, N.Mex.	KSWS	1230	
	KGFL	1400	M
	KBIM	910	
Rouyn, Que.	CKRN	1400	
Roxboro, N.C.	WRXO	1430	
Royal Oak, Mich.	WEXL	1340	
Rumford, Me.	WRUM	790	
Rupert, Idaho	KAYT	970	
Rushton, La.	KRUS	1490	
Rusk, Texas	KTLU	1580	
Russell, Kans.	KRSL	990	
Russellville, Ala.	WWWR	920	
Russellville, Ark.	KXRJ	1490	
Russellville, Ky.	WRUS	610	
Rutland, Vt.	WHWB	1000	
	WSYB	1380	M
Sackville, N.B.	CBA	1070	
Sacramento, Calif.	KCRA	1320	N
	KFBK	1530	A
	KGMS	1380	M
	KROY	1240	C
	KXOA	1470	
Safford, Ariz.	KGLU	1480	M
Saginaw, Mich.	WKNX	1210	
	WSAM	1400	N
	WSGW	790	M
St. Albans, Vt.	WWSR	1420	
St. Albans, W.Va.	WKLC	1300	
Ste. Anne de la Pocatiere, Que.	CHGB	1350	
St. Augustine, Fla.	WFOY	1240	C
	WSTN	1420	
St. Boniface, Man.	CKSB	1050	
St. Catharine, Ont.	CKTB	610	
St. Charles, Mo.	KADY	1460	
St. Cloud, Minn.	KFAM	1450	N
	WJON	1240	
St. George, Utah	KDXU	1450	
St. Helen, Mich.	WCBQ	1590	
St. Jean, Que.	CHRS	1090	
St. Jerome, Que.	CKJL	900	
Saint John, N.B.	CFBC	930	
	CHSJ	1150	
St. John's, Nfld.	CBN	640	
	CJON	930	
	VOAR	1230	
	VOCM	590	
	VOWR	800	
St. Johnsbury, Vt.	WTWN	1340	
St. Joseph, Mich.	WSJM	1400	
St. Joseph, Mo.	KFEQ	680	
	KRES	1550	M
	KUSN	1270	
St. Joseph d'Alma, Que.	CFGT	1270	
St. Louis, Mo.	KATZ	1600	
	KFUO	850	
	KMOX	1120	C
	KSD	550	N
	KSTL	690	
	KWK	1380	
	KXOK	630	
	WEW	770	
	WIL	1430	A
St. Mary's, Pa.	WKBI	1400	
St. Paul, Minn.	KSTP	1500	N
	WISK	1590	M
St. Peter, Minn.	KRBI	1310	
St. Petersburg, Fla.	WPIN	680	
	WSUN	620	A
	WTSP	1380	M
St. Petersburg Beach, Fla.	WILZ	1590	
St. Thomas, Ont.	CHLO	680	
Ste. Genevieve, Mo.	KSGM	980	
Salamanca, N.Y.	WNYS	1590	
Salem, Ill.	WJBD	1350	
Salem, Ind.	WSLM	1220	
Salem, Mass.	WESX	1230	
Salem, Mo.	KSMO	1340	
Salem, Oreg.	KSLM	1390	M
	KBZY	1490	N
	KGAY	1430	
Salem, Va.	WBLU	1480	
Salida, Colo.	KVRH	1340	M
Salina, Kans.	KSAL	1150	M
Salinas, Calif.	KDON	1460	
	KSBW	1380	M
Saline, Mich.	WOIA	1290	
Salisbury, Md.	WBOC	960	
	WICO	1320	
	WJDY	1470	
Salisbury, N.C.	WSTP	1490	M
	WSAT	1280	A
Salt Lake City, Utah	KALL	910	M
	KDYL	1320	N
	KLUB	570	A
	KNAK	1280	
	KSL	1160	C
	KSOP	1370	
	KWHO	860	
	KWIC	1570	
San Angelo, Tex.	KTXL	1340	
	KGKL	960	A
	KPEP	1420	
	KWFR	1260	
San Antonio, Tex.	KCOR	1350	
	KENS	680	C
	KEXX	1250	
	KITE	930	
	KIWW	1540	
	KMAC	630	A
	KONO	860	
	KTSA	550	
	WOAI	1200	
San Bernardino, Calif.	KCKC	1350	
	KFXM	590	M
	KRNO	1240	
	KITO	1290	A
Sandersville, Ga.	WSNT	1490	
San Diego, Calif.	KCBQ	1170	
	KFMB	540	C
	KFSD	600	N
	KGB	1360	M
	KSON	1240	
	KSDO	1130	
Sandpoint, Idaho	KSPT	1400	
Sandusky, Ohio	WLEC	1450	M
San Fernando, Calif.	KGIL	1260	
Sanford, Fla.	WTRR	1400	
	WIOD	1360	
Sanford, Me.	WSME	1220	
Sanford, N.C.	WEYE	1290	
	WWGP	1050	
San Francisco, California	KFRC	610	M
	KCBS	740	C
	KJBS	1100	
	KNBC	680	N
	KOBY	1550	
	KSAY	1010	
	KSAN	1450	
	KSFO	560	
	KYA	1260	
San Jose, Calif.	KLOK	1170	
	KSJO	1590	
	KEEN	1370	
	KXRX	1500	
San Juan, P.R.	WAPA	680	M
	WHOA	1400	
	WIPR	940	
	WKAQ	580	C
	WKVM	1230	
	WITA	1140	
San Luis Obispo, Calif.	KATY	1340	
	KVEC	920	M
San Marcos, Tex.	KCNY	1470	
San Mateo, Calif.	KOFY	1050	
San Rafael, Calif.	KTIM	1510	
San Saba, Tex.	KBAL	1410	
Santa Ana, Calif.	KWIZ	1480	
Santa Barbara, Cal.	KDB	1490	
	KIST	1340	N
	KTMS	1250	A-M
Santa Cruz, Calif.	KSCO	1080	
Santa Fe, N.Mex.	KTRC	1400	A
	KVSF	1260	C
Santa Maria, Cal.	KCOY	1400	
	KSMA	1240	
Santa Monica, Cal.	KDAY	1580	
Santa Paula, Calif.	KSPA	1400	
Santa Rosa, Calif.	KSRO	1350	
Santurce, P.R.	WIAC	740	
	WKAQ	580	C
Saranac Lake, N.Y.	WNBZ	1240	A
Sarasota, Fla.	WKXY	930	
	WSPB	1450	C
Saratoga Springs, N.Y.	WSPN	900	
	WRSA	1280	
Sarnia, Ont.	CHOK	1070	
Saskatoon, Sask.	CFQC	600	
	CFNS	1170	
	CKOM	1420	
Saugerties, N.Y.	WSKN	920	
Sault Ste. Marie, Michigan	WSOO	1230	
Sault Ste. Marie, Ontario	CJIC	1050	
	CKCY	1400	
Savannah, Ga.	WCCP	1450	M
	WJIV	900	
	WSAV	630	N
	WSGA	1400	
	WTOC	1290	C
	WFRP	1230	A
Savannah, Tenn.	WORM	1010	
Sayre, Pa.	WATS	960	
Schefferville, Que.	CFKL	1230	
Schenectady, N.Y.	WGY	810	N
	WSNY	1240	
Scottsbluff, Nebr.	KNEB	960	M
	KOLT	1320	C
Scottsboro, Ala.	WCRI	1050	
	WROS	1330	
Scottsdale, Ariz.	KPOK	1440	
Scottsville, Ky.	WLCK	1250	
Scranton, Pa.	WARM	590	A
	WEJL	630	
	WGBI	910	C
	WICK	1400	
	WSCR	1320	N
Seaford, Del.	WSUX	1280	
Seattle, Wash.	KAYO	1150	
	KING	1090	A
	KIRO	710	C
	KJR	950	
	KOL	1300	
	KOMO	1000	N
	KTIX	1590	
	KTW	1250	
	KXA	770	
Searcy, Ark.	KWCB	1300	
Sebring, Fla.	WJCM	960	
Sedalia, Mo.	KDRO	1490	
	KSIS	1050	
Seguin, Tex.	KWED	1580	
Selma, Ala.	WGWC	1340	C
	WHBB	1490	
	WRWJ	1570	
Seminole, Tex.	KSML	1250	
Seneca Township, S.C.	WSNW	1150	
Sevierville, Tenn.	WSEV	930	
Seward, Alaska	KIBH	1340	C-A
Seymour, Ind.	WJCD	1390	
Seymour, Tex.	KSEY	1230	
Shamokin, Pa.	WISL	1480	
Shamrock, Tex.	KEVA	1580	
Sharon, Pa.	WPIC	790	
Shawano, Wis.	WTCH	960	
Shawinigan Falls, Que.	CKSM	1220	
Shawnee, Okla.	KGFF	1450	M
Sheboygan, Wis.	WHBL	1330	A
	WKTL	950	
Shelby, Mont.	KIYI	1150	M
Shelby, N.C.	WOHS	730	M
	WAOA	1390	
Shelbyville, Tenn.	WHAL	1400	
Shenandoah, Iowa	KFNF	920	
	KMA	960	A
Sherbrooke, Que.	CHLT	630	
	CKTS	900	
Sheridan, Wyo.	KWYO	1410	M
Sherman, Tex.	KRRV	910	M
	KTXO	1500	
Show Low, Ariz.	KVWM	1050	
Shreveport, La.	KANB	1300	
	KCIJ	1050	
	KEEL	710	
	KENT	1550	M
	KJOE	1480	
	KOKA	980	
	KRMD	1340	A
	KWKH	1130	C
Sidney, Mont.	KGCX	1480	M
Sidney, Nebr.	KSID	1340	A
Sierra Vista, Ariz.	KHFH	1420	
Sikeston, Mo.	KSIM	1400	
Siler City, N.C.	WNCA	1570	
Siloam Sprgs., Ark.	KUOA	1290	M
Silver City, N.Mex.	KSIL	1340	C
Silver Sprgs., Md.	WGAY	1050	
Simcoe, Ont.	CFRS	1560	
Sinton, Tex.	KANN	1590	
Sioux City, Iowa	KSCJ	1360	A
	KMNS	620	
	KTRI	1470	
Sioux Falls, S.Dak.	KISD	1230	
	KELO	1320	
	KIHO	1270	
	KSOO	1140	A
Sitka, Alaska	KIFW	1230	C-A
	KSEW	1400	
Skowhegan, Maine	WGHM	1150	
Smithfield, N.C.	WMPM	1270	
Smiths Falls, Ont.	CJET	630	
Snyder, Tex.	KSNY	1450	M
Socorro, N.Mex.	KSRC	1290	
Soda Sprgs., Idaho	KBRV	540	
Somerset, Ky.	WSFC	1240	M
Somerset, Pa.	WVSC	990	
Sonora, Calif.	KROG	1450	
Sorel, P.Q.	CJSO	1320	
So. Bend, Ind.	WNDU	1490	A
	WJVA	1580	M
	WSBT	960	C
Southbridge, Mass.	WESO	970	
So. Boston, Va.	WHLF	1400	A
South Daytona Beach, Florida	WDAT	1590	
So. Paris, Me.	WKTQ	1450	
So. Pittsburg, Tenn.	WEPG	910	
So. St. Paul, Minn.	WISK	1590	M
So. Williamsport, Pa.	WMPT	1450	
Sparta, Ill.	WHCO	1230	
Sparta, Tenn.	WSMT	1050	
Sparta, Wis.	WCOW	1290	
Spartanburg, S.C.	WTHE	1400	M
	WORD	910	N
	WSPA	950	C
Spencer, Iowa	KICD	1240	
Spokane, Wash.	KGA	1510	A
	KLYK	1230	
	KPEG	1380	
	KHQ	590	N
	KNEW	790	M
	KREM	970	
	KXLY	920	C
Springdale, Ark.	KBRS	1340	A
Springfield, Ill.	WCVS	1450	A-M
	WMAY	970	N
	WTAX	1240	C
Springfield, Mass.	WBZA	1030	
	WHYN	560	C
	WMAS	1450	M
	WSPR	1270	
Springfield, Mo.	KGBX	1260	N
	KICK	1340	
	KTTS	1400	C
	KWTO	560	A
Springfield, Ohio	WIZE	1340	A
	WBLY	1600	
Springfield, Oreg.	KEED	1050	
Springfield, Tenn.	WDBL	1590	
Springfield, Vt.	WCFR	1480	
Springhill, La.	KBSF	1460	
Spruce Pine, N.C.	WTOE	1470	
Stamford, Conn.	WSTC	1400	A
Stamford, Tex.	KDWT	1400	
Starke, Fla.	WRGR	1490	
Starkville, Miss.	WSSO	1230	
State College, Pa.	WMAJ	1450	M
Statesboro, Ga.	WWNS	1240	
Statesville, N.C.	WSIC	1400	
	WDBM	550	
Staunton, Va.	WTON	1240	A
	WAFC	900	
Stephenville, Tex.	KSTV	1510	
Sterling, Colo.	KGEK	1230	
	KOLR	1490	
Sterling, Ill.	WSDR	1240	
Steubenville, Ohio	WSTV	1340	M
Stevens Point, Wis.	WSPT	1010	
	WLBL	930	
Stillwater, Minn.	WAVN	1220	
Stillwater, Okla.	KSPI	780	
Stockton, Calif.	KJOY	1280	
	KRAK	1140	
	KSTN	1420	
	KWG	1230	A-M
Storm Lake, Iowa	KAYL	990	
Stratford, Ont.	CJCS	1240	
Streator, Ill.	WIZZ	1250	
Stroudsburg, Pa.	WVPO	840	
Stuart, Fla.	WSTU	1450	M
Sturgeon Bay, Wis.	WDOR	910	
Sturgis, Mich.	WSTR	1230	
Stuttgart, Ark.	KWAK	1240	M
Sudbury, Ont.	CKSO	790	
	CFBR	550	
	CHNO	900	
Suffolk, Va.	WLPM	1450	A
Sulphur, La.	KIKS	1310	
Sulphur Sprgs., Tex.	KSST	1230	
Summerside, P.E.I.	CJRW	1240	
Summerville, Ga.	WGTA	950	
Sumter, S.C.	WFIG	1290	M
	WSSC	1340	A
Sunbury, Pa.	WKOK	1240	C
Sunnyside, Wash.	KREW	1230	
Superior, Wis.	WDSM	710	M
Susanville, Calif.	KSUE	1240	
Swainsboro, Ga.	WJAT	800	
Sweetwater, Tenn.	WDEH	800	
Sweetwater, Tex.	KXOX	1240	
Swift Current, Sask.	CKSW	1400	
Sydney, N.S.	CBI	1570	
	CJCB	1270	
Sylacauga, Ala.	WFEB	1340	M
	WMLS	1290	
Sylva, N.C.	WMSJ	1480	
Sylvania, Ga.	WSYL	1490	
Syracuse, N.Y.	WHEN	620	C
	WFBL	1390	A
	WNDR	1260	M
	WOLF	1490	
	WSYR	570	N
Tabor City, N.C.	WTAB	1370	
Tacoma, Wash.	KMO	1360	
	KTAC	850	
	KTNT	1400	
	KVI	570	M
Taft, Calif.	KTKR	1310	
Tahlequah, Okla.	KTLQ	1350	
Talladega, Ala.	WJHB	1580	
	WHTB	1230	M
Tallahassee, Fla.	WMEN	1330	
Tallassee, Ala.	WTLS	1300	
	WTAL	1270	
	WTNT	1450	A-M-C
Tallulah, La.	KTLD	1360	
Tampa, Fla.	WALT	1110	
	WDAE	1250	C
	WFLA	970	N
	WHBO	1050	
	WTMP	1150	
	WWTB	1300	
Tarboro, N.C.	WCPS	760	
Tarpon Sprgs., Fla.	WDCL	1470	
Tasley, Va.	WESR	1330	
Taunton, Mass.	WPEP	1570	
Taylor, Tex.	KTAE	1260	
Taylorville, Ill.	WTIM	1410	
Tell City, Ind.	WTCJ	1230	
Temple, Tex.	KTEM	1400	
Terre Haute, Ind.	WBOW	1230	N
	WMFT	1300	
	WTHI	1480	C
Terrell, Tex.	KTER	1570	
Texarkana, Ark.	KOSY	790	M
Texarkana, Tex.	KCMC	1230	A
	KTFS	1400	
Texas City, Tex.	KTLW	920	
Thayer, Mo.	KALM	1290	
The Dalles, Oreg.	KODL	1440	
	KRMW	1300	
Thermopolis, Wyo.	KRTR	1490	M
	KTHE	1240	
Thief River Falls, Minn.	KTRF	1230	
Thetford Mines, Que.	CKLD	1230	
Thibodaux, La.	KTIB	630	
Thomaston, Ga.	WSFT	1220	
Thomasville, Ala.	WJDB	630	
Thomasville, Ga.	WPAX	1240	
	WKTG	730	
Thomasville, N.C.	WTNC	790	
Thomson, Ga.	WTWA	1240	M
Three Rivers, Que.	CHLN	550	
	CKTR	1150	
Ticonderoga, N.Y.	WIPS	1250	
Tifton, Ga.	WTIF	1340	
	WWGS	1430	

Location	C.L.	Kc.	N.A.
Tillamook, Oreg.	KTIL	1590	
Tillsonburg, Ont.	CKOT	1510	
Timmins, Ont.	CFCL	580	
	CKGB	680	
Titusville, Fla.	WRMF	1050	
Toccoa, Ga.	WLET	1420	M
	WNEG	1320	
Toledo, Ohio	WOHO	1470	
	WSPD	1370	N
	WTOD	1560	M
	WTOL	1230	A
Tooele, Utah	KTUT	990	
Topeka, Kans.	WIBW	580	C
	KJAY	1440	
	WREN	1250	A
	KTOP	1490	M
Toppenish, Wash.	KENE	1490	
Toronto, Ont.	CBL	740	N
	CFRB	1010	C
	CHUM	1050	
	CJBC	860	
	CKEY	580	M
	CKFH	1400	
Torrington, Conn.	WBZY	990	
	WTOR	1490	M
Torrington, Wyo.	KGOS	1490	
Towson, Md.	WAQE	1570	
Trail, B.C.	CJAT	610	
Traverse City, Mich.	WTCM	1400	
Trenton, Mo.	KTTN	1600	
Trenton, N.J.	WTNJ	1300	
	WBUD	1260	
	WTTM	920	N
Trinidad, Colo.	KCRT	1240	M
Troy, Ala.	WTBF	970	M
Troy, N.Y.	WHAZ	1330	
	WTRY	980	
Truro, N.S.	CKCL	600	
Truth or Consequences, New Mexico	KCHS	1400	
Tryon, N.C.	WTYN	1580	
Tucson, Ariz.	KTUC	1400	M
	KAIR	1490	
	KCEE	790	
	KCNA	580	A
	KCUB	1290	N
	KEVT	690	
	KMOP	1330	
	KTKT	990	
	KOLD	1450	C
Tucumcari, N.Mex.	KTNM	1400	M
Tulare, Calif.	KCOK	1270	M
	KGEN	1370	
Tularosa, N.M.	KMAM	1590	
Tulia, Tex.	KTUE	1260	
Tullahoma, Tenn.	WJIG	740	
Tulsa, Okla.	KAKC	970	
	KOME	1300	
	KRMG	740	
	KTUL	1430	C
	KVOO	1170	N
	KFMJ	1050	
Tupelo, Miss.	WELO	1490	M
	WTUP	1380	
Turlock, Calif.	KTUR	1390	
Tuscaloosa, Ala.	WJRD	1150	
	WACT	1420	
	WNPT	1280	A
	WTUG	790	
	WTBC	1230	M
Tuscumbia, Ala.	WVNA	1590	
Tuskegee, Ala.	WTUS	580	
Twin Falls, Idaho	KTFI	1270	N
	KLIX	1310	M
	KEEP	1450	
Two Rivers, Wis.	WTRW	1590	
Tyler, Tex.	KDOK	1330	
	KGJB	1490	M
	KTBB	600	A
	KZEY	690	
Tyrone, Pa.	WTRN	1290	
Ukiah, Calif.	KUKI	1400	
Union, Mo.	KLPW	1220	
Union, S.C.	WBCU	1460	
Union City, Tenn.	WENK	1240	
	WTUC	1580	
Uniontown, Pa.	WMBS	590	C
Urbana, Ill.	WILL	580	
	WKID	1580	
Utica, N.Y.	WIBX	950	C
	WRUN	1150	

Location	C.L.	Kc.	N.A.
	WTLB	1310	A
Uvalde, Tex.	KVOU	1400	
Val D'Or, Que.	CKVD	1230	
Valdosta, Ga.	WGOV	950	M
	WGAF	910	A
	WJEM	1150	
Vallejo, Calif.	KNBA	1190	
Valley City, N.Dak.	KOVC	1490	M
Vanceburg, Ky.	WKKS	1570	
Vancleve, Ky.	WMTC	730	
Vancouver, B.C.	CBU	690	
	CFUN	1410	
	CJOR	600	
	CKWX	1130	M
Vancouver, Wash.	KKEY	1150	
	KVAN	910	
Ventura, Calif.	KVEN	1450	M
	KUDU	1590	
Verdun, Que.	CKVL	850	
Vermillion, S.Dak.	KUSD	690	
Vernal, Utah	KVEL	1250	
Vernon, B.C.	CJIB	940	
Vernon, Tex.	KVWC	1490	
Vero Beach, Fla.	WAXE	1370	
	WTTB	1490	A
Vicksburg, Miss.	WQBC	1420	M
	WVIM	1490	
Victoria, B.C.	CJVI	900	
	CKDA	1220	
Victoria, Tex.	KNAL	1410	
	KVIC	1340	M
Victoriaville, Que.	CFDA	1380	
Vidalia, Ga.	WVOP	970	
Vieques, P.R.	WIVV	1370	
Ville Marie, Que.	CKVM	710	
Ville Platte, La.	KVPI	1050	
Ville St. Georges, Que.	CKRB	1250	
Vincennes, Ind.	WAOV	1450	M
Vineland, N.J.	WWBZ	1360	
Vinita, Okla.	KVIN	1470	
Virginia, Minn.	WHLB	1400	N
Virginia Bch., Va.	WBOF	1600	
Viroqua, Wis.	WISV	1360	
Visalia, Calif.	KONG	1400	
Vivian, La.	KLVI	1600	
Waco, Tex.	WACO	1460	A
	KWTX	1230	M
Wadena, Minn.	KWAD	920	M
Wadesboro, N.C.	WADE	1210	
Wailuku, T.H.	KMVI	550	N
Waipahu Oahu, Hawaii	KAHU	920	
Wallace, Idaho	KWAL	620	M
Wallace, N.C.	WLSE	1400	
Walla Walla, Wash.	KHIT	1320	
	KUJ	1420	M
	KTEL	1490	A
Walnut Ridge, Ark.	KRLW	1320	
Walsenburg, Colo.	KFLJ	1380	
Walterboro, S.C.	WALD	1220	M
Waltham, Mass.	WCRB	1330	
Walton, N.Y.	WDLA	1270	
Ward Ridge, Fla.	WJOE	1570	
Ware, Mass.	WARE	1250	M
Warner Robbins, Ga.	WRPB	1350	
Warren, Ark.	KWRF	860	
Warren, Ohio	WHHH	1440	
Warren, Pa.	WNAE	1310	
Warrensburg, Mo.	KOKO	1450	
Warrenton, Mo.	KWRE	730	
Warrenton, Va.	WEER	1570	
	WKTF	1420	
Warsaw, Ind.	WRSW	1480	
Warsaw, Va.	WNNT	690	
Wasco, Calif.	KWSO	1050	
Washington, D.C.	WGMS	570	
	WMAL	630	A
	WOL	1450	M
	WOOK	1340	
	WWDC	1260	
	WRC	980	N
	WTOP	1500	C
Washington, Ga.	WKLE	1370	
Washington, Ind.	WAMW	1580	
Washington, N.J.	WCRV	1580	
Washington, N.C.	WOOW	1340	
	WRRF	930	A
Washington, Pa.	WJPA	1450	M

Location	C.L.	Kc.	N.A.
Washington Court House, Ohio	WCHO	1250	
Waterbury, Conn.	WATR	1320	A
	WBRY	1590	C
	WWCO	1240	M
Waterbury, Vt.	WDEV	550	M
Waterloo, Iowa	KXEL	1540	A
	KNWS	1090	
	KWWL	1330	M
Watertown, N.Y.	WATN	1240	
	WWNY	790	C
Watertown, S.Dak.	KWAT	950	M
Watertown, Wis.	WTTN	1580	
Waterville, Me.	WTVL	1490	A
Watsonville, Calif.	KOMY	1340	
Wauchula, Fla.	WAUC	1310	
Waukegan, Ill.	WKRS	1220	
Waukesha, Wis.	WAUX	1510	
Waupaca, Wis.	WDUX	800	
Wausau, Wis.	WRIG	1400	N
	WSAU	550	A
	WHVF	1230	
Waverly, Iowa	KWVY	1470	
Waverly, Ohio	WPKO	1380	
Waxahachie, Tex.	KBEC	1390	
Waycross, Ga.	WACL	570	
	WAYX	1230	M
Waynesboro, Ga.	WBRO	1310	
Waynesboro, Miss.	WABO	990	
Waynesboro, Pa.	WAYZ	1380	
Waynesboro, Va.	WAYB	1490	M
Waynesburg, Pa.	WANB	1580	
Waynesville, N.C.	WHCC	1400	
Weatherford, Tex.	KZEE	1220	
Webster City, Iowa	KJFJ	1570	
Weirton, W.Va.	WEIR	1430	
Weiser, Idaho	KWEI	1220	
Welch, W.Va.	WELC	1150	
	WOVE	1340	M
Welland, Ontario	CHOW	1470	
Wellsboro, Pa.	WNBT	1490	M
Wellston, Ohio	WKOV	1330	
Wellsville, N.Y.	WLSV	790	
Wenatchee, Wash.	KPQ	560	A
	KUEN	900	
	KMEL	1340	M
Weslaco, Tex.	KRGV	1290	N
W. Bend, Wis.	WBKV	1470	
W. Frankfort, Ill.	WFRX	1300	
W. Monroe, La.	KUZN	1310	
W. Palm Beach, Fla.	WEAT	850	N
	WJNO	1230	C
	WIRK	1290	M
West Plains, Mo.	KWPM	1450	
West Point, Ga.	WBMK	1310	
West Point, Miss.	WROB	1450	M
W. Springfield, Mass.	WTXL	1490	A
W. Yarmouth, Mass.	WOCB	1240	M
Westerly, R.I.	WERI	1230	M
Westfield, Mass.	WDEW	1570	
Westminster, Md.	WTTR	1470	
Weston, W.Va.	WHAW	1450	M
W. Warwick, R.I.	WWRI	1450	
Wetumpka, Ala.	WETU	1250	
Wewoka-Seminole, Okla.	KWSH	1260	A
Weyburn, Sask.	CFSL	1340	
Wheaton, Md.	WDON	1540	
Wheeling, W.Va.	WHLL	1600	
	WKWK	1400	A
	WWVA	1170	C
White Castle, La.	KEVL	1590	
White Plains, N.Y.	WFAS	1230	
Whitesburg, Ky.	WTCW	920	
Whiteville, N.C.	WENC	1220	
Wichita, Kans.	KAKE	1240	M
	KLEO	1480	N
	KFBI	1070	
	KFH	1330	C
	KSIR	900	
	KWBB	1410	
Wichita Falls, Tex.	KSYD	990	M
	KTRN	1290	
	KWFT	620	C
Wildwood, N.J.	WCMC	1230	
Wilkes-Barre, Pa.	WBAX	1240	M
	WBRE	1340	N
	WILK	980	A
Williamson, W.Va.	WBTH	1400	M

Location	C.L.	Kc.	N.A.
Williamsport, Pa.	WLYC	1050	
	WRAK	1400	N
	WWPA	1340	C
Williamston, N.C.	WIAM	900	
Willimantic, Conn.	WILI	1400	
Williston, N.D.	KEYZ	1360	
Willmar, Minn.	KWLM	1340	A
Willow Springs, Mo.	KUKU	1330	
Wilmington, Del.	WAMS	1380	M
	WDEL	1150	N
	WILM	1450	A
	WTUX	1290	
Wilmington, N.C.	WMFD	630	A
	WKLM	980	
	WGNI	1340	M
Wilson, N.C.	WGTM	590	C
	WVOT	1420	M
Winchester, Ky.	WWKY	1380	
Winchester, Tenn.	WCDT	1340	
Winchester, Va.	WINC	1400	A
Winder, Ga.	WIMO	1300	
Windsor, N.S.	CFAB	1450	
Windsor, Ont.	CBE	1550	
	CKLW	800	M
Wingham, Ont.	CKNX	920	
Winnemucca, Nev.	KWNA	1400	
Winnfield, La.	KVCL	1270	
Winner, S.Dak.	KWYR	1260	
Winnipeg, Man.	CBW	990	
	CKRC	630	
	CKY	580	
	CJOB	680	
Winnsboro, La.	KMAR	1570	
Winona, Minn.	KWNO	1230	A
	KAGE	1380	
Winslow, Ariz.	KVNC	1010	M
Winston-Salem, N.C.	WAAA	980	
	WAIR	1340	
	WSJS	600	N
	WTOB	1380	M-C
Winter Garden, Fla.	WGOA	1600	
Winter Haven, Fla.	WSIR	1490	M
	WINT	1360	
Winter Park, Fla.	WABR	1440	
Wisconsin Rapids, Wis.	WFHR	1340	M
Wolf Pt., Mont.	KVCK	1450	M
Woodside, N.Y.	WWRL	1600	
Woodstock, Ont.	CKOX	1340	
Woodward, Okla.	KSIW	1450	
Woonsocket, R.I.	WNRI	1380	
	WWON	1240	
Wooster, Ohio	WWST	960	
Worcester, Mass.	WAAB	1440	M-N-A
	WNEB	1230	
	WORC	1310	
	WTAG	580	C
Worland, Wyo.	KWOR	1340	M
Worthington, Minn.	KWOA	730	
Worthington, Ohio	WRFD	880	
Wynne, Ark.	KWYN	1400	
Wytheville, Va.	WYVE	1280	
Yakima, Wash.	KIT	1280	
	KIMA	1460	C
	KUTI	980	
	KYAK	1390	M
Yankton, S.D.	KYNT	1450	
	WNAX	570	C
Yarmouth, N.S.	CJLS	1340	
Yazoo City, Miss.	WAZF	1230	
York, Nebr.	KAWL	1370	
York, Pa.	WNOW	1250	
	WORK	1350	N
	WSBA	910	A-M
York, S.C.	WYCL	1580	
Yorkton, Sask.	CJGX	940	
Youngstown, Ohio	WBBW	1240	A
	WFMJ	1390	N
	WKBN	570	C
Yreka, Calif.	KSYC	1490	
Yuba City, Calif.	KUBA	1600	
	KAGR	1450	
Yuma, Ariz.	KOFA	1240	
	KVOY	1400	M
	KYUM	560	N
Zanesville, Ohio	WHIZ	1240	N
Zarephath, N.J.	WAWZ	1380	

U. S. and Canadian AM Stations by Call Letters

Canadian stations follow U.S. list, on p. 185

C.L., call letters; Kc., frequency in kilocycles

U. S.

C.L.	Location	Kc.
KAAA	Kingman, Ariz.	1230
KABC	Los Angeles, Calif.	790
KABR	Aberdeen, S. Dak.	1220
KACE	Riverside, Calif.	1570
KACT	Andrews, Tex.	1360
KACY	Port Hueneme, Calif.	1520
KADA	Ada, Okla.	1230
KADO	Marshall, Tex.	1410
KADY	St. Charles, Mo.	1460
KAFP	Petaluma, Calif.	1490
KAFY	Bakersfield, Calif.	550
KAGE	Winona, Minn.	1380
KAGH	Crossett, Ark.	800
KAGI	Grants Pass, Oreg.	1340
KAGT	Anacortes, Wash.	1340
KAGR	Yuba City, Calif.	1450
KAHI	Auburn, Calif.	950
KAHU	Waipahu, Hawaii	920
KAIM	Kaimuki, Hawaii	870
KAIR	Tucson, Ariz.	1490
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	Pasadena, Calif.	1430
KALL	Salt Lake City, Utah	910
KALM	Thayer, Mo.	1290
KALT	Atlanta, Tex.	900
KALV	Alva, Okla.	1430
KAMD	Camden, Ark.	910
KAML	Kenedy, Tex.	990
KAMO	Rogers, Ark.	1390
KAMP	El Centro, Calif.	1430
KAMQ	Amarillo, Tex.	1010
KANA	Anaconda, Mont.	1230
KANB	Shreveport, La.	1300
KAND	Corsicana, Tex.	1340
KANE	New Iberia, La.	1240
KANI	Kailua, Oahu, T.H.	1240
KANN	Sinton, Tex.	1590
KANO	Anoka, Minn.	1470
KANV	Jonesville, La.	1480
KAOK	Lake Charles, La.	1400
KAPA	Raymond, Wash.	1340
KAPB	Marksville, La.	1370
KAPR	Douglas, Ariz.	930
KARE	Atchison, Kan.	1470
KARK	Little Rock, Ark.	920
KARM	Fresno, Calif.	1430
KART	Jerome, Idaho	1400
KARY	Prosser, Wash.	1310
KASA	Elk City, Okla.	1240
KASH	Eugene, Ore.	1600
KASI	Ames, Iowa	1430
KASK	Ontario, Calif.	1510
KASL	Newcastle, Wyo.	1240
KASM	Albany, Minn.	1150
KASO	Minden, La.	1240
KAST	Astoria, Ore.	1370
KATE	Albert Lea, Minn.	1450
KATI	Casper, Wyo.	1400
KATL	Miles City, Mont.	1340
KATO	Reno, Nev.	1340
KATR	Corpus Christi, Tex.	1030
KATY	San Luis Obispo, Cal.	1340
KATZ	St. Louis, Mo.	1600
KAUS	Austin, Minn.	1480
KAVE	Carlsbad, N.Mex.	1240
KAVI	Rocky Ford, Colo.	1320
KAVL	Lancaster, Calif.	610
KAVR	Apple Valley, Calif.	960
KAWL	York, Neb.	1370
KAWT	Douglas, Ariz.	1450
KAYE	Puyallup, Wash.	1450
KAYL	Storm Lake, Iowa	990
KAYO	Seattle, Wash.	1150
KAYS	Hays, Kans.	1400
KAYT	Rupert, Idaho	970
KBAL	San Saba, Tex.	1410
KBAM	Longview, Wash.	1270
KBAR	Burley, Idaho	1230
KBBA	Benton, Ark.	690
KBBB	Borger, Tex.	1600
KBBC	Centerville, Utah	1600
KBBS	Buffalo, Wyo.	1450
KBCH	Oceanlake, Oreg.	1400
KBCL	Bossier City, La.	1220
KBCS	Grand Prairie, Tex.	730
KBEC	Waxahachie, Tex.	1390
KBEE	Modesto, Calif.	970
KBEL	Idabel, Okla.	1240
KBEN	Carrizo Sprgs., Tex.	1450
KBHM	Branson, Mo.	1220
KBHS	Hot Springs, Ark.	590
KBIA	Columbia, Mo.	1580
KBIF	Fresno, Calif.	900
KBIG	Avalon, Calif.	740
KBIM	Roswell, N.Mex.	910
KBIS	Bakersfield, Calif.	970
KBIX	Muskogee, Okla.	1490
KBIZ	Ottumwa, Iowa	1240
KBKC	Mission, Kans.	1480
KBKR	Baker, Oreg.	1490
KBKW	Aberdeen, Wash.	1450
KBLA	Burbank, Calif.	1490
KBLF	Red Bluff, Calif.	1490
KBLI	Blackfoot, Idaho	690
KBLO	Hot Springs, Ark.	1470
KBLR	Goodland, Kans.	730
KBLT	Big Lake, Tex.	1290
KBMI	Henderson, Nev.	1400
KBMN	Bozeman, Mont.	1230
KBMO	Benson, Minn.	1290
KBMW	Breckinrdg., Minn.	1450
KBMX	Coalinga, Calif.	1470
KBMY	Billings, Mont.	1240
KBND	Bend, Oreg.	1110
KBNZ	LaJunta, Colo.	1400
KBOA	Kennett, Mo.	830
KBOE	Oskaloosa, Iowa	740
KBOI	Boise, Idaho	950
KBOK	Malvern, Ark.	1310
KBOL	Boulder, Colo.	1490
KBOM	Mandan, N.Dak.	1270
KBON	Omaha, Nebr.	1490
KBOP	Pleasanton, Tex.	1380
KBOR	Brownsville, Tex.	1600
KBOW	Butte, Mont.	1490
KBOY	Medford, Oreg.	730
KBOX	Dallas, Tex.	1480
KBPS	Portland, Oreg.	1450
KBRC	Mt. Vernon, Wash.	1430
KBRK	Brookings, S.Dak.	1430
KBRL	McCook, Nebr.	1300
KBRO	Bremerton, Wash.	1490
KBRS	Springdale, Ark.	1340
KBRV	Soda Sprgs., Ida.	540
KBRX	O'Neill, Nebr.	1400
KBRZ	Freeport, Texas	1460
KBSF	Springhill, La.	1460
KBST	Big Spring, Tex.	1490
KBTA	Batesville, Ark.	1340
KBTK	Missoula, Mont.	1340
KBTM	Jonesboro, Ark.	1230
KBTN	Neosho, Mo.	1420
KBTO	El Dorado, Kans.	1360
KBUC	Corona, Calif.	1370
KBUD	Athens, Tex.	1410
KBUH	Brigham City, Utah	800
KBUN	Bemidji, Minn.	1450
KBUR	Burlington, Iowa	1490
KBUS	Mexia, Tex.	1590
KBUZ	Mesa, Ariz.	1310
KBVM	Lancaster, Calif.	1380
KBWD	Brownwood, Tex.	1380
KBYE	Okla. City, Okla.	890
KBYG	Big Spring, Tex.	1400
KBYR	Anchorage, Alaska	1270
KBZY	Salem, Oreg.	1490
KCAL	Redlands, Calif.	1410
KCAP	Helena, Mont.	1340
KCAR	Clarksville, Tex.	1350
KCBC	Des Moines, Iowa	1390
KCBD	Lubbock, Tex.	1590
KCBQ	San Diego, Calif.	1170
KCBS	San Fran., Calif.	740
KCCO	Lawton, Okla.	1050
KCCT	Corpus Christi, Tex.	1150
KCEE	Tucson, Ariz.	790
KCFH	Cuero, Tex.	1600
KCHA	Charles City, Iowa	1580
KCHE	Cherokee, Iowa	1440
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
KCIJ	Shreveport, La.	1050
KCIL	Houma, La.	1490
KCIM	Carroll, Iowa	1380
KCJB	Minot, N.Dak.	910
KCKC	San Bernardino, Cal.	1350
KCKN	Kansas City, Kans.	1340
KCKY	Coolidge, Ariz.	1150
KCLA	Pine Bluff, Ark.	1400
KCLE	Cleburne, Tex.	1120
KCLF	Clifton, Ariz.	1400
KCLN	Clinton, Iowa	1390
KCLO	Leavenworth, Kans.	1410
KCLP	Rayville, La.	990
KCLS	Flagstaff, Ariz.	600
KCLV	Clovis, N.Mex.	1240
KCLW	Hamilton, Tex.	900
KVLX	Colfax, Wash.	1450
KCMC	Texarkana, Tex.	1230
KCMJ	Palm Sprgs., Calif.	1010
KCMD	Kansas City, Mo.	810
KCMR	McCamey, Tex.	1450
KCMS	Manitou Sprgs., Colo.	1490
KCNA	Tucson, Ariz.	580
KCNI	Broken Bow, Nebr.	1280
KCNO	Alturas, Calif.	570
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
KCON	Conway, Ark.	1230
KCOR	San Antonio, Tex.	1350
KCOW	Alliance, Nebr.	1400
KCOY	Santa Maria, Calif.	1400
KCRA	Sacramento, Calif.	1320
KCRB	Chanute, Kans.	1460
KCRC	Enid, Okla.	1390
KCRE	Crescent City, Calif.	1240
KCRG	Cedar Rapids, Iowa	1600
KCRS	Midland, Tex.	550
KCRT	Trinidad, Colo.	1240
KCRV	Caruthersville, Mo.	1370
KCSJ	Pueblo, Colo.	590
KCSR	Chadron, Nebr.	1450
KCTI	Gonzales, Tex.	1450
KCTX	Childress, Tex.	1510
KCUB	Tucson, Ariz.	1290
KCUE	Red Wing, Minn.	1250
KCUL	Fort Worth, Tex.	1540
KCVL	Colville, Wash.	1270
KCVR	Lodi, Calif.	1570
KCYL	Lampasas, Tex.	1450
KDAC	Ft. Bragg, Calif.	1230
KDAL	Duluth, Minn.	610
KDAN	Eureka, Calif.	790
KDAV	Lubbock, Tex.	580
KDAY	Santa Monica, Calif.	1580
KDB	Santa Barbara, Calif.	1490
KDBC	Mansfield, La.	1360
KDBM	Dillon, Mont.	800
KDBS	Alexandria, La.	1410
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
KDEX	Dexter, Mo.	1590
KDGO	Durango, Colo.	1240
KDHL	Faribault, Minn.	920
KDIO	Ortonville, Minn.	1350
KDIX	Dickinson, N.Dak.	1230
KDJI	Holbrook, Ariz.	1270
KDKA	Pittsburgh, Pa.	1020
KDKD	Clinton, Mo.	1280
KDLA	DeRidder, La.	1010
KDLK	Del Rio, Tex.	1230
KDLM	Detroit Lakes, Minn.	1340
KDLR	Devils Lake, N.Dak.	1240
KDMA	Montevideo, Minn.	1450
KDMO	Carthage, Mo.	1490
KDMS	El Dorado, Ark.	1290
KDNT	Denton, Tex.	1440
KDOK	Tyler, Tex.	1330
KDON	Salinas, Calif.	1460
KDOT	Reno, Nev.	1230
KDQN	DeQueen, Ark.	1390
KDRO	Sedalia, Mo.	1490
KDRS	Paragould, Ark.	1490
KDSJ	Deadwood, S.Dak.	980
KDSN	Denison, Iowa	1580
KDSX	Denison, Tex.	950
KDTA	Delta, Colo.	1400
KDTH	Dubuque, Iowa	1370
KDUB	Lubbock, Tex.	1340
KDUZ	Hutchinson, Minn.	1260
KDWT	Stamford, Tex.	1400
KDXU	St. George, Utah	1450
KDYL	Salt Lake City, Utah	1320
KDZA	Pueblo, Colo.	1230
KEAN	Brownwood, Tex.	1240
KEAP	Fresno, Calif.	980
KEBE	Jacksonville, Tex.	1400
KECK	Odessa, Tex.	920
KEDO	Longview, Wash.	1400
KEED	Springfield, Oreg.	1050
KEEE	Nacogdoches, Tex.	1230
KEEL	Shreveport, La.	710
KEEN	San Jose, Calif.	1370
KEEP	Twin Falls, Idaho	1450
KELA	Centralia, Wash.	1470
KELD	El Dorado, Ark.	1400
KELK	Elko, Nev.	1240
KELO	Sioux Falls, S.Dak.	1320
KELP	El Paso, Tex.	920
KENA	Mena, Ark.	1450
KENE	Toppenish, Wash.	1490
KENI	Anchorage, Alaska	550
KENL	Arcata, Calif.	1340
KENM	Portales, N.Mex.	1450
KENN	Farmington, N.M.	1390
KENO	Las Vegas, Nev.	1460
KENS	San Antonio, Tex.	680
KENT	Shreveport, La.	1550
KENY	Bellingham-Ferndale, Wash.	930
KEOK	Payette, Idaho	1450
KEPR	Kennewick, Wash.	610
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
KETX	Livingston, Tex.	1440
KEUN	Eunice, La.	1490
KEVA	Shamrock, Tex.	1580
KEVE	Minneapolis, Minn.	1440
KEVL	White Castle, La.	1590
KEVT	Tucson, Ariz.	690
KEX	Portland, Oreg.	1190
KEXO	Grand Junc., Colo.	1230
KEXX	San Antonio, Tex.	1250
KEYE	Perryton, Tex.	1400
KEYJ	Jamestown, N.Dak.	1400
KEYS	Corpus Christi, Tex.	1440
KEYY	Provo, Utah	1450
KEYZ	Williston, N.Dak.	1360
KFAB	Omaha, Nebr.	1110
KFAC	Los Angeles, Calif.	1330
KFAL	Fulton, Mo.	900
KFAM	St. Cloud, Minn.	1450
KFAR	Fairbanks, Alaska	660
KFAY	Fayetteville, Ark.	1250
KFBB	Great Falls, Mont.	1310
KFBC	Cheyenne, Wyo.	1240
KFBI	Wichita, Kans.	1070
KFBK	Sacramento, Calif.	1530
KFDA	Amarillo, Tex.	1440
KFDM	Beaumont, Tex.	560
KFDR	Grand Coulee, Wash.	1400
KFEL	Pueblo, Colo.	970
KFEQ	St. Joseph, Mo.	680
KFFA	Helena, Ark.	1360
KFGQ	Boone, Iowa	1260
KFH	Wichita, Kans.	1330
KFI	Los Angeles, Calif.	640
KFIR	North Bend, Oreg.	1340
KFIV	Modesto, Calif.	1360
KFIZ	Fond du Lac, Wis.	1450
KFJB	Marshalltown, Iowa	1230
KFJI	Klamath Falls, Oreg.	1150
KFJM	Grand Forks, N.Dak	1370
KFJZ	Ft. Worth, Tex.	1270
KFKA	Greeley, Colo.	1310
KFKF	Bellevue, Wash.	1330
KFKU	Lawrence, Kans.	1250
KFLD	Floydada, Tex.	900
KFLJ	Walsenburg, Colo.	1380
KFLW	Klamath Falls, Oreg.	1450
KFLY	Corvallis, Oreg.	1240
KFMA	Davenport, Iowa	1580
KFMB	San Diego, Calif.	540
KFMJ	Tulsa, Okla.	1050
KFML	Denver, Colo.	1390
KFMO	Flat River, Mo.	1240
KFNF	Shenandoah, Iowa	920
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	730
KFRB	Fairbanks, Alaska	900
KFRC	San Francisco, Calif.	610
KFRD	Rosenberg, Tex.	980
KFRE	Fresno, Calif.	940
KFRM	Kansas City, Mo.	550
KFRO	Longview, Tex.	1370
KFRU	Columbia, Mo.	1400
KFSA	Ft. Smith, Ark.	950
KFSB	Joplin, Mo.	1310
KFSC	Denver, Colo.	1220
KFSD	San Diego, Calif.	600
KFSG	Los Angeles, Calif.	1150
KFST	Ft. Stockton, Tex.	860
KFTM	Ft. Morgan, Colo.	1400
KFTV	Paris, Tex.	1250
KFUN	Las Vegas, N.Mex.	1230
KFUO	St. Louis, Mo.	850
KFVS	Cape Girardeau, Mo.	960
KFWB	Los Angeles, Calif.	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
KGAN	Bastrop, La.	1340
KGAS	Carthage, Tex.	1590
KGAY	Salem, Oreg.	1430
KGB	San Diego, Calif.	1360
KGBC	Galveston, Tex.	1540
KGBT	Harlingen, Tex.	1530
KGBX	Springfield, Mo.	1260
KGCX	Sidney, Mont.	1480
KGDE	Fergus Falls, Minn.	1250
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.Mex.	1400
KGFW	Kearney, Nebr.	1340
KGFX	Pierre, S.Dak.	630
KGGF	Coffeyville, Kans.	690
KGGM	Albuquerque, N.Mex.	610
KGHF	Pueblo, Colo.	1350
KGHI	Little Rock, Ark.	1250
KGHL	Billings, Mont.	790
KGHM	Brookfield, Mo.	1470
KGIL	San Fernando, Calif.	1260
KGIW	Alamosa, Colo.	1450
KGKB	Tyler, Tex.	1490
KGKL	San Angelo, Tex.	960
KGLC	Miami, Okla.	910
KGLN	Glenwood Sprgs., Colo.	980
KGLO	Mason City, Iowa	1300

C.L.	Location	Kc.
KGLU	Safford, Ariz.	1480
KGMB	Honolulu, Hawaii	590
KGMC	Englewood, Colo.	1150
KGMO	Cape Girardeau, Mo.	1220
KGMS	Sacramento, Calif.	1380
KGNB	New Braunfels, Tex.	1420
KGNC	Amarillo, Tex.	710
KGNO	Dodge City, Kans.	1370
KGO	San Francisco, Calif.	810
KGON	Oregon City, Oreg.	1520
KGOS	Torrington, Wyo.	1490
KGPC	Grafton, N.Dak.	1340
KGRI	Henderson, Tex.	1000
KGRN	Grinnell, Iowa	1410
KGRO	Gresham, Oreg.	1230
KGRT	Las Cruces, N.Mex.	570
KGST	Fresno, Calif.	1600
KGU	Honolulu, Hawaii	760
KGVL	Greenville, Tex.	1400
KGVO	Missoula, Mont.	1290
KGW	Portland, Oreg.	620
KGWA	Enid, Okla.	960
KGY	Olympia, Wash.	1240
KGYN	Guymon, Okla.	1220
KHAM	Albuquerque, N.Mex.	1580
KHAS	Hastings, Nebr.	1230
KHAT	Phoenix, Ariz.	1480
KHBC	Hilo, Hawaii	970
KHBG	Okmulgee, Okla.	1240
KHBM	Monticello, Ark.	1430
KHBR	Hillsboro, Tex.	1560
KHCD	Clifton, Ariz.	1450
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	Brighton-Fort Lupton, Colorado	800
KHIT	Walla Walla, Wash.	1320
KHJ	Los Angeles, Calif.	930
KHMO	Hannibal, Mo.	1070
KHOB	Hobbs, N.Mex.	1280
KHOG	Fayetteville, Ark.	1450
KHOK	Golden, Colo.	1250
KHON	Honolulu, T.H.	1380
KHOT	Madera, Calif.	1250
KHOW	Denver, Colo.	630
KHOZ	Harrison, Ark.	900
KHQ	Spokane, Wash.	590
KHSL	Chico, Calif.	1290
KHUB	Fremont, Nebr.	1340
KHUZ	Borger, Tex.	1490
KHVH	Honolulu, Hawaii	1040
KIAL	Astoria, Oreg.	1230
KIBE	Palo Alto, Calif.	1220
KIBH	Seward, Alaska	1340
KIBL	Beeville, Tex.	1490
KIBS	Bishop, Calif.	1230
KICA	Clovis, N.Mex.	980
KICD	Spencer, Iowa	1240
KICK	Springfield, Mo.	1340
KICO	Calexico, Calif.	1490
KID	Idaho Falls, Idaho	590
KIDD	Monterey, Calif.	630
KIDO	Boise, Idaho	630
KIEM	Eureka, Calif.	1480
KIEV	Glendale, Calif.	870
KIFI	Idaho Falls, Idaho	1260
KIFN	Phoenix, Ariz.	860
KIFW	Sitka, Alaska	1230
KIHN	Hugo, Okla.	1340
KIHO	Sioux Falls, S.Dak.	1270
KIHR	Hood River, Oreg.	1340
KIJV	Huron, S.Dak.	1340
KIKI	Honolulu, Hawaii	830
KIKO	Miami, Ariz.	1340
KIKS	Sulphur, La.	1310
KILE	Galveston, Tex.	1400
KILO	Grand Forks, S.Dak.	1440
KILT	Houston, Tex.	610
KIMA	Yakima, Wash.	1460
KIML	Gillette, Wyo.	1490
KIMO	Independence, Mo.	1510
KIMN	Denver, Colo.	950
KIMP	Mt. Pleasant, Tex.	960
KIND	Independence, Kans.	1010
KINE	Kingsville, Tex.	1330
KING	Seattle, Wash.	1090
KINS	Eureka, Calif.	980
KINY	Juneau, Alaska	800
KIOA	Des Moines, Iowa	940
KIOX	Bay City, Tex.	1270
KIPA	Hilo, Hawaii	1110
KIRO	Seattle, Wash.	710
KIRT	Mission, Tex.	1580
KIRX	Kirksville, Mo.	1450
KISD	Sioux Falls, S.Dak.	1230
KIST	Santa Barbara, Calif.	1340
KIT	Yakima, Wash.	1280
KITE	San Antonio, Tex.	930
KITI	Chehalis, Wash.	1420
KITN	Olympia, Wash.	1440
KITO	San Bernardino, Calif.	1290
KIUL	Garden City, Kans.	1240
KIUN	Pecos, Tex.	1400
KIUP	Durango, Colo.	930
KIVY	Crockett, Tex.	1290
KIWW	San Antonio, Tex.	1540
KIXL	Dallas, Tex.	1040
KIXX	Provo, Utah	1400
KIYI	Shelby, Mont.	1150
KJAN	Atlantic, Iowa	1220
KJAY	Topeka, Kans.	1440
KJBC	Midland, Tex.	1150
KJBS	San Francisco, Calif.	1100
KJCF	Festus, Mo.	1010
KJCK	Junction City, Kans.	1420
KJEF	Jennings, La.	1290
KJET	Beaumont, Tex.	1380
KJFJ	Webster City, Iowa	1570
KJIM	Ft. Worth, Tex.	870
KJLT	North Platte, Nebr.	970
KJNO	Juneau, Alaska	630
KJOE	Shreveport, La.	1480
KJOY	Stockton, Calif.	1280
KJR	Seattle, Wash.	950
KJRG	Newton, Kans.	950
KJSK	Columbus, Nebr.	900
KKEY	Vancouver, Wash.	1150
KKIS	Pittsburg, Calif.	990
KKOG	Ogden, Utah	730
KLAC	Los Angeles, Calif.	570
KLAD	Klamath Falls, Oreg.	900
KLAK	Lakewood, Colo.	1600
KLAM	Cordova, Alaska	1450
KLAS	Las Vegas, Nev.	1230
KLBM	La Grande, Oreg.	1450
KLCN	Blytheville, Ark.	910
KLCO	Poteau, Okla.	1280
KLEA	Lovington, N.Mex.	630
KLEE	Ottumwa, Iowa	1480
KLEM	LeMars, Iowa	1410
KLEN	Killeen, Tex.	1050
KLEO	Wichita, Kans.	1480
KLER	Orofino, Idaho	950
KLEX	Lexington, Mo.	1570
KLFT	Golden Meadow, La.	1600
KLGA	Algona, Iowa	1600
KLGN	Logan, Utah	1390
KLGR	Redwood Falls, Minn.	1490
KLIC	Monroe, La.	1230
KLIF	Dallas, Tex.	1190
KLIK	Jefferson City, Mo.	950
KLIL	Estherville, Iowa	1340
KLIN	Lincoln, Nebr.	1400
KLIQ	Portland, Oreg.	1290
KLIR	Denver, Colo.	990
KLIX	Twin Falls, Idaho	1310
KLIZ	Brainerd, Minn.	1380
KLKC	Parsons, Kans.	1540
KLLA	Leesville, La.	1570
KLLL	Lubbock, Tex.	1460
KLMO	Longmont, Colo.	1050
KLMR	Lamar, Colo.	920
KLMS	Lincoln, Nebr.	1480
KLMX	Clayton, N.Mex.	1450
KLO	Ogden, Utah	1430
KLOG	Kelso, Wash.	1490
KLOH	Pipestone, Minn.	1050
KLOK	San Jose, Calif.	1170
KLOO	Corvallis, Oreg.	1340
KLOS	Albuquerque, N.Mex.	1450
KLOU	Lake Charles, La.	1580
KLOV	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
KLTF	Little Falls, Minn.	960
KLTI	Longview, Tex.	1280
KLTR	Blackwell, Okla.	1580
KLTZ	Glasgow, Mont.	1240
KLUB	Salt Lake City, Utah	570
KLUK	Evanston, Wyo.	1240
KLUV	Haynesville, La.	1580
KLVC	Leadville, Colo.	1230
KLVI	Vivian, La.	1600
KLVL	Pasadena, Tex.	1480
KLVT	Levelland, Tex.	1230
KLWN	Lawrence, Kans.	1320
KLWT	Lebanon, Mo.	1230
KLX	Oakland, Calif.	910
KLYD	Bakersfield, Calif.	1350
KLYK	Spokane, Wash.	1230
KLYN	Amarillo, Tex.	940
KLYR	Clarksville, Ark.	1360
KLZ	Denver, Colo.	560
KMA	Shenandoah, Iowa	960
KMAC	San Antonio, Tex.	630
KMAE	McKinney, Tex.	1600
KMAK	Fresno, Calif.	1340
KMAM	Tularosa, N.Mex.	1590
KMAN	Manhattan, Kans.	1350
KMAP	Bakersfield, Calif.	1490
KMAR	Winnsboro, La.	1570
KMBC	Kansas City, Mo.	980
KMBL	Junction, Tex.	1450
KMBY	Monterey, Calif.	1240
KMCD	Fairfield, Iowa	1570
KMCM	McMinnville, Oreg.	1260
KMCO	Conroe, Tex.	900
KMDO	Ft. Scott, Kans.	1600
KMED	Medford, Oreg.	1440
KMEL	Wenatchee, Wash.	1340
KMHL	Marshall, Minn.	1400
KMHT	Marshall, Tex.	1450
KMIL	Cameron, Tex.	1330
KMIN	Grants, N.M.	980
KMJ	Fresno, Calif.	580
KMLB	Monroe, La.	1440
KMLW	Marlin, Tex.	1010
KMMJ	Grand Island, Nebr.	750
KMMO	Marshall, Mo.	1300
KMNS	Sioux City, Iowa	620
KMO	Tacoma, Wash.	1360
KMON	Great Falls, Mont.	560
KMOP	Tucson, Ariz.	1330
KMOR	Oroville, Calif.	1340
KMOX	St. Louis, Mo.	1120
KMPC	Los Angeles, Calif.	710
KMRC	Morgan City, La.	1430
KMRS	Morris, Minn.	1570
KMUL	Muleshoe, Tex.	1380
KMUR	Murray, Utah	1230
KMUS	Muskogee, Okla.	1380
KMVI	Wailuku, T.H.	550
KMYC	Marysville, Calif.	1410
KMYR	Denver, Colo.	710
KNAF	Fredericksburg, Tex.	1340
KNAK	Salt Lake City, Utah	1280
KNAL	Victoria, Tex.	1410
KNBA	Vallejo, Calif.	1190
KNBC	San Francisco, Calif.	680
KNBX	Kirkland, Wash.	1050
KNBY	Newport, Ark.	1280
KNCK	Concordia, Kans.	1390
KNCM	Moberly, Mo.	1230
KNCO	Garden City, Kans.	1050
KNDC	Hettinger, N.Dak.	1490
KNDY	Marysville, Kans.	1570
KNEA	Jonesboro, Ark.	970
KNEB	Scottsbluff, Nebr.	960
KNED	McAlester, Okla.	1150
KNEL	Brady, Tex.	1490
KNEM	Nevada, Mo.	1240
KNET	Palestine, Tex.	1450
KNEU	Provo, Utah	1450
KNEW	Spokane, Wash.	790
KNEX	McPherson, Kans.	1540
KNEZ	Lompoc, Calif.	960
KNGS	Hanford, Calif.	620
KNIM	Maryville, Mo.	1580
KNIT	Abilene, Tex.	1280
KNLR	N. Little Rock, Ark.	1380
KNOC	Natchitoches, La.	1450
KNOE	Monroe, La.	1390
KNOG	Nogales, Ariz.	1340
KNOK	Ft. Worth, Tex.	970
KNOR	Norman, Okla.	1400
KNOT	Prescott, Ariz.	1450
KNOW	Austin, Tex.	1490
KNOX	Grand Forks, N.Dak.	1310
KNPT	Newport, Ore.	1310
KNUJ	New Ulm, Minn.	860
KNUZ	Houston, Tex.	1230
KNWS	Waterloo, Iowa	1090
KNX	Los Angeles, Calif.	1070
KOA	Denver, Colo.	850
KOAC	Corvallis, Oreg.	550
KOAL	Price, Utah	1230
KOAM	Pittsburg, Kans.	860
KOB	Albuquerque, N.Mex.	1030
KOBE	Las Cruces, N.Mex.	1450
KOBY	San Francisco, Calif.	1550
KOCA	Kilgore, Tex.	1240
KOCY	Oklahoma City, Okla.	1340
KODE	Joplin, Mo.	1230
KODI	Cody, Wyo.	1400
KODL	The Dalles, Oreg.	1440
KODY	North Platte, Nebr.	1240
KOEL	Oelwein, Iowa	950
KOFA	Yuma, Ariz.	1240
KOFE	Pullman, Wash.	1150
KOFI	Kalispell, Mont.	930
KOFO	Ottawa, Kans.	1220
KOFY	San Mateo, Calif.	1050
KOGA	Ogallala, Nebr.	930
KOGT	Orange, Tex.	1600
KOH	Reno, Nev.	630
KOHU	Hermiston, Oreg.	1570
KOIL	Omaha, Nebr.	1290
KOIN	Portland, Oreg.	970
KOJM	Havre, Mont.	610
KOKA	Shreveport, La.	980
KOKE	Austin, Tex.	1370
KOKO	Warrensburg, Mo.	1450
KOKX	Keokuk, Iowa	1310
KOKY	Little Rock, Ark.	1440
KOL	Seattle, Wash.	1300
KOLD	Tucson, Ariz.	1450
KOLE	Port Arthur, Tex.	1340
KOLJ	Quanah, Tex.	1150
KOLL	Libby, Mont.	1230
KOLO	Reno, Nev.	920
KOLR	Sterling, Colo.	1490
KOLS	Pryor, Okla.	1570
KOLT	Scottsbluff, Nebr.	1320
KOLY	Mobridge, S.Dak.	1300
KOMA	Okla. City, Okla.	1520
KOMB	Cottage Grove, Oreg.	1400
KOME	Tulsa, Okla.	1300
KOMO	Seattle, Wash.	1000
KOMW	Omak, Wash.	680
KOMY	Watsonville, Calif.	1340
KONE	Reno, Nev.	1450
KONG	Visalia, Calif.	1400
KONI	Phoenix, Ariz.	1400
KONO	San Antonio, Tex.	860
KONP	Port Angeles, Wash.	1450
KOOK	Billings, Mont.	970
KOOL	Phoenix, Ariz.	960
KOOO	Omaha, Nebr.	1420
KOOS	Coos Bay, Oreg.	1230
KOPR	Butte, Mont.	550
KOPY	Alice, Tex.	1070
KORA	Bryan, Tex.	1240
KORC	Mineral Wells, Tex.	1140
KORD	Pasco, Wash.	910
KORE	Eugene, Oreg.	1450
KORK	Las Vegas, Nev.	1340
KORN	Mitchell, S.Dak.	1490
KORT	Grangeville, Idaho	1230
KOSA	Odessa, Tex.	1230
KOSE	Osceola, Ark.	860
KOSI	Aurora, Colo.	1430
KOSY	Texarkana, Ark.	790
KOTA	Rapid City, S.Dak.	1380
KOTN	Pine Bluff, Ark.	1490
KOTS	Deming, N.M.	1230
KOVC	Valley City, N.Dak.	1490
KOVE	Lander, Wyo.	1330
KOVO	Provo, Utah	960
KOWB	Laramie, Wyo.	1340
KOWH	Omaha, Nebr.	660
KOWL	Lake Tahoe, Calif.	1490
KOWN	Escondido, Calif.	1450
KOXR	Ornard, Calif.	910
KOY	Phoenix, Ariz.	550
KOYE	El Paso, Tex.	1150
KOYL	Odessa, Tex.	1310
KOYN	Billings, Mont.	910
KOZE	Lewiston, Idaho	1300
KOZI	Chelan, Wash.	1220
KOZY	Grand Rapids, Minn.	1490
KPAC	Port Arthur, Tex.	1250
KPAL	Palm Springs, Calif.	1450
KPAM	Portland, Oreg.	1410
KPAN	Hereford, Tex.	860
KPAP	Redding, Calif.	1270
KPAS	Banning, Calif.	1490
KPAY	Chico, Calif.	1060
KPBA	Pine Bluff, Ark.	1590
KPBM	Carlsbad, N.Mex.	740
KPCA	Marked Tree, Ark.	1580
KPDN	Pampa, Tex.	1340
KPDQ	Portland, Oreg.	800
KPEG	Spokane, Wash.	1380
KPEL	Lafayette, La.	1420
KPEP	San Angelo, Tex.	1420
KPER	Gilroy, Calif.	1290
KPET	Lamesa, Tex.	690
KPHO	Phoenix, Ariz.	910
KPIG	Cedar Rapids, Iowa	1450
KPIK	Colorado Sprgs., Colo.	1580
KPIN	Casa Grande, Ariz.	1260
KPKW	Pasco, Wash.	1340
KPLC	Lake Charles, La.	1470
KPLK	Dallas, Oreg.	1460
KPMC	Bakersfield, Calif.	1560
KPOA	Honolulu, T.H.	630
KPOC	Pocahontas, Ark.	1420
KPOF	Denver, Colo.	910
KPOJ	Portland, Oreg.	1330
KPOK	Scottsdale, Ariz.	1440
KPOL	Los Angeles, Calif.	1540
KPOP	Los Angeles, Calif.	1020
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
KPRK	Livingston, Mont.	1340
KPRL	Paso Robles, Calif.	1230
KPRO	Riverside, Calif.	1440
KPRS	Kansas City, Mo.	1590
KPSO	Falfurrias, Tex.	1260
KPST	Preston, Idaho	1340
KPTL	Carson City, Nev.	1400
KPUG	Bellingham, Wash.	1170
KPVA	Camas, Wash.	1480
KQDE	Renton, Wash.	910
KQDI	Bismarck, N.D.	1350
KQDY	Minot, N.Dak.	1320
KQEO	Albuquerque, N.Mex.	920
KQIK	Lakeview, Oreg.	1230
KQTY	Everett, Wash.	1230
KQV	Pittsburgh, Pa.	1410
KRAC	Alamogordo, N.M.	1270
KRAI	Craig, Colo.	550
KRAK	Stockton, Calif.	1140
KRAL	Rawlins, Wyo.	1240
KRAM	Las Vegas, Nev.	920
KRAY	Amarillo, Tex.	1360
KRBA	Lufkin, Tex.	1340
KRBC	Abilene, Tex.	1470
KRBI	St. Peter, Minn.	1310
KRBO	Las Vegas, Nev.	1050
KRCK	Ridgecrest, Calif.	1360
KRCO	Prineville, Oreg.	690
KRCT	Baytown, Tex.	650
KRDG	Redding, Calif.	1230
KRDO	Colo. Springs, Colo.	1240
KRDU	Dinuba, Calif.	1240
KRE	Berkeley, Calif.	1400
KREH	Oakdale, La.	900
KREI	Farmington, Mo.	800
KREL	Baytown, Tex.	1360
KREM	Spokane, Wash.	970
KREO	Indio, Calif.	1400
KRES	St. Joseph, Mo.	1550
KREW	Sunnyside, Wash.	1230
KREX	Grand Junc., Colo.	920
KRFO	Owatonna, Minn.	1390
KRGI	Grand Island, Neb.	1430
KRGV	Weslaco, Tex.	1290
KRHD	Duncan, Okla.	1350
KRIB	Mason City, Iowa	1490
KRIC	Beaumont, Tex.	1450
KRIG	Odessa, Tex.	1410
KRIO	McAllen, Tex.	910
KRIZ	Phoenix, Ariz.	1230
KRPF	Miles City, Mont.	1340
KRKD	Los Angeles, Calif.	1150
KRKO	Everett, Wash.	1380
KRKS	Ridgecrest, Calif.	1240
KRLC	Lewiston, Idaho	1350
KRLD	Dallas, Tex.	1080
KRLN	Canon City, Colo.	1400
KRLW	Walnut Ridge, Ark.	1320
KRMD	Shreveport, La.	1340
KRMG	Tulsa, Okla.	740
KRMO	Monett, Mo.	990

C.L.	Location	Kc.
KRMS	Osage Beach, Mo.	1150
KRMW	The Dalles, Oreg.	1300
KRNO	San Bernardino, Calif.	1240
KRNR	Roseburg, Oreg.	1490
KRNS	Burns, Oreg.	1230
KRNT	Des Moines, Iowa	1350
KRNY	Kearney, Nebr.	1460
KROC	Rochester, Minn.	1340
KROD	El Paso, Tex.	600
KROF	Abbeville, La.	960
KROG	Sonora, Calif.	1450
KROP	Brawley, Calif.	1300
KROS	Clinton, Iowa	1340
KROW	Oakland, Calif.	960
KROX	Crookston, Minn.	1260
KROY	Sacramento, Calif.	1240
KRPL	Moscow, Idaho	1400
KRRV	Sherman, Tex.	910
KRSC	Othello, Wash.	1450
KRSD	Rapid City, S.Dak.	1340
KRSL	Russell, Kans.	990
KRSN	Los Alamos, N.Mex.	1490
KRTN	Raton, N.Mex.	1490
KRTR	Thermopolis, Wyo.	1490
KRUN	Ballinger, Tex.	1400
KRUS	Ruston, La.	1490
KRUX	Glendale, Ariz.	1360
KRVN	Lexington, Nebr.	1010
KRWC	Forest Grove, Oreg.	1570
KRXK	Rexburg, Idaho	1230
KRXL	Roseburg, Oreg.	1240
KRYS	Corpus Christi, Tex.	1360
KSAC	Manhattan, Kans.	580
KSAL	Salina, Kans.	1150
KSAM	Huntsville, Tex.	1490
KSAN	San Francisco, Calif.	1450
KSAY	San Francisco, Calif.	1010
KSBW	Salinas, Calif.	1380
KSCB	Liberal, Kans.	1270
KSCJ	Sioux City, Iowa	1360
KSCO	Santa Cruz, Calif.	1080
KSD	St. Louis, Mo.	550
KSDA	Redding, Calif.	1400
KSDN	Aberdeen, S.Dak.	930
KSDO	San Diego, Calif.	1130
KSEI	Pocatello, Idaho	930
KSEK	Pittsburg, Kans.	1340
KSEL	Lubbock, Tex.	950
KSEM	Moses Lake, Wash.	1470
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	Ste. Genevieve, Mo.	980
KSIB	Creston, Iowa	1520
KSID	Sidney, Nebr.	1340
KSIG	Crowley, La.	1450
KSIJ	Gladewater, Tex.	1430
KSIL	Silver City, N.Mex.	1340
KSIM	Sikeston, Mo.	1400
KSIR	Wichita, Kans.	900
KSIS	Sedalia, Mo.	1050
KSIW	Woodward, Okla.	1450
KSIX	Corpus Christi, Tex.	1230
KSJB	Jamestown, N.Dak.	600
KSJO	San Jose, Calif.	1590
KSKY	Dallas, Tex.	660
KSL	Salt Lake City, Utah	1160
KSLM	Salem, Oreg.	1390
KSLO	Opelousas, La.	1230
KSLV	Monte Vista, Colo.	1240
KSMA	Santa Maria, Calif.	1240
KSML	Seminole, Tex.	1250
KSMN	Mason City, Iowa	1010
KSMD	Salem, Mo.	1340
KSNY	Snyder, Tex.	1450
KSO	Des Moines, Iowa	1460
KSOK	Arkansas City, Kans.	1280
KSON	San Diego, Calif.	1240
KSOO	Sioux Falls, S.Dak.	1140
KSOP	Salt Lake City, Utah	1370
KSOX	Raymondville, Tex.	1240
KSPA	Santa Paula, Calif.	1400
KSPI	Stillwater, Okla.	780
KSPL	Diboll, Tex.	1260
KSPR	Casper, Wyo.	1470
KSPT	Sandpoint, Idaho	1400
KSRC	Socorro, N.Mex.	1290
KSRO	Santa Rosa, Calif.	1350
KSRV	Ontario, Oreg.	1380
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
KSUE	Susanville, Calif.	1240
KSUM	Fairmont, Minn.	1370
KSUN	Bisbee, Ariz.	1230
KSVC	Richfield, Utah	980
KSVP	Artesia, N.Mex.	990
KSWA	Graham, Tex.	1330
KSWI	Council Bluffs, Iowa	1560
KSWO	Lawton, Okla.	1380
KSWS	Roswell, N.Mex.	1230
KSYC	Yreka, Calif.	1490
KSYD	Wichita Falls, Tex.	990
KSYL	Alexandria, La.	970

C.L.	Location	Kc.
KTAC	Tacoma, Wash.	850
KTAE	Taylor, Tex.	1260
KTAR	Phoenix, Ariz.	620
KTAT	Frederick, Okla.	1570
KTBB	Tyler, Tex.	600
KTBC	Austin, Tex.	590
KTCB	Malden, Mo.	1470
KTCN	Berryville, Ark.	1480
KTCS	Fort Smith, Ark.	1410
KTEE	Carmel, Calif.	1410
KTEL	Walla Walla, Wash.	1490
KTEM	Temple, Tex.	1400
KTER	Terrell, Tex.	1570
KTET	Livingston, Tex.	1220
KTFI	Twin Falls, Idaho	1270
KTFS	Texarkana, Tex.	1400
KTFY	Bronwfield, Tex.	1300
KTHE	Thermopolis, Wyo.	1240
KTHS	Little Rock, Ark.	1090
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	Seattle, Wash.	1590
KTJS	Hobart, Okla.	1420
KTKN	Ketchikan, Alaska	930
KTKR	Taft, Calif.	1310
KTKT	Tucson, Ariz.	990
KTLO	Tullulah, La.	1360
KTLN	Denver, Colo.	1280
KTLO	Mtn. Home, Ark.	1490
KTLQ	Tahlequah, Okla.	1350
KTLU	Rusk, Tex.	1580
KTLW	Texas City, Tex.	920
KTMC	McAlester, Okla.	1400
KTMS	Santa Barbara, Calif.	1250
KTNC	Falls City, Nebr.	1230
KTNM	Tucumcari, N.Mex.	1400
KTNT	Tacoma, Wash.	1400
KTOE	Mankato, Minn.	1420
KTOH	Lihue, Hawaii	1490
KTOK	Oklahoma City, Okla.	1000
KTOO	Henderson, Nev.	1280
KTOP	Topeka, Kans.	1490
KTOW	Oklahoma City, Okla.	800
KTRB	Modesto, Calif.	860
KTRC	Santa Fe, N.Mex.	1400
KTRE	Lufkin, Tex.	1420
KTRF	Thief River Falls, Minn.	1230
KTRH	Houston, Tex.	740
KTRI	Sioux City, Iowa	1470
KTRM	Beaumont, Tex.	990
KTRN	Wichita Falls, Tex.	1290
KTRY	Bastrop, La.	730
KTSA	San Antonio, Tex.	550
KTSM	El Paso, Tex.	1380
KTTN	Trenton, Mo.	1600
KTTR	Rolla, Mo.	1490
KTTS	Springfield, Mo.	1400
KTUC	Tucson, Ariz.	1400
KTUE	Tulia, Tex.	1260
KTUL	Lookout Mountain, Oklahoma	1430
KTUR	Turlock, Calif.	1390
KTUT	Tooele, Utah	990
KTW	Seattle, Wash.	1250
KTXJ	Jasper, Tex.	1350
KTXL	San Angelo, Tex.	1340
KTXO	Sherman, Tex.	1500
KTYM	Inglewood, Calif.	1460
KUBA	Yuba City, Calif.	1600
KUBC	Montrose, Colo.	580
KUBE	Pendleton, Oreg.	1050
KUDE	Oceanside, Calif.	1320
KUDI	Great Falls, Mont.	1450
KUDL	Kansas City, Mo.	1380
KUDU	Ventura, Calif.	1590
KUDY	Littleton, Colo.	1510
KUEN	Wenatchee, Wash.	900
KUEQ	Phoenix, Ariz.	740
KUGN	Eugene, Oreg.	590
KUIK	Hillsboro, Oreg.	1360
KUJ	Walla Walla, Wash.	1420
KUKI	Ukiah, Calif.	1400
KUKU	Willow Springs, Mo.	1330
KULA	Honolulu, T.H.	690
KULE	Ephrata, Wash.	730
KULP	El Campo, Tex.	1390
KUMA	Pendleton, Oreg.	1290
KUNO	Corpus Christi, Tex.	1400
KUOA	Siloam Springs, Ark.	1290
KUOM	Minneapolis, Minn.	770
KUPI	Idaho Falls, Idaho	980
KURA	Moab, Utah	1450
KURV	Edinburg, Tex.	710
KURY	Brookings, Oreg.	910
KUSD	Vermillion, S.Dak.	690
KUSH	Cushing, Okla.	1600
KUSN	St. Joseph, Mo.	1270
KUTI	Yakima, Wash.	980
KUTY	Palmdale, Calif.	1470
KUVR	Holdredge, Nebr.	1380
KUZN	W. Monroe, La.	1310
KVAN	Vancouver, Wash.	910
KVCK	Wolf Point, Nebr.	1450
KVCL	Winnfield, La.	1270
KVCV	Redding, Calif.	600
KVEC	San Luis Obispo, Calif.	920
KVEL	Vernal, Utah	1250
KVEN	Ventura, Calif.	1450
KVET	Austin, Tex.	1300
KVFC	Cortez, Colo.	740
KVFD	Ft. Dodge, Iowa	1400
KVGB	Great Bend, Kans.	1590
KVHL	Homer, La.	1320

C.L.	Location	Kc.
KVI	Seattle, Wash.	570
KVIC	Victoria, Tex.	1340
KVIM	New Iberia, La.	1360
KVIN	Vinita, Okla.	1470
KVIP	Redding, Calif.	540
KVKM	Monahans, Tex.	1340
KVLB	Cleveland, Tex.	1410
KVLC	Little Rock, Ark.	1050
KVLF	Alpine, Tex.	1240
KVLH	Pauls Valley, Okla.	1470
KVLV	Fallon, Nev.	1250
KVMA	Magnolia, Ark.	630
KVMC	Colorado City, Tex.	1320
KVNA	Flagstaff, Ariz.	690
KVNC	Winslow, Ariz.	1010
KVNI	Coeur d'Alene, Idaho	1240
KVNU	Logan, Utah	610
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
KVOS	Bellingham, Wash.	790
KVOU	Uvalde, Tex.	1400
KVOW	Littlefield, Tex.	1490
KVOX	Moorhead, Minn.	1280
KVOY	Yuma, Ariz.	1400
KVOZ	Laredo, Tex.	1490
KVPI	Ville Platte, La.	1050
KVRC	Arkadelphia, Ark.	1240
KVRH	Salida, Colo.	1340
KVRS	Rock Springs, Wyo.	1360
KVSA	McGehee, Ark.	1220
KVSF	Santa Fe, N.Mex.	1260
KVSO	Ardmore, Okla.	1240
KVWC	Vernon, Tex.	1490
KVWM	Show Low, Ariz.	1050
KVWO	Cheyenne, Wyo.	1370
KWAD	Wadena, Minn.	920
KWAK	Stuttgart, Ark.	1240
KWAL	Wallace, Idaho	620
KWAT	Watertown, S.Dak.	950
KWBB	Wichita, Kans.	1410
KWBE	Beatrice, Nebr.	1450
KWBG	Boone, Iowa	1590
KWBR	Oakland, Calif.	1310
KWBY	Colo. Sprgs., Colo.	740
KWBW	Hutchinson, Kans.	1450
KWCB	Searcy, Ark.	1300
KWCL	Oak Grove, La.	1280
KWCO	Chickasha, Okla.	1560
KWDM	Des Moines, Iowa	1150
KWEB	Rochester, Minn.	1270
KWED	Seguin, Tex.	1580
KWEI	Weiser, Idaho	1220
KWEL	Midland, Tex.	1600
KWEM	Memphis, Tenn.	990
KWEW	Hobbs, N.Mex.	1480
KWFC	Hot Springs, Ark.	1350
KWFR	San Angelo, Tex.	1260
KWFT	Wichita Falls, Tex.	620
KWG	Stockton, Calif.	1230
KWHI	Brenham, Tex.	1280
KWHK	Hutchinson, Kans.	1260
KWHN	Fort Smith, Ark.	1320
KWHO	Salt Lake City, Utah	860
KWHW	Altus, Dkla.	1450
KWIC	Salt Lake City, Utah	1570
KWIK	Pocatello, Idaho	1240
KWIL	Albany, Oreg.	790
KWIN	Ashland, Oreg.	1400
KWIV	Douglas, Wyo.	1050
KWIZ	Santa Ana, Calif.	1480
KWJB	Globe, Ariz.	1240
KWJC	Natchitoches, La.	1450
KWJJ	Portland, Oreg.	1080
KWIP	Merced, Calif.	1580
KWIQ	Moses Lake, Wash.	1260
KWK	St. Louis, Mo.	1380
KWKC	Abilene, Tex.	1340
KWKH	Shreveport, La.	1130
KWKW	Pasadena, Calif.	1300
KWLC	Decorah, Iowa	1240
KWLM	Willmar, Minn.	1340
KWMT	Ft. Dodge, Iowa	540
KWNA	Winnemucca, Nev.	1400
KWNO	Winona, Minn.	1230
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	Pendleton, Oreg.	1240
KWRD	Henderson, Tex.	1470
KWRE	Warrenton, Mo.	730
KWRF	Warren, Ark.	860
KWRL	Riverton, Wyo.	1450
KWRO	Coquille, Oreg.	1450
KWRT	Boonville, Mo.	1370
KWRW	Guthrie, Okla.	1490
KWSC	Pullman, Wash.	1250
KWSD	Mt. Shasta, Calif.	620
KWSH	Wewoka-Seminole, Oklahoma	1260
KWSK	Pratt, Kans.	1570
KWSO	Wasco, Calif.	1050
KWTC	Barstow, Calif.	1230
KWTO	Springfield, Mo.	560
KWTX	Waco, Tex.	1230

C.L.	Location	Kc.
KWVY	Waverly, Iowa	1470
KWWL	Waterloo, Iowa	1330
KWYK	Farmington, N.Mex.	960
KWYN	Wynne, Ark.	1400
KWYO	Sheridan, Wyo.	1410
KWYR	Winner, S.Dak.	1260
KXA	Seattle, Wash.	770
KXAR	Hope, Ark.	1490
KXEL	Waterloo, Iowa	1540
KXEO	Mexico, Mo.	1340
KXGI	Ft. Madison, Iowa	1360
KXGN	Glendive, Mont.	1400
KXGO	Fargo, N.D.	790
KXIC	Iowa City, Iowa	800
KXIT	Dalhart, Tex.	1410
KXJK	Forrest City, Ark.	950
KXL	Portland, Oreg.	750
KXLA	Pasadena, Calif.	1110
KXLE	Ellensburg, Wash.	1240
KXLF	Butte, Mont.	1370
KXLJ	Helena, Mont.	1240
KXLK	Great Falls, Mont.	1400
KXLL	Missoula, Mont.	1450
KXLO	Lewiston, Mont.	1230
KXLQ	Bozeman, Mont.	1450
KXLR	No. 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
KXOX	Sweetwater, Tex.	1240
KXRA	Alexandria, Minn.	1490
KXRJ	Russellville, Ark.	1490
KXRO	Aberdeen, Wash.	1320
KXRX	San Jose, Calif.	1500
KXXX	Colby, Kans.	790
KXYZ	Houston, Tex.	1320
KYA	San Francisco, Calif.	1260
KYCA	Prescott, Ariz.	1490
KYJC	Medford, Oreg.	1230
KYME	Boise, Idaho	740
KYNO	Fresno, Calif.	1300
KYNG	Coos Bay, Oreg.	1420
KYNT	Yankton, S.Dak.	1450
KYOK	Houston, Tex.	1590
KYOR	Blythe, Calif.	1450
KYOS	Merced, Calif.	1480
KYOU	Greeley, Colo.	1450
KYSM	Mankato, Minn.	1230
KYSN	Colorado Sprgs., Colo.	1460
KYTE	Pocatello, Idaho	1290
KYUM	Yuma, Ariz.	560
KYW	Cleveland, Ohio	1100
KZEE	Weatherford, Tex.	1220
KZEY	Tyler, Tex.	690
KZIN	Coeur d'Alene, Idaho	1050
KZIP	Amarillo, Tex.	1310
KZOK	Prescott, Ariz.	1340
KZOL	Muleshoe, Tex.	1570
KZUM	Farmington, N.Mex.	1280
KZUN	Opportunity, Wash.	630
WAAA	Winston-Salem, N.C.	980
WAAB	Worcester, Mass.	1440
WAAF	Chicago, Ill.	950
WAAG	Adel, Ga.	1470
WAAY	Huntsville, Ala.	1550
WABA	Aguadilla, P.Rico	850
WABB	Mobile, Ala.	1480
WABC	New York, N.Y.	770
WABG	Greenwood, Miss.	960
WABI	Bangor, Maine	910
WABJ	Adrian, Mich.	1490
WABL	Amite, La.	1570
WABM	Houlton, Maine	1340
WABO	Waynesboro, Miss.	990
WABR	Winter Park, Fla.	1440
WABV	Abbeville, S.C.	1590
WABW	Annapolis, Md.	810
WABY	Albany, N.Y.	1400
WABZ	Albemarle, N.C.	1010
WACA	Camden, S.C.	1590
WACB	Kittanning, Pa.	1380
WACE	Chicopee, Mass.	730
WACK	Newark, N.J.	1420
WACL	Waycross, Ga.	570
WACO	Waco, Tex.	1460
WACR	Columbus, Miss.	1050
WACT	Tuscaloosa, Ala.	1420
WADA	Shelby, N.C.	1390
WADC	Akron, Ohio	1350
WADE	Wadesboro, N.C.	1210
WADK	Newport, R.I.	1540
WADP	Kane, Pa.	960
WADS	Ansonia, Conn.	690
WAEB	Allentown, Pa.	790
WAEL	Mayaguez, P.Rico	600
WAEW	Crossville, Tenn.	1330
WAFC	Staunton, Va.	900
WAGA	Atlanta, Ga.	590
WAGC	Chattanooga, Tenn.	1450
WAGE	Leesburg, Va.	1290
WAGF	Dothan, Ala.	1320
WAGG	Franklin, Tenn.	950
WAGM	Presque Isle, Maine	1450
WAGN	Menominee, Mich.	1340
WAGR	Lumberton, N.C.	1480
WAGS	Bishopville, S.C.	1380
WAGY	Forest City, N.C.	1320
WAIL	Baton Rouge, La.	1460
WAIM	Anderson, S.C.	1230
WAIN	Columbia, Ky.	1270
WAIP	Prichard, Ala.	1270
WAIR	Winston-Salem, N.C.	1340
WAIT	Chicago, Ill.	820
WAJF	Decatur, Ala.	1490
WAJR	Morgantown, W.Va.	1440

C.L.	Location	Kc.
WAKE	Atlanta, Ga.	1340
WAKN	Aiken, S.C.	990
WAKR	Akron, Ohio	1590
WAKU	Latrobe, Pa.	1570
WALA	Mobile, Ala.	1410
WALB	Albany, Ga.	1590
WALD	Walterboro, S.C.	1220
WALE	Fall River, Mass.	1400
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
WAMD	Aberdeen, Md.	970
WAME	Miami, Fla.	1260
WAMI	Opp, Ala.	860
WAML	Laurel, Miss.	1340
WAMM	Flint, Mich.	1420
WAMO	Homestead, Pa.	860
WAMP	Pittsburgh, Pa.	1320
WAMS	Wilmington, Del.	1380
WAMV	E. St. Louis, Ill.	1490
WAMW	Washington, Ind.	1580
WAMY	Amory, Miss.	1580
WANA	Anniston, Ala.	1490
WANB	Waynesburg, Pa.	1580
WAND	Canton, Ohio	900
WANE	Ft. Wayne, Ind.	1450
WANN	Annapolis, Md.	1190
WANS	Anderson, S.C.	1280
WANT	Richmond, Va.	990
WAOK	Atlanta, Ga.	1380
WAOV	Vincennes, Ind.	1450
WAPA	San Juan, P.R.	680
WAPF	McComb, Miss.	980
WAPG	Arcadia, Fla.	1480
WAPI	Birmingham, Ala.	1070
WAPL	Appleton, Wis.	1570
WAPO	Chattanooga, Tenn.	1150
WAPX	Montgomery, Ala.	1600
WAQE	Towson, Md.	1570
WARA	Attleboro, Mass.	1320
WARB	Covington, La.	730
WARD	Johnstown, Pa.	1490
WARE	Ware, Mass.	1250
WARF	Jasper, Ala.	1240
WARK	Hagerstown, Md.	1490
WARL	Arlington, Va.	780
WARM	Scranton, Pa.	590
WARN	Ft. Pierce, Fla.	1330
WARU	Peru, Ind.	1600
WASA	Havre de Grace, Md.	1330
WASK	Lafayette, Ind.	1450
WATA	Boone, N.C.	1450
WATC	Gaylord, Mich.	900
WATE	Knoxville, Tenn.	620
WATG	Ashland, Ohio	1340
WATH	Athens, Ohio	970
WATK	Antigo, Wis.	900
WATM	Atmore, Ala.	1590
WATN	Watertown, N.Y.	1240
WATO	Oak Ridge, Tenn.	1490
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
WAUC	Wauchula, Fla.	1310
WAUD	Auburn, Ala.	1230
WAUG	Augusta, Ga.	1050
WAUX	Waukesha, Wis.	1510
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
WAVU	Albertville, Ala.	630
WAVY	Portsmouth, Va.	1350
WAVZ	New Haven, Conn.	1300
WAWK	Kendallville, Ind.	1570
WAWZ	Zarephath, N.J.	1380
WAXE	Vero Beach, Fla.	1370
WAXX	Chippewa Falls, Wis.	1150
WAYB	Waynesboro, Va.	1490
WAYE	Dundalk, Md.	860
WAYN	Rockingham, N.C.	900
WAYS	Charlotte, N.C.	610
WAYX	Waycross, Ga.	1230
WAYZ	Waynesboro, Pa.	1380
WAZA	Bainbridge, Ga.	1360
WAZF	Yazoo City, Miss.	1230
WAZL	Hazelton, Pa.	1490
WBAA	West Lafayette, Ind.	920
WBAB	Babylon, N.Y.	1440
WBAC	Cleveland, Tenn.	1340
WBAL	Baltimore, Md.	1090
WBAM	Montgomery, Ala.	740
WBAP	Ft. Worth, Tex.	570, 820
WBAR	Bartow, Fla.	1460
WBAT	Marion, Ind.	1400
WBAX	Wilkes-Barre, Pa.	1240
WBAW	Barnwell, S.C.	740
WBAY	Green Bay, Wis.	1360
WBBA	Pittsfield, Ill.	1580
WBBB	Burlington, N.C.	920
WBBC	Flint, Mich.	1330
WBBF	Rochester, N.Y.	950
WBBI	Abingdon, Va.	1230
WBBL	Richmond, Va.	1480
WBBM	Chicago, Ill.	780
WBBN	Perry, Ga.	980
WBBO	Forest City, N.C.	780
WBBQ	Augusta, Ga.	1340
WBBW	Youngstown, Ohio	1240
WBBZ	Ponca City, Okla.	1230
WBCA	Bay Minette, Ala.	1150
WBCB	Levittown, Pa.	1490
WBCH	Hastings, Mich.	1220
WBCK	Battle Creek, Mich.	930
WBCM	Bay City, Mich.	1440
WBCR	Christiansburg, Va.	1260
WBCU	Union, S.C.	1460
WBEC	Pittsfield, Mass.	1420
WBEE	Harvey, Ill.	1570
WBEJ	Elizabethton, Tenn.	1240
WBEL	Beloit, Wis.	1380
WBEN	Buffalo, N.Y.	930
WBET	Brockton, Mass.	1460
WBEU	Beaufort, S.C.	960
WBEV	Beaver Dam, Wis.	1430
WBEX	Chillicothe, Ohio	1490
WBFC	Fremont, Mich.	1490
WBFD	Bedford, Pa.	1310
WBGC	Chipley, Fla.	1240
WBGR	Jesup, Ga.	1370
WBHB	Fitzgerald, Ga.	1240
WBHC	Hampton, S.C.	1270
WBHF	Cartersville, Ga.	1450
WBHP	Huntsville, Ala.	1230
WBIA	Augusta, Ga.	1230
WBIE	Marietta, Ga.	1050
WBIG	Greensboro, N.C.	1470
WBIL	Leesburg, Fla.	1410
WBIP	Booneville, Miss.	1400
WBIR	Knoxville, Tenn.	1240
WBIS	Bristol, Conn.	1440
WBIW	Bedford, Ind.	1340
WBIZ	Eau Claire, Wis.	1400
WBKH	Hattiesburg, Miss.	950
WBKN	Newton, Miss.	1410
WBKV	West Bend, Wis.	1470
WBLA	Elizabethtown, N.C.	1450
WBLE	Batesville, Miss.	1290
WBLF	Bellefonte, Pa.	1330
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
WBMK	West Point, Ga.	1310
WBML	Macon, Ga.	1240
WBNC	Conway, N.H.	1050
WBNL	Boonville, Ind.	1540
WBNS	Columbus, Ohio	1460
WBNX	New York, N.Y.	1380
WBNY	Buffalo, N.Y.	1400
WBOB	Galax, Va.	1360
WBOC	Salisbury, Md.	960
WBOF	Virginia Beach, Va.	1600
WBOK	New Orleans, La.	800
WBOP	Pensacola, Fla.	980
WBOS	Brookline, Mass.	1600
WBOW	Terre Haute, Ind.	1230
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
WBRK	Pittsfield, Mass.	1340
WBRM	Marion, N.C.	1250
WBRN	Big Rapids, Mich.	1460
WBRO	Waynesboro, Ga.	1310
WBRT	Bardstown, Ky.	1320
WBRV	Boonville, N.Y.	900
WBRX	Berwick, Pa.	1280
WBRY	Waterbury, Conn.	1590
WBSC	Bennetsville, S.C.	1550
WBSE	Hillsdale, Mich.	1340
WBSM	New Bedford, Mass.	1420
WBSR	Pensacola, Fla.	1450
WBT	Charlotte, N.C.	1110
WBTA	Batavia, N.Y.	1490
WBTH	Williamson, W.Va.	1400
WBTM	Danville, Va.	1330
WBTN	Bennington, Vt.	1370
WBTO	Linton, Ind.	1600
WBUD	Trenton, N.J.	1260
WBUT	Butler, Pa.	1050
WBUX	Doylestown, Pa.	1570
WBUY	Lexington, N.C.	1440
WBUZ	Fredonia, N.Y.	1570
WBVL	Barboursville, Ky.	950
WBVP	Beaver Falls, Pa.	1230
WBYE	Calera, Ala.	1370
WBYS	Canton, Ill.	1560
WBZ	Boston, Mass.	1030
WBZA	Springfield, Mass.	1030
WBZY	Torrington, Conn.	990
WCAE	Pittsburgh, Pa.	1250
WCAL	Northfield, Minn.	770
WCAM	Camden, N.J.	1310
WCAO	Baltimore, Md.	600
WCAP	Lowell, Mass.	980
WCAR	Detroit, Mich.	1130
WCAS	Gadsden, Ala.	570
WCAT	Orange, Mass.	1390
WCAU	Philadelphia, Pa.	1210
WCAW	Charleston, W.Va.	1300
WCAX	Burlington, Vt.	620
WCAY	Cayce, S.C.	620
WCAZ	Carthage, Ill.	990
WCBA	Corning, N.Y.	1350
WCBC	Anderson, Ind.	1470
WCBD	Chicago, Ill.	820
WCBG	Chambersburg, Pa.	1590
WCBI	Columbus, Miss.	550
WCBL	Benton, Ky.	1290
WCBM	Baltimore, Md.	680
WCBQ	St. Helen, Mich.	1590
WCBS	New York, N.Y.	880
WCBT	Roanoke Rapids, N.C.	1230
WCBY	Cheboygan, Mich.	1240
WCCC	Hartford, Conn.	1290
WCCM	Lawrence, Mass.	800
WCCN	Neillsville, Wis.	1370
WCCO	Minneapolis, Minn.	830
WCCP	Savannah, Ga.	1450
WCDL	Carbondale, Pa.	1440
WCDJ	Edenton, N.C.	1260
WCDT	Winchester, Tenn.	1340
WCEC	Rocky Mount, N.C.	810
WCED	DuBois, Pa.	1420
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
WCGA	Calhoun, Ga.	900
WCGC	Belmont, N.C.	1270
WCHA	Chambersburg, Pa.	800
WCHB	Inkster, Mich.	1440
WCHI	Chillicothe, Ohio	1350
WCHJ	Brookhaven, Miss.	1470
WCHK	Canton, Ga.	1290
WCHO	Washington Court House, Ohio	1250
WCHL	Chapel Hill, N.C.	1360
WCHN	Norwich, N.Y.	970
WCHS	Charleston, W.Va.	580
WCHV	Charlottesville, Va.	1260
WCIL	Carbondale, Ill.	1020
WCIN	Cincinnati, Ohio	1480
WCJU	Columbia, Miss.	1450
WCKB	Dunn, N.C.	780
WCKI	Greer, S.C.	1300
WCKR	Miami, Fla.	610
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
WCLW	Mansfield, Ohio	1570
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
WCMW	Canton, Ohio	1060
WCMY	Ottawa, Ill.	1430
WCNB	Connersville, Ind.	1580
WCNC	Elizabeth City, N.C.	1240
WCNG	Canonsburg, Pa.	540
WCNH	Quincy, Fla.	1230
WCNR	Bloomsburg, Pa.	930
WCNT	Centralia, Ill.	1210
WCNU	Crestview, Fla.	1010
WCNX	Middletown, Conn.	1150
WCOA	Pensacola, Fla.	1370
WCOC	Meridian, Miss.	910
WCOG	Greensboro, N.C.	1320
WCOH	Newnan, Ga.	1400
WCOJ	Coatesville, Pa.	1420
WCOL	Columbus, Ohio	1230
WCOM	Parkersburg, W.Va.	1230
WCON	Cornelia, Ga.	1450
WCOP	Boston, Mass.	1150
WCOR	Lebanon, Tenn.	900
WCOS	Alma, Ga.	1400
WCOU	Lewiston, Maine	1240
WCOV	Montgomery, Ala.	1170
WCOW	Sparta, Wis.	1290
WCOY	Columbia, Pa.	1580
WCPA	Clearfield, Pa.	900
WCPC	Houston, Miss.	1320
WCPH	Etowah, Tenn.	1220
WCPM	Cumberland, Ky.	1280
WCPO	Cincinnati, Ohio	1230
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
WCRD	Johnstown, Pa.	1230
WCRR	Corinth, Miss.	1330
WCRS	Greenwood, S.C.	1450
WCRT	Birmingham, Ala.	1260
WCRV	Washington, N.J.	1580
WCRW	Chicago, Ill.	1240
WCRY	Macon, Ga.	900
WCSC	Charleston, S.C.	1390
WCSH	Portland, Maine	970
WCSI	Columbus, Ind.	1010
WCSS	Amsterdam, N.Y.	1490
WCTA	Andalusia, Ala.	920
WCTC	New Brunswick, N.J.	1450
WCTT	Corbin, Ky.	680
WCUB	Manitowoc, Wis.	980
WCUE	Akron, Ohio	1150
WCUM	Cumberland, Md.	1230
WCVA	Culpeper, Va.	1490
WCVI	Connellsville, Pa.	1340
WCVS	Springfield, Ill.	1450
WCWC	Ripon, Wis.	1600
WCYB	Bristol, Va.	690
WCYN	Cynthiana, Ky.	1400
WDAD	Indiana, Pa.	1450
WDAE	Tampa, Fla.	1250
WDAF	Kansas City, Mo.	610
WDAK	Columbus, Ga.	1340
WDAL	Meridian, Miss.	1330
WDAN	Danville, Ill.	1490
WDAR	Darlington, S.C.	1350
WDAS	Philadelphia, Pa.	1480
WDAT	South Daytona Beach, Fla.	1590
WDAX	McRae, Ga.	1410
WDAY	Fargo, N. Dak.	970
WDBC	Escanaba, Mich.	680
WDBF	Delray Beach, Fla.	1420
WDBJ	Roanoke, Va.	960
WDBL	Springfield, Tenn.	1590
WDBM	Statesville, N.C.	550
WDBO	Orlando, Fla.	580
WDBQ	Dubuque, Iowa	1490
WDCF	Dade City, Fla.	1350
WDCL	Tarpon Sprgs., Fla.	1470
WDCR	Hanover, N.H.	1340
WDDT	Greenville, Miss.	900
WDDY	Gloucester, Va.	1420
WDEC	Americus, Ga.	1290
WDEF	Chattanooga, Tenn.	1370
WDEH	Sweetwater, Tenn.	800
WDEL	Wilmington, Del.	1150
WDEV	Waterbury, Vt.	550
WDEW	Westfield, Mass.	1570
WDGY	Minneapolis, Minn.	1130
WDIA	Memphis, Tenn.	1070
WDIG	Dothan, Ala.	1450
WDIX	Orangeburg, S.C.	1150
WDKD	Kingstree, S.C.	1310
WDKN	Dickson, Tenn.	1260
WDLA	Walton, N.Y.	1270
WDLB	Marshfield, Wis.	1450
WDLC	Port Jervis, N.Y.	1490
WDLP	Panama City, Fla.	590
WDMF	Buford, Ga.	1460
WDMG	Douglas, Ga.	860
WDMJ	Marquette, Mich.	1320
WDNC	Durham, N.C.	620
WDNE	Elkins, W.Va.	1240
WDNG	Anniston, Ala.	1450
WDNT	Dayton, Tenn.	1280
WDOB	Canton, Miss.	1370
WDOC	Prestonsburg, Ky.	1310
WDOD	Chattanooga, Tenn.	1310
WDOE	Dunkirk, N.Y.	1410
WDOG	Marine City, Mich.	1590
WDOK	Cleveland, Ohio	1260
WDOL	Athens, Ga.	1470
WDON	Wheaton, Md.	1540
WDOR	Sturgeon Bay, Wis.	910
WDOS	Oneonta, N.Y.	730
WDOT	Burlington, Va.	1400
WDOV	Dover, Del.	1410
WDQN	DuQuoin, Ill.	1580
WDRC	Hartford, Conn.	1360
WDRF	Chester, Pa.	1590
WDSC	Dillon, S.C.	800
WDSG	Dyersburg, Tenn.	1450
WDSM	Superior, Wis.	710
WDSP	DeFuniak Springs, Florida	1280
WDSR	Lake City, Fla.	1340
WDSU	New Orleans, La.	1280
WDTV	St. John, V.I.	1190
WDUN	Gainesville, Ga.	1240
WDUX	Waupaca, Wis.	800
WDUZ	Green Bay, Wis.	1400
WDVA	Danville, Va.	1250
WDVH	Gainesville, Fla.	980
WDVM	Pocomoke City, Md.	540
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
WDZ	Decatur, Ill.	1050
WEAB	Greer, S.C.	800
WEAG	Alcoa, Tenn.	1470
WEAM	Arlington, Va.	1390
WEAN	Providence, R.I.	790
WEAS	Decatur, Ga.	1010
WEAT	W. Palm Beach, Fla.	850
WEAU	Eau Claire, Wis.	790
WEAV	Plattsburg, N.Y.	960
WEAW	Evanston, Ill.	1330
WEBB	Dundalk, Md.	1360
WEBC	Duluth, Minn.	560
WEBJ	Brewton, Ala.	1240
WEBO	Owego, N.Y.	1330
WEBQ	Harrisburg, Ill.	1240
WEBR	Buffalo, N.Y.	970
WEBY	Milton, Fla.	1330
WECL	Eau Claire, Wis.	1050
WEDC	Chicago, Ill.	1240
WEDO	McKeesport, Pa.	810
WEDR	Birmingham, Ala.	1220
WEEB	Southern Pines, N.C.	990
WEED	Rocky Mount, N.C.	1390
WEEI	Boston, Mass.	590

C.L.	Location	Kc.
WEEK	Peoria, Ill.	1350
WEEL	Fairfax, Va.	1310
WEEP	Pittsburgh, Pa.	1080
WEER	Warrenton, Va.	1570
WEEU	Reading, Pa.	850
WEEX	Easton, Pa.	1230
WEGO	Concord, N.C.	1410
WEHH	Elmira Heights-Horseheads, N. Y.	1590
WEIC	Charleston, Ill.	1270
WEIM	Fitchburg, Mass.	1280
WEIR	Weirton, W.Va.	1430
WEJL	Scranton, Pa.	630
WEKR	Fayetteville, Tenn.	1240
WEKY	Richmond, Ky.	1340
WEKZ	Monroe, Wis.	1260
WELC	Welch, W.Va.	1150
WELD	Fisher, W.Va.	690
WELI	New Haven, Conn.	960
WELK	Charlottesville, Va.	1010
WELL	Battle Creek, Mich.	1400
WELM	Elmira, N.Y.	1400
WELO	Tupelo, Miss.	1490
WELP	Easley, S.C.	1360
WELR	Roanoke, Ala.	1360
WELS	Kinston, N.C.	1010
WELY	Ely, Minn.	1450
WEMB	Erwin, Tenn.	1420
WEMP	Milwaukee, Wis.	1250
WENA	Bayamon, P.R.	1560
WENC	Whiteville, N.C.	1220
WEND	Baton Rouge, La.	1380
WENE	Endicott, N.Y.	1430
WENK	Union City, Tenn.	1240
WENN	Bessemer, Ala.	1450
WENO	Madison, Tenn.	1430
WENT	Gloversville, N.Y.	1340
WENY	Elmira, N.Y.	1230
WEOA	Evansville, Ind.	1400
WEOK	Poughkeepsie, N.Y.	1390
WEOL	Elyria, Ohio	930
WEPG	S. Pittsburgh, Tenn.	910
WEPM	Martinsburg, W.Va.	1340
WERC	Erie, Pa.	1260
WERD	Atlanta, Ga.	860
WERE	Cleveland, Ohio	1300
WERH	Hamilton, Ala.	970
WERI	Westerly, R.I.	1230
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
WETO	Gadsden, Ala.	930
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
WEW	St. Louis, Mo.	770
WEWO	Laurinburg, N.C.	1080
WEXL	Royal Oak, Mich.	1340
WEYE	Sanford, N.C.	1290
WEZB	Homewood, Ala.	1320
WEZE	Boston, Mass.	1260
WEZL	Richmond, Va.	1590
WEZN	Elizabethtown, Pa.	1600
WEZY	Cocoa, Fla.	1480
WFAA	Dallas, Tex.	570, 820
WFAH	Alliance, Ohio	1310
WFAR	Farrell, Pa.	1470
WFAS	White Plains, N.Y.	1230
WFAU	Augusta, Me.	1340
WFAX	Falls Church, Va.	1220
WFBC	Greenville, S.C.	1330
WFBF	Fernandina Bch., Fla.	1570
WFBG	Altoona, Pa.	1340
WFBL	Syracuse, N.Y.	1390
WFBM	Indianapolis, Ind.	1260
WFBR	Baltimore, Md.	1300
WFBS	Ft. Walton Bch., Fla.	950
WFDF	Flint, Mich.	910
WFDR	Manchester, Ga.	1370
WFEA	Manchester, N.Y.	1370
WFEB	Sylacauga, Ala.	1340
WFEC	Miami, Fla.	1220
WFGM	Fitchburg, Mass.	1580
WFGN	Gaffney, S.C.	1570
WFHG	Bristol, Va.	980
WFHK	Pell City, Ala.	1430
WFHR	Wis. Rapids, Wis.	1340
WFIG	Sumter, S.C.	1290
WFIL	Philadelphia, Pa.	560
WFIN	Findlay, Ohio	1330
WFIS	Fountain Inn, S.C.	1600
WFIW	Fairfield, Ill.	1390
WFKN	Franklin, Ky.	1220
WFKY	Frankfort, Ky.	1490
WFLA	Tampa, Fla.	970
WFLB	Fayetteville, N.C.	1490
WFLO	Farmville, Va.	870
WFLR	Dundee, N.Y.	1570
WFLW	Monticello, Ky.	1360
WFMC	Goldsboro, N.C.	730
WFMD	Frederick, Md.	930
WFMH	Cullman, Ala.	1460
WFMJ	Youngstown, Ohio	1390
WFMO	Fairmont, N.C.	860
WFMW	Madisonville, Ky.	730

C.L.	Location	Kc.
WFNC	Fayetteville, N.C.	1390
WFNM	DeFuniak Springs, Florida	1460
WFNS	Burlington, N.C.	1150
WFOB	Fostoria, Ohio	1430
WFOM	Marietta, Ga.	1230
WFOR	Hattiesburg, Miss.	1400
WFOX	Milwaukee, Wis.	860
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.	1430
WFRC	Reidsville, N.C.	1600
WFRL	Freeport, Ill.	1570
WFRM	Coudersport, Pa.	600
WFRO	Fremont, Ohio	900
WFRP	Savannah, Ga.	1230
WFRX	West Frankfort, Ill.	1300
WFSC	Franklin, N.C.	1050
WFST	Caribou, Maine	600
WFTC	Kinston, N.C.	960
WFTG	London, Ky.	1400
WFTL	Ft. Lauderdale, Fla.	1400
WFTM	Maysville, Ky.	1240
WFTR	Front Royal, Va.	1450
WFTW	Ft. Walton Beach, Florida	1260
WFUL	Fulton, Ky.	1270
WFUN	Huntsville, Ala.	1450
WFUR	Grand Rapids, Mich.	1570
WFVA	Fredericksburg, Va.	1230
WFVG	Fuquay Sprgs., N.C.	1460
WFWL	Camden, Tenn.	1220
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
WGAU	Athens, Ga.	1340
WGAW	Gardner, Mass.	1340
WGAY	Silver Spring, Md.	1050
WGBA	Columbus, Ga.	1270
WGBB	Freeport, N.Y.	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
WGCM	Gulfport, Miss.	1240
WGEA	Geneva, Ala.	1150
WGEE	Indianapolis, Ind.	1590
WGEM	Quincy, Ill.	1440
WGES	Chicago, Ill.	1390
WGET	Gettysburg, Pa.	1450
WGEZ	Beloit, Wis.	1490
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
WGHM	Skowegan, Maine	1150
WGHN	Grd. Haven, Mich.	1370
WGIG	Brunswick, Ga.	1440
WGIL	Galesburg, Ill.	1400
WGIR	Manchester, N.H.	610
WGIV	Charlotte, N.C.	1600
WGKA	Atlanta, Ga.	1600
WGKV	Charleston, W.Va.	1300
WGL	Fort Wayne, Ind.	1250
WGLC	Centreville, Miss.	1580
WGMA	Hollywood, Fla.	1320
WGMS	Washington, D.C.	570
WGN	Chicago, Ill.	720
WGNI	Wilmington, N.C.	1450
WGNS	Murfreesboro, Tenn.	1450
WGNY	Newburgh, N.Y.	1220
WGOA	Winter Garden, Fla.	1600
WGOL	Goldsboro, N.C.	1300
WGOR	Georgetown, Ky.	1580
WGOV	Valdosta, Ga.	950
WGPA	Bethlehem, Pa.	1100
WGPC	Albany, Ga.	1450
WGR	Buffalo, N.Y.	550
WGRA	Cairo, Ga.	790
WGRC	Louisville, Ky.	790
WGRD	Grand Rapids, Mich.	1410
WGRF	Aguadella, P.R.	1340
WGRM	Greenwood, Miss.	1240
WGRV	Greeneville, Tenn.	1340
WGRY	Gary, Ind.	1370
WGSA	Savannah, Ga.	1400
WGSM	Huntington, N.Y.	740
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
WGUS	North Augusta, S.C.	1600
WGUY	Bangor, Maine	1230
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

C.L.	Location	Kc.
WHA	Madison, Wis.	970
WHAB	Baxley, Ga.	1260
WHAI	Greenfield, Mass.	1240
WHAK	Rogers City, Mich.	960
WHAL	Shelbyville, Tenn.	1400
WHAM	Rochester, N.Y.	1180
WHAN	Charleston, S.C.	1340
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.	1450
WHAY	New Britain, Conn.	910
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
WHBI	Newark, N.J.	1280
WHBL	Sheboygan, Wis.	1330
WHBN	Harrodsburg, Ky.	1420
WHBO	Tampa, Fla.	1050
WHBQ	Memphis, Tenn.	560
WHBT	Harriman, Tenn.	1230
WHBU	Anderson, Ind.	1240
WHBY	Appleton, Wis.	1230
WHCC	Waynesville, N.C.	1400
WHCO	Sparta, Ill.	1230
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
WHEN	Syracuse, N.Y.	620
WHER	Memphis, Tenn.	1430
WHEY	Millington, Tenn.	1220
WHFB	Benton Harbor, Mich.	1060
WHFC	Cicero, Ill.	1450
WHGB	Harrisburg, Pa.	1400
WHGR	Houghton L., Mich.	1290
WHHH	Warren, Ohio	1440
WHHY	Montgomery, Ala.	1440
WHHM	Memphis, Tenn.	1340
WHIE	Griffin, Ga.	1320
WHIL	Medford, Mass.	1430
WHIM	E. 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
WHIY	Orlando, Fla.	1270
WHIZ	Zanesville, Ohio	1240
WHJB	Greensburg, Pa.	620
WHJC	Matawan, W.Va.	1360
WHK	Cleveland, Ohio	1420
WHKK	Akron, Ohio	640
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
WHLP	Centerville, Tenn.	1570
WHLS	Port Huron, Mich.	1450
WHLT	Huntington, Ind.	1300
WHMA	Anniston, Ala.	1390
WHMI	Howell, Mich.	1350
WHMP	Northampton, Mass.	1400
WHMS	Charleston, W.Va.	1490
WHNC	Henderson, N.C.	890
WHNY	McComb, Miss.	1250
WHO	Des Moines, Iowa	1040
WHOA	San Juan, P.R.	1400
WHOC	Philadelphia, Miss.	1490
WHOK	Lancaster, Ohio	1320
WHOL	Allentown, Pa.	600
WHOM	New York, N.Y.	1480
WHOO	Orlando, Fla.	990
WHOP	Hopkinsville, Ky.	1230
WHOS	Decatur, Ala.	800
WHOT	Campbell, Ohio	1570
WHOW	Clinton, Ill.	1520
WHP	Harrisburg, Pa.	580
WHPB	Belton, S.C.	1390
WHPE	High Point, N.C.	1070
WHRT	Hartselle, Ala.	860
WHRV	Ann Arbor, Mich.	1600
WHSC	Hartsville, S.C.	1450
WHSM	Hayward, Wis.	910
WHSY	Hattiesburg, Miss.	1230
WHTB	Talledega, Ala.	1230
WHTC	Holland, Mich.	1450
WHTG	Eatontown, N.J.	1410
WHTN	Huntington, W.Va.	800
WHUB	Cookeville, Tenn.	1400
WHUC	Hudson, N.Y.	1230
WHUM	Reading, Pa.	1240
WHUN	Huntington, Pa.	1150
WHVF	Wausau, Wis.	1230
WHVH	Henderson, N.C.	1450
WHVR	Hanover, Pa.	1280
WHWB	Rutland, Vt.	1000
WHXY	Bogalusa, La.	920
WHYE	Roanoke, Va.	910
WHYL	Carlisle, Pa.	960
WHYN	Springfield, Mass.	560
WHYS	Ocala, Fla.	1370
WIAC	San Juan, P.R.	580

C.L.	Location	Kc.
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
WIBR	Baton Rouge, La.	1300
WIBU	Poynette, Wis.	1240
WIBV	Belleville, Ill.	1260
WIBW	Topeka, Kans.	580
WIBX	Utica, N.Y.	950
WICA	Ashtabula, Ohio	970
WICC	Bridgeport, Conn.	600
WICE	Providence, R.I.	1290
WICH	Norwich, Conn.	1310
WICK	Scranton, Pa.	1400
WICO	Salisbury, Md.	1320
WICU	Erie, Pa.	1330
WICY	Malone, N.Y.	1490
WIDE	Biddeford, Maine	1400
WIDU	Fayetteville, N.C.	1600
WIEL	Elizabethtown, Ky.	1400
WIFM	Elkin, N.C.	1540
WIGM	Medford, Wis.	1490
WIIN	Decatur, Ga.	970
WIKB	Iron River, Mich.	1230
WIKC	Bogalusa, La.	1490
WIKE	Newport, Vt.	1490
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
WILZ	St. Petersburg Beach, Florida	1590
WIMA	Lima, Ohio	1150
WIMO	Winder, Ga.	1300
WIMS	Michigan City, Ind.	1420
WINA	Charlottesville, Va.	1400
WINC	Winchester, Va.	1400
WIND	Chicago, Ill.	560
WINE	Kenmore, N.Y.	1080
WINF	Manchester, Conn.	1230
WING	Dayton, Ohio	1410
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
WINX	Rockville, Md.	1600
WINZ	Miami, Fla.	940
WIOD	Sanford, Fla.	1360
WIOK	Mount Dora, Fla.	1580
WION	Ionia, Mich.	1430
WIOU	Kokomo, Ind.	1350
WIP	Philadelphia, Pa.	610
WIPC	Lake Wales, Fla.	1280
WIPR	San Juan, P.R.	940
WIPS	Ticonderoga, N.Y.	1250
WIRA	Fort Pierce, Fla.	1400
WIRB	Enterprise, Ala.	600
WIRC	Hickory, N.C.	630
WIRE	Indianapolis, Ind.	1430
WIRJ	Humboldt, Tenn.	740
WIRK	W. Palm Beach, Fla.	1290
WIRL	Peoria, Ill.	1290
WIRO	Ironton, Ohio	1230
WIRY	Plattsburg, N.Y.	1340
WIS	Columbia, S.C.	560
WISC	Madison, Wis.	1480
WISE	Asheville, N.C.	1310
WISH	Indianapolis, Ind.	1310
WISK	St. Paul, Minn.	1590
WISL	Shamokin, Pa.	1480
WISN	Milwaukee, Wis.	1150
WISO	Ponce, P.R.	1260
WISP	Kinston, N.C.	1230
WISR	Butler, Pa.	680
WIST	Charlotte, N.C.	930
WISV	Viroqua, Wis.	1360
WITA	San Juan, P.R.	1140
WITH	Baltimore, Md.	1230
WITT	Lewisburg, Pa.	1010
WITY	Danville, Ill.	980
WITZ	Jasper, Ind.	990
WIVI	Christiansted, V.I.	1040
WIVK	Knoxville, Tenn.	860
WIVV	Vieques, P.R.	1370
WIVY	Jacksonville, Fla.	1050
WIZE	Springfield, Ohio	1340
WIZZ	Streator, Ill.	1250
WJAC	Johnstown, Pa.	1400
WJAG	Norfolk, Nebr.	780
WJAK	Jackson, Tenn.	1460
WJAM	Marion, Ala.	1310
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.	1050
WJBB	Haleyville, Ala.	1230
WJBC	Bloomington, Ill.	1230
WJBD	Salem, Ill.	1350
WJBK	Detroit, Mich.	1500
WJBL	Holland, Mich.	1260
WJBO	Baton Rouge, La.	1150
WJBS	DeLand, Fla.	1490
WJBW	New Orleans, La.	1230
WJCD	Seymour, Ind.	1390

C.L.	Location	Kc.
WJCM	Sebring, Fla.	960
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, Ohio	1450
WJET	Erie, Pa.	1400
WJGD	Columbia, Tenn.	1280
WJHB	Talladega, Ala.	1580
WJHL	Johnson City, Tenn.	910
WJHO	Opelika, Ala.	1400
WJIG	Tullahoma, Tenn.	740
WJIM	Lansing, Mich.	1240
WJIV	Savannah, Ga.	900
WJJC	Commerce, Ga.	1270
WJJD	Chicago, Ill.	1160
WJJL	Niagara Falls, N.Y.	1440
WJJM	Lewisburg, Tenn.	1490
WJKO	Springfield, Mass.	1600
WJLB	Detroit, Mich.	1400
WJLD	Homewood, Ala.	1400
WJLK	Asbury Park, N.J.	1310
WJLS	Beckley, W.Va.	560
WJMA	Orange, Va.	1340
WJMB	Brookhaven, Miss.	1340
WJMC	Rice Lake, Wis.	1240
WJMJ	Philadelphia, Pa.	1540
WJMO	Cleveland, Ohio	1540
WJMR	New Orleans, La.	990
WJMS	Ironwood, Mich.	630
WJMW	Athens, Ala.	730
WJMX	Florence, S.C.	970
WJNC	Jacksonville, N.C.	1240
WJNO	W. Palm Beach, Fla.	1230
WJOB	Hammond, Ind.	1230
WJOC	Jamestown, N.Y.	1340
WJOE	Ward Ridge, Fla.	1570
WJOI	Florence, Ala.	1340
WJOL	Joliet, Ill.	1340
WJON	St. Cloud, Minn.	1240
WJOT	Lake City, S.C.	1260
WJOY	Burlington, Vt.	1230
WJPA	Washington, Pa.	1450
WJPD	Ishpeming, Mich.	1240
WJPF	Herrin, Ill.	1340
WJPG	Green Bay, Wis.	1440
WJPR	Greenville, Miss.	1330
WJPS	Evansville, Ind.	1330
WJQS	Jackson, Miss.	1400
WJR	Detroit, Mich.	760
WJRD	Tuscaloosa, Ala.	1150
WJRI	Lenoir, N.C.	1340
WJSB	Crestview, Fla.	1050
WJTN	Jamestown, N.Y.	1240
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
WKAB	Mobile, Ala.	840
WKAI	Macomb, Ill.	1510
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
WKAY	Glasgow, Ky.	1490
WKAZ	Charleston, W.Va.	950
WKBC	N. Wilkesboro, N.C.	810
WKBH	La Crosse, Wis.	1410
WKBI	St. Mary's, Pa.	1400
WKBJ	Milan, Tenn.	1600
WKBL	Covington, Tenn.	1250
WKBN	Youngstown, Ohio	570
WKBO	Harrisburg, Pa.	1230
WKBR	Manchester, N.H.	1240
WKBV	Richmond, Ind.	1490
WKBW	Buffalo, N.Y.	1520
WKBZ	Muskegon, Mich.	850
WKCB	Berlin, N.H.	1230
WKCT	Bowling Green, Ky.	930
WKDA	Nashville, Tenn.	1240
WKDK	Newberry, S.C.	1240
WKDL	Clarksdale, Miss.	1600
WKDN	Camden, N.J.	800
WKDX	Hamlet, N.C.	1400
WKEI	Kewanee, Ill.	1450
WKEN	Dover, Del.	1600
WKEU	Griffin, Ga.	1450
WKEY	Covington, Va.	1340
WKGN	Knoxville, Tenn.	1340
WKHM	Jackson, Mich.	970
WKIC	Hazard, Ky.	1430
WKID	Urbana, Ill.	1580
WKIK	Leonardtown, Md.	1370
WKIN	Kingsport, Tenn.	1320
WKIP	Poughkeepsie, N.Y.	1450
WKIS	Orlando, Fla.	740
WKIT	Mineola, N.Y.	1520
WKIX	Raleigh, N.C.	850
WKJB	Mayaguez, P.R.	710
WKJG	Fort Wayne, Ind.	1380
WKKO	Cocoa, Fla.	860
WKKS	Vanceburg, Ky.	1570
WKLA	Ludington, Mich.	1450
WKLC	St. Albans, W.Va.	1300
WKLE	Washington, Ga.	1370
WKLF	Clanton, Ala.	980
WKLK	Cloquet, Minn.	1230
WKLM	Wilmington, N.C.	980
WKLO	Louisville, Ky.	1080
WKLV	Blackstone, Va.	1440
WKLX	Paris, Ky.	1440
WKLY	Hartwell, Ga.	980
WKLZ	Kalamazoo, Mich.	1470
WKMC	Roaring Sprgs., Pa.	1370
WKMF	Flint, Mich.	1470
WKMH	Dearborn, Mich.	1310
WKMI	Kalamazoo, Mich.	1360
WKMT	Kings Mtn., N.C.	1220
WKNB	New Britain, Conn.	840
WKNE	Keene, N.H.	1290
WKNX	Saginaw, Mich.	1210
WKNY	Kingston, N.Y.	1490
WKOA	Hopkinsville, Ky.	1480
WKOK	Sunbury, Pa.	1240
WKOP	Binghamton, N.Y.	1360
WKOV	Wellston, Ohio	1330
WKOW	Madison, Wis.	1070
WKOX	Framingham, Mass.	1190
WKOY	Bluefield, W.Va.	1240
WKOZ	Kosciusko, Miss.	1350
WKPA	New Kensington, Pa.	1150
WKPT	Kingsport, Tenn.	1400
WKRC	Cincinnati, Ohio	550
WKRG	Mobile, Ala.	710
WKRM	Columbia, Tenn.	1340
WKRO	Cairo, Ill.	1490
WKRS	Waukegan, Ill.	1220
WKRT	Cortland, N.Y.	920
WKRZ	Oil City, Pa.	1340
WKSB	Milford, Del.	930
WKSR	Pulaski, Tenn.	1420
WKST	New Castle, Pa.	1280
WKTC	Charlotte, N.C.	1310
WKTF	Warrenton, Va.	1420
WKTG	Thomasville, Ga.	730
WKTL	Sheboygan, Wis.	950
WKTM	Mayfield, Ky.	1050
WKTQ	South Paris, Maine	1450
WKTX	Atlantic Beach, Fla.	1600
WKTY	LaCrosse, Wis.	580
WKUL	Cullman, Ala.	1340
WKVA	Lewistown, Pa.	920
WKVM	San Juan, P.R.	810
WKWF	Key West, Fla.	1600
WKWK	Wheeling, W.Va.	1400
WKXL	Concord, N.H.	1450
WKXV	Knoxville, Tenn.	900
WKXY	Sarasota, Fla.	930
WKY	Oklahoma City, Okla.	930
WKYB	Paducah, Ky.	570
WKYR	Keyser, W.Va.	1270
WKYW	Louisville, Ky.	900
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
WLAT	Conway, S.C.	1330
WLAU	Laurel, Miss.	1600
WLAV	Grand Rapids, Mich.	1340
WLAY	Muscle Shoals, Ala.	1450
WLBA	Gainesville, Ga.	1580
WLBB	Carrollton, Ga.	1100
WLBC	Muncie, Ind.	1340
WLBE	Leesburg, Fla.	790
WLBG	Laurens, S.C.	860
WLBH	Mattoon, Ill.	1170
WLBJ	Bowling Green, Ky.	1410
WLBK	DeKalb, Ill.	1360
WLBL	Auburndale, Wis.	930
WLBN	Lebanon, Ky.	1590
WLBR	Lebanon, Pa.	1270
WLBZ	Bangor, Maine	620
WLCK	Scottsville, Ky.	1250
WLCM	Lancaster, S.C.	1360
WLCO	Eustis, Fla.	1240
WLCS	Baton Rouge, La.	910
WLCX	LaCrosse, Wis.	1490
WLDB	Atlantic City, N.J.	1490
WLDS	Jacksonville, Ill.	1180
WLDY	Ladysmith, Wis.	1340
WLEA	Hornell, N.Y.	1480
WLEC	Sandusky, Ohio	1450
WLEE	Richmond, Va.	1480
WLEM	Emporium, Pa.	1250
WLEO	Ponce, P.R.	1170
WLET	Toccoa, Ga.	1420
WLEU	Erie, Pa.	1450
WLEW	Bad Axe, Mich.	1340
WLFA	Lafayette, Ga.	1590
WLFH	Little Falls, N.Y.	1230
WLIB	New York, N.Y.	1190
WLIK	Newport, Tenn.	1270
WLIL	Lenoir, Tenn.	730
WLIP	Kenosha, Wis.	1050
WLIS	Old Saybrook, Conn.	1420
WLIV	Livingston, Tenn.	920
WLLH	Lowell, Mass.	1400
WLLY	Richmond, Va.	1320
WLMJ	Jackson, Ohio	1280
WLNA	Peekskill, N.Y.	1420
WLNH	Laconia, N.H.	1350
WLOA	Braddock, Pa.	1550
WLOB	Portland, Maine	1310
WLOE	Leaksville, N.C.	1490
WLOF	Orlando, Fla.	950
WLOG	Logan, W.Va.	1230
WLOH	Princeton, W.Va.	1490
WLDI	LaPorte, Ind.	1540
WLOK	Memphis, Tenn.	1480
WLOL	Minneapolis, Minn.	1330
WLON	Lincolnton, N.C.	1050
WLOS	Asheville, N.C.	1380
WLOU	Louisville, Ky.	1350
WLOW	Portsmouth, Va.	1400
WLOX	Biloxi, Miss.	1490
WLPM	Suffolk, Va.	1450
WLPO	LaSalle, Ill.	1220
WLRP	New Albany, Ind.	1570
WLS	Chicago, Ill.	890
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
WLSV	Wellsville, N.Y.	790
WLTC	Gastonia, N.C.	1370
WLVA	Lynchburg, Va.	590
WLW	Cincinnati, Ohio	700
WLYC	Williamsport, Pa.	1050
WLYN	Lynn, Mass.	1360
WMAB	Munising, Mich.	1400
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
WMAX	Grand Rapids, Mich.	1480
WMAY	Springfield, Ill.	970
WMAZ	Macon, Ga.	940
WMBA	Ambridge, Pa.	1460
WMBC	Macon, Miss.	1400
WMBD	Peoria, Ill.	1470
WMBG	Richmond, Va.	1380
WMBH	Joplin, Mo.	1450
WMBI	Chicago, Ill.	1110
WMBL	Morehead City, N.C.	740
WMBM	Miami Beach, Fla.	800
WMBN	Petoskey, Mich.	1340
WMBO	Auburn, N.Y.	1340
WMBR	Jacksonville, Fla.	1460
WMBS	Uniontown, Pa.	590
WMC	Memphis, Tenn.	790
WMCA	New York, N.Y.	570
WMCH	Church Hill, Tenn.	1260
WMCK	McKeesport, Pa.	1360
WMCW	Harvard, Ill.	1600
WMDC	Hazlehurst, Miss.	1220
WMDD	Fajardo, P.R.	1490
WMDN	Midland, Mich.	1490
WMEG	Eau Gallie, Fla.	920
WMEN	Tallahassee, Fla.	1330
WMET	Miami Beach, Fla.	1490
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
WMFS	Chattanooga, Tenn.	1260
WMFT	Terre Haute, Ind.	1300
WMGA	Moultrie, Ga.	1400
WMGM	New York, N.Y.	1050
WMGR	Bainbridge, Ga.	930
WMGW	Meadville, Pa.	1490
WMGY	Montgomery, Ala.	800
WMIC	Monroe, Mich.	560
WMID	Atlantic City, N.J.	1340
WMIE	Miami, Fla.	1140
WMIK	Middlesboro, Ky.	560
WMIL	Milwaukee, Wis.	1290
WMIN	Mpls.-St. Paul, Minn.	1400
WMIQ	Iron Mountain, Mich.	1450
WMIS	Natchez, Miss.	1240
WMIX	Mt. Vernon, Ill.	940
WMJM	Cordele, Ga.	1490
WMLF	Pineville, Ky.	1230
WMLP	Milton, Pa.	1570
WMLS	Sylacauga, Ala.	1290
WMLT	Dublin, Ga.	1330
WMLY	Millville, N.J.	1440
WMMB	Melbourne, Fla.	1240
WMMH	Marshall, N.C.	1460
WMMN	Fairmont, W.Va.	920
WMMS	Bath, Maine	730
WMMT	McMinnville, Tenn.	1230
WMMW	Meriden, Conn.	1470
WMNA	Gretna, Va.	730
WMNB	No. Adams, Mass.	1230
WMNC	Morganton, N.C.	1430
WMNE	Menomonie, Wis.	1360
WMNF	Richwood, W.Va.	1280
WMNI	Columbus, Ohio	920
WMNS	Olean, N.Y.	1360
WMOA	Marietta, Ohio	1490
WMOD	Moundsville, W.Va.	1370
WMOG	Brunswick, Ga.	1490
WMOH	Hamilton, Ohio	1450
WMOK	Metropolis, Ill.	920
WMON	Montgomery, W.Va.	1340
WMOP	Ocala, Fla.	900
WMOR	Morehead, Ky.	1330
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
WMPS	Memphis, Tenn.	680
WMPT	So. Williamsport, Pa.	1450
WMRB	Greenville, S.C.	1490
WMRC	Milford, Mass.	1490
WMRE	Monroe, Ga.	1490
WMRF	Lewistown, Pa.	1490
WMRI	Marion, Ind.	860
WMRN	Marion, Ohio	1490
WMRO	Aurora, Ill.	1280
WMRP	Flint, Mich.	1570
WMSA	Massena, N.Y.	1340
WMSC	Columbia, S.C.	1320
WMSJ	Sylva, N.C.	1480
WMSL	Decatur, Ala.	1400
WMSN	Raleigh, N.C.	570
WMSR	Manchester, Tenn.	1320
WMST	Mt. Sterling, Ky.	1150
WMT	Cedar Rapids, Iowa	600
WMTA	Central City, Ky.	1380
WMTC	Vancleve, Ky.	730
WMTE	Manistee, Mich.	1340
WMTM	Moultrie, Ga.	1300
WMTN	Morristown, Tenn.	1300
WMTR	Morristown, N.J.	1250
WMTS	Murfreesboro, Tenn.	860
WMUS	Muskegon, Mich.	1090
WMUU	Greenville, S.C.	1260
WMVA	Martinsville, Va.	1450
WMVB	Millville, N.J.	1440
WMVG	Milledgeville, Ga.	1450
WMVO	Mt. Vernon, Ohio	1300
WMYB	Myrtle Beach, S.C.	1450
WMYN	Mayodan, N.C.	1420
WMYR	Ft. Myers, Fla.	1410
WNAB	Bridgeport, Conn.	1450
WNAC	Boston, Mass.	680
WNAD	Norman, Okla.	640
WNAE	Warren, Pa.	1310
WNAG	Grenada, Miss.	1400
WNAH	Nashville, Tenn.	1360
WNAK	Nanticoke, Pa.	730
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
WNBF	Binghamton, N.Y.	1290
WNBH	New Bedford, Mass.	1340
WNBP	Newburyport, Mass.	1470
WNBS	Murray, Ky.	1340
WNBT	Wellsboro, Pa.	1490
WNBZ	Saranac Lake, N.Y.	1240
WNCA	Siler City, N.C.	1570
WNCC	Barnesboro, Pa.	950
WNDB	Daytona Beach, Fla.	1150
WNDR	Syracuse, N.Y.	1260
WNDU	South Bend, Ind.	1490
WNEB	Worcester, Mass.	1230
WNEG	Taccoa, Ga.	1320
WNER	Live Oak, Fla.	1250
WNES	Central City, Ky.	1600
WNEW	New York, N.Y.	1130
WNEX	Macon, Ga.	1400
WNGO	Mayfield, Ky.	1320
WNHC	New Haven, Conn.	1340
WNIA	Cheektowaga, N.Y.	1230
WNIK	Arecibo, P.R.	1230
WNIL	Niles, Mich.	1290
WNJR	Newark, N.J.	1430
WNKY	Neon, Ky.	1480
WNLA	Indianola, Miss.	1380
WNLC	New London, Conn.	1490
WNLK	Norwalk, Conn.	1350
WNMP	Evanston, Ill.	1590
WNNC	Newton, N.C.	1230
WNNJ	Newton, N.J.	1360
WNNT	Warsaw, Va.	690
WNOE	New Orleans, La.	1060
WNOG	Naples, Fla.	1270
WNOK	Columbia, S.C.	1230
WNOP	Newport, Ky.	740
WNOR	Norfolk, Va.	1230
WNOS	High Point, N.C.	1590
WNOW	York, Pa.	1250
WNOX	Knoxville, Tenn.	990
WNPS	New Orleans, La.	1450
WNPT	Tuscaloosa, Ala.	1280
WNRG	Grundy, Va.	1250
WNRI	Woonsocket, R.I.	1380
WNRV	Narrows, Va.	990
WNSL	Laurel, Miss.	1260
WNTA	Newark, N.J.	970
WNVA	Norton, Va.	1350
WNVY	Pensacola, Fla.	1230
WNYC	New York, N.Y.	830
WNYS	Salamanca, N.Y.	1590
WNXT	Portsmouth, Ohio	1260
WOAI	San Antonio, Tex.	1200
WOAP	Owosso, Mich.	1080
WOAY	Oak Hill, W.Va.	860
WOBS	Jacksonville, Fla.	1360
WOBT	Rhinelander, Wis.	1240
WOC	Davenport, Iowa	1420
WOCB	W. Yarmouth, Mass.	1240
WOCH	North Vernon, Ind.	1460
WOHI	E. Liverpool, Ohio	1490
WOHO	Toledo, Ohio	1470
WOHP	Bellefontaine, Ohio	1390
WOHS	Shelby, N.C.	730
WOI	Ames, Iowa	640
WOIA	Saline, Mich.	1290
WOIC	Columbia, S.C.	1470
WOKE	Oak Ridge, Tenn.	1290
WOKK	Meridian, Miss.	1450

C.L.	Location	Kc.
WOKJ	Jackson, Miss.	1590
WOKO	Albany, N.Y.	1460
WOKY	Milwaukee, Wis.	920
WOKZ	Alton, Ill.	1570
WOL	Washington, D.C.	1450
WOLF	Syracuse, N.Y.	1490
WOLS	Florence, S.C.	1230
WOMI	Owensboro, Ky.	1490
WOMT	Manitowoc, Wis.	1240
WOND	Pleasantville, N.J.	1400
WONE	Dayton, Ohio	980
WONG	Oneida, N.Y.	1600
WONN	Lakeland, Fla.	1230
WONW	Defiance, Ohio	1280
WOOD	Grand Rapids, Mich.	1300
WOOF	Dothan, Ala.	560
WOOK	Washington, D.C.	1340
WOOO	Deland, Fla.	1310
WOOW	Washington, N.C.	1340
WOPA	Oak Park, Ill.	1490
WOPI	Bristol, Tenn.	1490
WOR	New York, N.Y.	710
WORA	Mayaguez, P.R.	1150
WORC	Worcester, Mass.	1310
WORD	Spartanburg, S.C.	910
WORK	York, Pa.	1350
WORL	Boston, Mass.	950
WORM	Savannah, Tenn.	1010
WORX	Madison, Ind.	1270
WOSC	Fulton, N.Y.	1300
WOSH	Oshkosh, Wis.	1490
WOSU	Columbus, Ohio	820
WOTR	Corry, Pa.	1370
WOTW	Nashua, N.H.	900
WOUB	Athens, Ohio	1340
WOV	New York, N.Y.	1280
WOVE	Welch, W.Va.	1340
WOW	Omaha, Nebr.	590
WOWL	Florence, Ala.	1240
WOWO	Ft. Wayne, Ind.	1190
WOXF	Oxford, N.C.	1340
WOZK	Ozark, Ala.	900
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
WPAT	Paterson, N.J.	930
WPAW	Pawtucket, R.I.	550
WPAX	Thomasville, Ga.	1240
WPAY	Portsmouth, Ohio	1400
WPAZ	Pottstown, Pa.	1370
WPBC	Minneapolis, Minn.	980
WPCC	Clinton, S.C.	1400
WPCF	Panama City, Fla.	1400
WPCO	Mt. Vernon, Ind.	1590
WPCT	Putnam, Conn.	1350
WPDM	Potsdam, N.Y.	1470
WPDQ	Jacksonville, Fla.	600
WPDR	Portage, Wis.	1350
WPDX	Clarksburg, W.Va.	750
WPEG	Arlington, Fla.	1220
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
WPFP	Park Falls, Wis.	1450
WPGC	Bradbury Hghts., Md.	1580
WPGW	Portland, Ind.	1440
WPHB	Philipsburg, Pa.	1260
WPIC	Sharon, Pa.	790
WPID	Piedmont, Ala.	1280
WPIK	Alexandria, Va.	730
WPIN	St. Petersburg, Fla.	680
WPIT	Pittsburgh, Pa.	730
WPKE	Pikeville, Ky.	1240
WPKO	Waverly, Ohio	1380
WPKY	Princeton, Ky.	1580
WPLA	Plant City, Fla.	910
WPLH	Huntington, W.Va.	1470
WPLM	Plymouth, Mass.	1390
WPLY	Plymouth, Wis.	1420
WPME	Punxsutawney, Pa.	1540
WPMP	Pascagoula, Miss.	1580
WPNC	Plymouth, N.C.	1470
WPNF	Brevard, N.C.	1240
WPNX	Phenix City, Ala.	1460
WPON	Pontiac, Mich.	1460
WPOP	Hartford, Conn.	1410
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
WPRT	Prestonsburg, Ky.	960
WPRO	Providence, R.I.	630
WPRP	Ponce, P.R.	910
WPRS	Paris, Ill.	1440
WPRW	Manassas, Va.	1460
WPRY	Perry, Fla.	1400
WPTF	Raleigh, N.C.	680
WPTR	Albany, N.Y.	1540
WPTS	Pittston, Pa.	1540
WPTW	Piqua, Ohio	1570
WPTX	Lexington Pk., Md.	920
WPUV	Pulaski, Va.	1580
WPVA	Colonial Hghts., Va.	1290
WPVL	Painesville, Ohio	1460
WQAM	Miami, Fla.	560
WQBC	Vicksburg, Miss.	1420
WQIC	Meridian, Miss.	1390
WQIK	Jacksonville, Fla.	1280
WQOK	Greenville, S.C.	1440
WQSN	Charleston, S.C.	1450
WQUA	Moline, Ill.	1230
WQUB	Galesburg, Ill.	1590
WQXI	Atlanta, Ga.	790
WQXQ	Ormond Bch., Fla.	1380
WQXR	New York, N.Y.	1560
WQXT	Palm Beach, Fla.	1340
WRAC	Racine, Wis.	1460
WRAD	Radford, Va.	1460
WRAG	Carrollton, Ala.	590
WRAJ	Anna, Ill.	1440
WRAK	Williamsport, Pa.	1400
WRAL	Raleigh, N.C.	1240
WRAM	Monmouth, Ill.	1330
WRAP	Norfolk, Va.	850
WRAW	Reading, Pa.	1340
WRAY	Princeton, Ind.	1250
WRBC	Jackson, Miss.	1300
WRBL	Columbus, Ga.	1420
WRC	Washington, D.C.	980
WRCA	New York, N.Y.	660
WRCD	Dalton, Ga.	1430
WRCO	Richland, Wis.	1450
WRCS	Ahoskie, N.C.	970
WRCV	Philadelphia, Pa.	1060N
WRDB	Reedsburg, Wis.	1400
WRDO	Augusta, Maine	1400
WRDW	Augusta, Ga.	1480
WREB	Holyoke, Mass.	930
WREC	Memphis, Tenn.	600
WREL	Lexington, Va.	1450
WREM	Remsen, N.Y.	1480
WREN	Topeka, Kans.	1250
WREV	Reidsville, N.C.	1220
WRFC	Athens, Ga.	960
WRFD	Worthington, Ohio	880
WRFS	Alexander City, Ala.	1050
WRGA	Rome, Ga.	1470
WRGR	Starke, Fla.	1490
WRGS	Rogersville, Tenn.	1370
WRHC	Jacksonville, Fla.	1400
WRHI	Rock Hill, S.C.	1340
WRIB	Providence, R.I.	1220
WRIC	Richlands, Va.	540
WRIG	Wausau, Wis.	1400
WRIO	Rio Piedras, P.R.	1320
WRIS	Roanoke, Va.	1410
WRIT	Milwaukee, Wis.	1340
WRIV	Riverhead, N.Y.	1390
WRJN	Racine, Wis.	1400
WRJW	Picayune, Miss.	1320
WRKD	Rockland, Maine	1450
WRKH	Rockwood, Tenn.	580
WRLD	Lanitt, Ala.	1490
WRMA	Montgomery, Ala.	950
WRMF	Titusville, Fla.	1050
WRMN	Elgin, Ill.	1410
WRNB	New Bern, N.C.	1490
WRNL	Richmond, Va.	910
WROA	Gulfport, Miss.	1390
WROB	West Point, Miss.	1450
WROD	Daytona Beach, Fla.	1340
WROK	Rockford, Ill.	1440
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
WRPB	Warner Robbins, Ga.	1350
WRR	Dallas, Tex.	1310
WRRF	Washington, N.C.	930
WRRR	Rockford, Ill.	1330
WRRZ	Clinton, N.C.	880
WRSA	Saratoga Sprgs., N.Y.	1280
WRSW	Warsaw, Ind.	1480
WRTA	Altoona, Pa.	1240
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
WRVM	Rochester, N.Y.	680
WRWB	Kissimmee, Fla.	1220
WRWJ	Selma, Ala.	1570
WRXO	Roxboro, N.C.	1430
WSAC	Radcliff, Ky.	1470
WSAI	Cincinnati, Ohio	1360
WSAJ	Grove City, Pa.	1340
WSAL	Logansport, Ind.	1230
WSAM	Saginaw, Mich.	1400
WSAN	Allentown, Pa.	1470
WSAR	Fall River, Mass.	1480
WSAT	nr. 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, Florida	1230
WSBC	Chicago, Ill.	1240
WSBS	Gt. Barrington, Mass.	860
WSBT	South Bend, Ind.	960
WSCM	Panama City Beach, Florida	1290
WSCR	Scranton, Pa.	1320
WSDB	Homestead, Fla.	1430
WSDR	Sterling, Ill.	1240
WSEV	Sevierville, Tenn.	930
WSFB	Quitman, Ga.	1490
WSFC	Somerset, Ky.	1240
WSFT	Thomaston, Ga.	1220
WSGA	Savannah, Ga.	1400
WSGC	Elberton, Ga.	1400
WSGN	Birmingham, Ala.	610
WSGW	Saginaw, Mich.	790
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	Douglas, Ga.	1310
WSJC	Magee, Miss.	1280
WSJM	St. Joseph, Mich.	1400
WSJS	Winston-Salem, N.C.	600
WSKI	Montpelier-Barre, Vt.	1240
WSKN	Saugerties, N.Y.	920
WSKP	Miami, Fla.	1450
WSKY	Asheville, N.C.	1230
WSLB	Ogdensburg, N.Y.	1400
WSLI	Jackson, Miss.	930
WSLM	Salem, Ind.	1220
WSLS	Roanoke, Va.	610
WSM	Nashville, Tenn.	650
WSMB	New Orleans, La.	1350
WSME	Sanford, Maine	1220
WSMI	Litchfield, Ill.	1540
WSMN	Nashua, N.H.	1590
WSMT	Sparta, Tenn.	1050
WSNJ	nr. Bridgeton, N.J.	1240
WSNT	Sandersville, Ga.	1490
WSNW	Seneca Twnshp., S.C.	1150
WSNY	Schenectady, N.Y.	1240
WSOC	Charlotte, N.C.	1240
WSON	Henderson, Ky.	860
WSOO	Slt. Ste. Marie, Mich.	1230
WSOY	Decatur, Ill.	1340
WSPA	Spartanburg, S.C.	950
WSPB	Sarasota, Fla.	1450
WSPD	Toledo, Ohio	1370
WSPN	Saratoga Sprgs., N.Y.	900
WSPR	Springfield, Mass.	1270
WSPT	Stevens Pt., Wis.	1010
WSRC	Durham, N.C.	1410
WSRS	Cleveland Hgts., Ohio	1490
WSRW	Hillsboro, Ohio	1590
WSSB	Durham, N.C.	1490
WSSC	Sumter, S.C.	1340
WSSO	Starkville, Miss.	1230
WSSV	Petersburg, Va.	1240
WSTA	Charlotte Amalie, V.I.	1340
WSTC	Stamford, Conn.	1400
WSTK	Woodstock, Va.	1230
WSTL	Eminence, Ky.	1600
WSTN	St. Augustine, Fla.	1420
WSTP	Salisbury, N.C.	1490
WSTR	Sturgis, Mich.	1230
WSTU	Suart, Fla.	1450
WSTV	Steubenville, Ohio	1340
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
WSVS	Crewe, Va.	800
WSWN	Belle Glade, Fla.	900
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
WTAG	Worcester, Mass.	580
WTAL	Tallahassee, Fla.	1270
WTAN	Clearwater, Fla.	1340
WTAO	Cambridge, Mass.	740
WTAQ	LaGrange, Ill.	1300
WTAR	Norfolk, Va.	790
WTAW	Bryan, Tex.	1150
WTAX	Springfield, Ill.	1240
WTAY	Robinson, Ill.	1570
WTBC	Tuscaloosa, Ala.	1230
WTBF	Troy, Ala.	970
WTBO	Cumberland, Md.	1450
WTCB	Flomaton, Ala.	990
WTCH	Shawano, Wis.	960
WTCJ	Tell City, Ind.	1230
WTCM	Traverse City, Mich.	1400
WTCN	Minneapolis, Minn.	1280
WTCO	Campbellsville, Ky.	1450
WTCR	Ashland, Ky.	1420
WTCS	Fairmont, W.Va.	1490
WTCW	Whitesburg, Ky.	920
WTEL	Philadelphia, Pa.	860
WTHE	Spartanburg, S.C.	1400
WTHG	Jackson, Ala.	1290
WTHI	Terre Haute, Ind.	1480
WTHR	Panama City, Fla.	1480
WTIC	Hartford, Conn.	1080
WTIF	Tifton, Ga.	1340
WTIG	Massillon, Ohio	900
WTIK	Durham, N.C.	1310
WTIL	Mayaguez, P.R.	1300
WTIM	Taylorville, Ill.	1410
WTIP	Charleston, W.Va.	1240
WTIX	New Orleans, La.	690
WTJH	East Point, Ga.	1260
WTJS	Jackson, Tenn.	1390
WTKM	Hartford, Wis.	1540
WTKO	Ithaca, N.Y.	1470
WTLB	Utica, N.Y.	1310
WTLG	Bowling Green, Ohio	730
WTLS	Tallasee, Ala.	1300
WTMA	Charleston, S.C.	1250
WTMC	Ocala, Fla.	1290
WTMJ	Milwaukee, Wis.	620
WTMP	Tampa, Fla.	1150
WTMT	Louisville, Ky.	620
WTNC	Thomasville, N.C.	790
WTND	Orangeburg, S.C.	920
WTNJ	Trenton, N.J.	1300
WTNS	Coshocton, Ohio	1560
WTNT	Tallahassee, Fla.	1450
WTOB	Winston-Salem, N.C.	1380
WTOC	Savannah, Ga.	1290
WTOD	Toledo, Ohio	1560
WTOE	Spruce Pine, N.C.	1470
WTOL	Toledo, Ohio	1230
WTON	Staunton, Va.	1240
WTOP	Washington, D.C.	1500
WTOR	Torrington, Conn.	1490
WTOT	Marianna, Fla.	980
WTPR	Paris, Tenn.	710
WTRA	Latrobe, Pa.	1480
WTRB	Ripley, Tenn.	1570
WTRC	Elkhart, Ind.	1340
WTRL	Bradenton, Fla.	1490
WTRN	Tyrone, Pa.	1290
WTRO	Dyersburg, Tenn.	1330
WTRP	LaGrange, Ga.	620
WTRR	Sanford, Fla.	1400
WTRU	Muskegon, Mich.	1600
WTRW	Two Rivers, Wis.	1590
WTRX	Bellaire, Ohio	1290
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
WTSP	St. Petersburg, Fla.	1380
WTSV	Claremont, N.H.	1230
WTTB	Vero Beach, Fla.	1490
WTTH	Port Huron, Mich.	1380
WTTL	Madisonville, Ky.	1310
WTTM	Trenton, N.J.	920
WTTN	Watertown, Wis.	1580
WTTR	Westminster, Md.	1470
WTTS	Bloomington, Ind.	1370
WTUC	Union City, Tenn.	1580
WTUG	Tuscaloosa, Ala.	790
WTUP	Tupelo, Miss.	1380
WTUS	Tuskegee, Ala.	580
WTUX	Wilmington, Del.	1290
WTVB	Coldwater, Mich.	1590
WTVL	Waterville, Maine	1490
WTVN	Columbus, Ohio	610
WTWA	Thomson, Ga.	1240
WTWB	Auburndale, Fla.	1570
WTWN	St. Johnsbury, Vt.	1340
WTXL	W. Spgfd., Mass.	1490
WTYC	Rock Hill, S.C.	1150
WTYM	East Longmeadow, Mass.	1600
WTYN	Tryon, N.C.	1580
WTYS	Marianna, Fla.	1340
WULA	Eufaula, Ala.	1240
WUSJ	Lockport, N.Y.	1340
WUST	Bethesda, Md.	1120
WVAM	Altoona, Pa.	1430
WVCG	Coral Gables, Fla.	1070
WVCH	Chester, Pa.	740
WVEC	Hampton, Va.	1490
WVET	Rochester, N.Y.	1280
WVIM	Vicksburg, Miss.	1490
WVIP	Mt. Kisco, N.Y.	1310
WVJP	Caguas, P.R.	1110
WVJS	Owensboro, Ky.	1420
WVKO	Columbus, Ohio	1580
WVLK	Lexington, Ky.	590
WVLN	Olney, Ill.	740
WVMC	Mt. Carmel, Ill.	1360
WVMI	Biloxi, Miss.	570
WVNA	Tuscumbia, Ala.	1590
WVNJ	Newark, N.J.	620
WVOK	Birmingham, Ala.	690
WVOL	Nashville, Tenn.	1470
WVOP	Vidalia, Ga.	970
WVOS	Liberty, N.Y.	1240
WVOT	Wilson, N.C.	1420
WVOW	Logan, W.Va.	1290
WVPO	Stroudsburg, Pa.	840
WVSC	Somerset, Pa.	990
WVVW	Grafton, W.Va.	1260
WWBC	Bay City, Mich.	1250
WWBD	Bamberg, S.C.	790
WWBZ	Vineland, N.J.	1360
WWCA	Gary, Ind.	1270
WWCC	Bremen, Ga.	1440
WWCO	Waterbury, Conn.	1240
WWDC	Washington, D.C.	1260
WWES	New Rochelle, N.Y.	1460
WWGP	Sanford, N.C.	1050
WWGS	Tifton, Ga.	1430
WWHG	Hornell, N.Y.	1320
WWIL	Ft. Lauderdale, Fla.	1580
WWIN	Baltimore, Md.	1400
WWIT	Canton, N.C.	970
WWIZ	Lorain, Ohio	1380
WWJ	Detroit, Mich.	950
WWJB	Brooksville, Fla.	1450
WWKY	Winchester, Ky.	1380
WWL	New Orleans, La.	870
WWNC	Asheville, N.C.	570
WWNH	Rochester, N.H.	930
WWNR	Beckley, W.Va.	620
WWNS	Statesboro, Ga.	1240
WWNY	Watertown, N.Y.	790
WWOD	Lynchburg, Va.	1390
WWOK	Charlotte, N.C.	1480
WWOL	Buffalo, N.Y.	1120
WWON	Woonsocket, R.I.	1240

C.L.	Location	Kc.
WWPA	Williamsport, Pa.	1340
WWPF	Palatka, Fla.	1260
WWRI	W. Warwick, R.I.	1450
WWRL	Woodside, N.Y.	1600
WWSC	Glens Falls, N.Y.	1450
WWSR	St. Albans, Vt.	1420
WWST	Wooster, Ohio	960
WWSW	Pittsburgh, Pa.	970
WWTB	Tampa, Fla.	1300
WWVA	Wheeling, W.Va.	1170
WWWB	Jasper, Ala.	1360
WWWF	Fayette, Ala.	990
WWWR	Russellville, Ala.	920
WWWW	Rio Piedras, P.R.	1520
WWXL	Manchester, Ky.	1580
WWYO	Pineville, W.Va.	970
WXAL	Demopolis, Ala.	1400
WXGI	Richmond, Va.	950
WXLI	Dublin, Ga.	1440
WXLW	Indianapolis, Ind.	950
WXOK	Baton Rouge, La.	1260
WXRF	Guayama, P.R.	1590
WXXX	Hattiesburg, Miss.	1310
WXYZ	Detroit, Mich.	1270
WYCL	York, S.C.	1580
WYDE	Birmingham, Ala.	850
WYFE	New Orleans, La.	600
WYLD	New Orleans, La.	940
WYMB	Manning, S.C.	1410
WYSE	Lakeland, Fla.	1330
WYSR	Franklin, Va.	1250
WYTH	Madison, Ga.	1250
WYTI	Rocky Mount, Va.	1570
WYUO	Newport News, Va.	1270
WYVE	Wytheville, Va.	1280
WYZE	Atlanta, Ga.	1480
WZIP	Covington, Ky.	1050
WZKY	Albemarle, N.Dak.	1580
WZOB	Ft. Payne, Ala.	1250
WZOK	Jacksonville, Fla.	1320
WZRO	Jacksonville Beach, Florida	1010
WZYX	Cowan, Tenn.	1440

Canada

C.L.	Location	Kc.
CBA	Sackville, N.B.	1070
CBAF	Moncton, N.B.	1300
CBE	Windsor, Ont.	1550
CBF	Montreal, Que.	690
CBG	Gander, Nfld.	1450
CBH	Halifax, N.S.	1330
CBI	Sydney, N.S.	1140
CBJ	Chicoutimi, Que.	1580
CBK	Regina, Sask.	540
CBL	Toronto, Ont.	740
CBM	Montreal, Que.	940
CBN	St. John's, Nfld.	640
CBO	Ottawa, Ont.	910
CBT	Grand Falls, Nfld.	990
CBU	Vancouver, B.C.	690
CBV	Quebec, Que.	980
CBW	Winnipeg, Man.	990
CBX	Edmonton, Alta.	1010
CBXA	Edmonton, Alta.	740
CBY	Corner Brook, Nfld.	790
CFAB	Windsor, N.S.	1450
CFAC	Calgary, Alta.	960
CFAM	Altona, Man.	1290
CFAR	Flin Flon, Man.	590
CFBC	Saint John, N.B.	930
CFBR	Sudbury, Ont.	550
CFCF	Montreal, Que.	600
CFCH	North Bay, Ont.	600
CFCL	Timmins, Ont.	580
CFCN	Calgary, Alta.	1060
CFCO	Chatham, Ont.	630
CFCW	Camrose, Alta.	1230
CFCY	Charlottetown, P.E.I.	630
CFDA	Victoriaville, Que.	1380
CFGP	Grande Prairie, Alta.	1050
CFGR	Gravelbourg, Sask.	1230
CFGT	St. Joseph d'Alma, Que.	1270
CFJB	Brampton, Ont.	1090
CFJC	Kamloops, B.C.	910
CFJR	Brockville, Ont.	1450
CFKL	Schefferville, Que.	1230
CFNB	Fredericton, N.B.	550
CFNS	Saskatoon, Sask.	1170
CFOB	Fort Frances, Ont.	800
CFOR	Orillia, Ont.	1570
CFOS	Owen Sound, Ont.	560
CFPA	Port Arthur, Ont.	1230
CFPL	London, Ont.	980
CFPR	Prince Rupert, B.C.	1240
CFQC	Saskatoon, Sask.	600
CFRA	Ottawa, Ont.	560
CFRB	Toronto, Ont.	1010
CFRC	Kingston, Ont.	1490
CFRG	Gravelbourg, Sask.	710
CFRN	Edmonton, Alta.	1260
CFRS	Simcoe, Ont.	1560
CFRY	Portage la Prairie, Man.	1570
CFSL	Weyburn, Sask.	1340
CFUN	Vancouver, B.C.	1410
CHAB	Moose Jaw, Sask.	800
CHAD	Amos, Que.	1340
CHAT	Medicine Hat, Alta.	1270
CHED	Edmonton, Alta.	1080
CHEF	Granby, Que.	1450
CHEX	Peterborough, Ont.	980
CHFA	Edmonton, Alta.	680
CHGB	St. Anne de la Pocatiere, Que.	1350
CHLN	Three Rivers, Que.	550
CHLO	St. Thomas, Ont.	680
CHLP	Montreal, Que.	1410
CHLT	Sherbrooke, Que.	630
CHML	Hamilton, Ont.	900
CHNC	New Carlisle, Que.	610
CHNO	Sudbury, Ont.	900
CHNS	Halifax, N.S.	960
CHOK	Sarnia, Ont.	1070
CHOV	Pembroke, Ont.	1350
CHOW	Welland, Ontario	1470
CHRC	Quebec, Que.	800
CHRD	Drummondville, Que.	1340
CHRL	Roberval, Que.	910
CHRS	St. Jean, Que.	1090
CHSJ	Saint John, N.B.	1150
CHUB	Nanaimo, B.C.	1570
CHUC	Port Hope, Ont.	1500
CHUM	Toronto, Ont.	1050
CHVC	Niagara Falls, Ont.	1600
CHWK	Chilliwack, B.C.	1270
CHWO	Oakville, Ont.	1250
CJAD	Montreal, Que.	800
CJAT	Trail, B.C.	610
CJAV	Port Alberni, B.C.	1240
CJBC	Toronto, Ont.	860
CJBQ	Belleville, Ont.	800
CJBR	Rimouski, Que.	900
CJCA	Edmonton, Alta.	930
CJCB	Sydney, N.S.	1270
CJCH	Halifax, N.S.	920
CJCS	Stratford, Ont.	1240
CJDC	Dawson Creek, B.C.	1350
CJEM	Edmundston, N.B.	570
CJET	Smiths Falls, Ont.	630
CJFP	Riviere du Loup, Que.	1400
CJFX	Antigonish, N.S.	580
CJGX	Yorkton, Sask.	940
CJIB	Vernon, B.C.	940
CJIC	Sault Ste. Marie, Ont.	1050
CJKL	Kirkland Lake, Ont.	560
CJLS	Yarmouth, N.S.	1340
CJMS	Montreal, Que.	1280
CJMT	Chicoutimi, Que.	1420
CJNB	N. Battleford, Sask.	1460
CJNR	Blind River, Ont.	730
CJOB	Winnipeg, Man.	680
CJOC	Lethbridge, Alta.	1220
CJON	St. John's, Nfld.	930
CJOR	Vancouver, B.C.	600
CJOY	Guelph, Ont.	1450
CJQC	Quebec, Que.	1340
CJRH	Richmond Hill, Ont.	1300
CJRL	Kenora, Ont.	1220
CJRW	Summerside, P.E.I.	1240
CJSO	Sorel, Que.	1320
CJSP	Leamington, Ont.	710
CJVI	Victoria, B.C.	900
CKAC	Montreal, Que.	730
CKAR	Huntsville, Ont.	590
CKBB	Barrie, Ont.	950
CKBC	Bathurst, N.B.	1400
CKBI	Prince Albert, Sask.	900
CKBL	Matane, Que.	1250
CKBM	Montmagny, Que.	1490
CKBW	Bridgewater, N.S.	1000
CKCH	Hull, Que.	970
CKCK	Regina, Sask.	620
CKCL	Truro, N.S.	600
CKCQ	Quesnel, B.C.	570
CKCR	Kitchener, Ont.	1490
CKCV	Quebec, Que.	1280
CKCW	Moncton, N.B.	1220
CKCY	Sault Ste. Marie, Ont.	1400
CKDA	Victoria, B.C.	1220
CKDH	Amherst, N.S.	1400
CKDM	Dauphin, Man.	730
CKEC	New Glasgow, N.S.	1230
CKEK	Cranbrook, B.C.	570
CKEN	Kentville, N.S.	1350
CKEY	Toronto, Ont.	580
CKFH	Toronto, Ont.	1400
CKGB	Timmins, Ont.	680
CKGR	Galt, Ont.	1110
CKJL	St. Jerome, Que.	900
CKLB	Oshawa, Ont.	1350
CKLC	Kingston, Ont.	1380
CKLD	Thetford Mines, Que.	1230
CKLG	N. Vancouver, B.C.	730
CKLN	Nelson, B.C.	1390
CKLS	LaSarre, Que.	1240
CKLW	Windsor, Ont.	800
CKLY	Lindsay, Ont.	910
CKMR	Newcastle, N.B.	790
CKMX	Gorse Crown, Nfld.	600
CKNB	Campbellton, N.B.	950
CKNW	New Westminster, British Columbia	980
CKNX	Wingham, Ont.	920
CKOC	Hamilton, Ont.	1150
CKOK	Penticton, B.C.	800
CKOM	Saskatoon, Sask.	1420
CKOT	Tillsonburg, Ont.	1510
CKOV	Kelowna, B.C.	630
CKOX	Woodstock, Ont.	1340
CKOY	Ottawa, Ont.	1310
CKPC	Brantford, Ont.	1380
CKPG	Prince George, B.C.	550
CKPR	Fort William, Ont.	580
CKRB	Ville St. Georges, Que.	1250
CKRC	Winnipeg, Man.	630
CKRD	Red Deer, Alta.	850
CKRM	Regina, Sask.	980
CKRN	Rouyn, Que.	1400
CKRS	Jonquiere, Que.	590
CKSA	Lloydminster, Alta.	1150
CKSB	St. Boniface, Man.	1050
CKSF	Cornwall, Ont.	1220
CKSL	London, Ont.	1290
CKSM	Shawinigan Falls, Quebec	1220
CKSO	Sudbury, Ont.	790
CKSW	Swift Current, Sask.	1400
CKTB	St. Catharines, Ont.	610
CKTR	Three Rivers, Que.	1150
CKTS	Sherbrooke, Que.	900
CKUA	Edmonton, Alta.	580
CKVD	Val d'Or, Que.	1230
CKVL	Verdun, Que.	850
CKVM	Ville Marie, Que.	710
CKWS	Kingston, Ont.	960
CKWX	Vancouver, B.C.	1130
CKX	Brandon, Man.	1150
CKXL	Calgary, Alta.	1140
CKY	Winnipeg, Man.	580
CKYL	Peace River, Alta.	630
VOAR	St. John's, Nfld.	1230
VOCM	St. John's, Nfld.	590
VOWR	St. John's, Nfld.	800

Mexican and Cuban AM Stations

Abbreviations: C.L., call letters; Kc., frequency in kilocycles; W.P., watt power

Mexico

BAJA CALIFORNIA

Location	C.L.	Kc.	W.P.
Ensenada	XEPF	1400	250
Mexicali	XED	1050	5000
	XEAA	1340	250
	XEAO	910	250
	XECL	990	5000
	XEGE	1570	1000
Tijuana	XEC	1310	250
	XEAC	690	50000
	XEAU	1470	5000
	XEAZ	1270	500
	XEBG	1550	1000
	XEGM	950	2500
	XEMO	860	5000
	XEXX	1420	2000

CHIHUAHUA

Location	C.L.	Kc.	W.P.
Chihuahua	XEM	1390	500
	XEBU	620	1000
	XEBW	1280	1000
	XEFI	1440	1000
	XERA	1490	250
Ciudad Camargo	XEHA	580	1000
Ciudad Delicias	XEBN	1240	250
	XEJK	1340	250
Ciudad Juarez	XEF	1420	250
	XEJ	970	5000
	XEP	1300	500
	XEFV	1240	250
	XELO	800	150000
	XEWG	1490	250
	XEYC	1460	1000
Hidalgo	XEJS	1150	500
N. Casas Grandes	XETX	1010	250

COAHUILA

Location	C.L.	Kc.	W.P.
Ciudad Acuna	XEKD	1010	1000
Monclova	XEMF	1260	250
Piedras Negras	XEMJ	920	1000
	XEMU	580	5000
Sabinas	XEBK	610	5000
Saltillo	XESJ	1250	500
	XESG	1510	1000
Torreon	XEBP	1310	5000
Villa Acuna	XEDH	1340	250
	XERF	1570	150000

DISTRITO FEDERAL

Location	C.L.	Kc.	W.P.
Mexico City	XEL	1260	5000
	XEN	690	20000
	XEQ	940	150000
	XEW	900	250000
	XEX	730	500000
	XEFR	1180	5000
	XEJP	1150	10000
	XELA	830	10000
	XELZ	1440	5000
	XEMX	1380	5000
	XENK	620	5000
	XEOY	1000	50000
	XEPH	590	5000
	XEQK	1350	1000
	XEQR	1030	10000
	XERC	790	1000
	XERCN	1110	50000
	XERH	1500	50000
	XERPM	660	10000
	XESM	1470	10000
	XEUN	860	5000

DURANGO

Location	C.L.	Kc.	W.P.
Durango	XEDU	860	1000

NUEVO LEON

Location	C.L.	Kc.	W.P.
Linares	XER	1260	250
Monterrey	XEG	1050	150000
	XEH	1420	1000
	XET	990	5000
	XEAR	1480	1000
	XEAW	1280	1000
	XEFB	630	5000
	XEMR	1370	300
	XEOK	920	500

SAN LUIS POTOSI

Location	C.L.	Kc.	W.P.
San Luis Potosi	XEWA	540	150000

SONORA

Location	C.L.	Kc.	W.P.
Agua Prieta	XEAQ	1490	250
	XEFH	1310	1000
Cananea	XEFQ	980	500
Ciudad Obregon	XEOX	1430	1000
Hermosillo	XEBH	920	5000
	XEDL	1250	500
	XEDM	1580	50000
	XEHQ	590	500
Magdalena	XEDJ	1450	100
Naco	XETM	1350	1000
Nogales	XEHF	1370	5000
San Luis	XECB	1450	250
Santa Ana	XEAB	1400	250

TAMAULIPAS

Location	C.L.	Kc.	W.P.
Matamoros	XEO	970	1000
	XEAM	1450	250
	XEMT	1340	250
Nuevo Laredo	XEAS	1410	250
	XEBK	1340	100
	XEDF	790	1000
	XEFE	960	1000
	XERG	1090	2500
	XEXO	1550	50000
Reynosa	XEOR	1390	1000
	XERT	590	5000
Rio Bravo	XEFD	1170	1000
Tampico	XEFW	810	50000

Cuba

Location	C.L.	Kc.	W.P.
Camaguey	CMJB	880	1000
	CMJL	920	5000
	CMJN	960	1000
	CMJE	1000	1000
	CMJR	1030	1000
	CMJC	1270	1000
	CMJF	1340	1000
Camajuani	CMHD	890	1000
Ciego de Avila	CMJY	760	1000
Habana	CMW	550	2500
	CMCY	590	15000
	CMQ	630	25000
	CMCU	660	1000
	CMBC	690	50000
	CMCD	740	10000
	CMCH	790	10000
	CMBZ	830	5000
	CMBL	860	15000
	CMCF	910	10000
	CMBF	950	5000
	CMCK	980	5000
	CMBQ	1010	5000
	CMCX	1060	10000
	CMCA	1150	10000
	CMCB	1330	1000
Holguin	CMKJ	730	5000
Holguin Orte	CMKM	560	5000
	CMKV	600	1000
	CMKD	970	1000
	CMDC	1290	1000
Marianao	CMZ	1560	5000
Pinar del Rio	CMAB	760	5000
	CMAN	840	1000
	CMAQ	920	1000
Santa Clara	CMHI	570	10000
	CMHQ	640	15000
	CMHW	810	1000
	CMHO	1310	1000
	CMHM	1130	1000
Sancti Spiritus	CMHT	990	1000
Santiago	CMDA	650	1000
	CMKC	770	1000
	CMKW	800	2000
	CMKU	850	2000
	CMKN	930	1000
	CMKB	1170	1000

World-Wide Short-Wave Stations

Active and Most Commonly Heard in U. S., Listed by Frequency

(For all Canadian Short-Wave Stations, see separate listing, p. 188) Abbreviations: Kc., frequency in kilocycles (to change to megacycles, divide by 1000); C.L. call letters. Due to malfunction of transmitter, interference by other stations, jamming, variance in propagational conditions, or reallocation of frequencies, stations may use other frequencies than those given. The abbreviation (VOA) denotes Voice of America.

The symbol ● denotes stations beaming regular evening broadcasts to the United States.

Kc.	C.L.	Location
3275	VP4RD	Port-of-Spain, Trinidad
3300		Belize, Brit. Honduras
3320	YVQG	Barcelona, Venez.
3330	YVQL	El Tigre, Venez.
3340	YVMV	Carora, Venez.
3350	YVKT	Caracas, Venez.
3360	YVOC	San Cristobal, Vz.
3360	ZQI	Kingston, Jamaica
3365		Grenada, Windward Is.
3370	YVMI	Maracaibo, Venez.
3380	YVQN	Puerto La Cruz, Vz.
3390	YVKX	Caracas, Venez.
3400	YVKP	Caracas, Venez.
3410	YVMK	Cabimas, Venez.
3420	YVOE	Merida, Venez.
3440	YVLI	Maracay, Venez.
3460	YVLC	Valencia, Venez.
3480	YVLE	Puerto Cabello, Vz.
3490	YVRA	Maturin, Venez.
3620	YVLG	Maracay, Venez.
3980		Suva, Fiji Islands
4650	HC2AJ	Guayaquil, Ecua.
4752	YVMA	Maracaibo, Venez.
4768	HJEF	Cali, Colombia
4775	HJGB	Bucaramanga, Col.
4783	HJAB	Barranquilla, Col.
4790	YVQC	Ciudad Bolivar, Vz.
4797	HJFU	Armenia, Colombia
4800	YVME	Maracaibo, Venez.
4805	ZYS8	Manaos, Brazil
4810	YVMG	Maracaibo, Venez.
4815	HJBB	Cucuta, Col.
4820	XEJG	Guadalajara, Mex.
4820	YVNB	Coro, Venez.
4830	YVOA	San Cristobal, Vez.
4835	HJKE	Bogota, Colombia
4840	YVOI	Valera, Venez.
4845	CSA93	Ponta Delgada, Az.
4848	HJGF	Bucaramanga, Col.
4850	YVMS	Barquisimeto, Vz.
4855	HJFN	Neiva, Colombia
4860	JKL	Tokyo, Japan
4860	YVPA	San Filipe, Venez.
4865	PRC5	Belem, Para, Brazil
4865	HJFA	Pereira, Colombia
4871	HJBG	Cucuta, Colombia
4880	YVKF	Caracas, Venez.
4892	YVKB	Caracas, Venez.
4895	HJCH	Bogota, Col.
4895	PRF6	Manaos, Brazil
4897	VLX4	Perth, Aust.
4900	YVQE	Ciudad Bolivar, Vz.
4903	HJAG	Barranquilla, Col.
4907	YVMM	Coro, Venez.
4910	JKI	Nazaki, Japan
4910	YDB2	Djakarta, Indon.
4915		Accra, Ghana
4915	YVKR	Caracas, Venez.
4917	HI9B	Santiago, Dom.Rep.
4917	VLM4	Brisbane, Aus.
4930	HJAP	Cartagena, Col.
4940	JKM	Kawachi, Japan
4940	YVMQ	Barquisimeto, Vz.
4945	HJCW	Bogota, Col.
4950	ZQI	Kingston, Jamaica
4951		Dakar, Senegal
4960	YVQA	Cumana, Venez.
4967	HJAE	Cartagena, Col.
4970	YVLK	Caracas, Venez.
4985	YVMO	Barquisimeto, Vz.
4993	HIIA	Santiago, D.Rep.
5010		Grenada, Windward Is.
5014	PJC3	Willimstad, Curac.
5020	HJFW	Manizales, Col.
5023	HI8Z	Santiago, D.Rep.
5030	YVKM	Caracas, Venez.
5045	ZYP23	Petropolis, Brazil
5050	YVKD	Caracas, Venez.
5053	HI2L	Ciudad Trujillo, D.R.
5055	HJDW	Medellin, Col.
5075	HJKH	Sutatenza, Colom.
5758	PZH5	Paramaribo, Surinam
5880	HRN	Tegucigalpa, Hond.
5920	HRA	Tegucigalpa, Hond.
5940		Khabarovsk, U.S.S.R.
5940		Moscow, U.S.S.R.
5952	TGNA	Guatemala, Guat.
5960	HJCF	Bogota, Colombia
5965		Shanghai, China
5969	HVJ	Vatican City
5970	HI4T	Ciudad Trujillo, D.R.
5981	ZFY	Georgetown, Br.Gui.
5985		Radio Free Europe, Munich, Germany
5990	TGJA	Guatemala, Guat.
5995	HO50	Panama, Panama
6005		Berlin, Germany
6005	HP5K	Colon, Panama
6009	HJFC	Armenia, Colombia
6010	GRB	London, England
6010	OLR2A	Prague, Czecho.
6010	XEOI	Mexico, Mex.
6015	PRA8	Recife, Brazil
6018	HJCX	Bogota, Col.
6020		Kiev, U.S.S.R.
6020		Radio Free Europe, Munich, Germany
6020	KNBH(VOA)	Dixon, Calif.
6020	XEUW	Vera Cruz, Mex.
6024		Brazzaville, Fr.Eq.Africa
6025		Radio Nederland
6025	HIIJ	San Pedro, D.R.
6030		Stuttgart, Germany
6030	DZH6	Manila, P.I.
6030	XEKW	Morelia, Mex.
6030	HP5B	Panama, Pan.
6035	GWS	London, England
6035		Monte Carlo, Monaco
6035	XYZ	Rangoon, Burma
6037		San Jose, Costa Rica
6040	GSY	London, England
6040	KCBR	Delano, Calif.
6040		Tangier, Tangier
6040	WLWO	Cincinnati, U.S.A.
6045	YDF	Djakarta, Indonesia
6050	HIIN	Ciudad Trujillo, D.R.
6050	GSA	London, England
6054	HJEX	Cali, Colombia
6055	HER2	Bern, Switzerland
6060	GSX	London, England
6060	KNBH(VOA)	Dixon, Calif.
6060		Tangier I, Tangier
6060	WDSI	New York, U.S.A.
6065	SBO	Motala, Sweden
6065	XEXE	Mexico City, Mex.
6069	JOB	Tokyo, Japan
6070	GRR	London, England
6075	KGEI	San Fran., U.S.A.
6080		Munich III, Germany
6081	OAX4Z	Lima, Peru
6085	ORU	Brussels, Belgium
6085	VP4RD	Port-of-Spain, Trinidad
6085	ZYK2	Recife, Brazil
6090	GWM	London, England
6090	VLI6	Sydney, Australia
6092		Radio Luxemburg
6095		Horby, Sweden
6095		Radio Free Europe, Munich, Germany
6095	ZYB7	Sao Paulo, Brazil
6095	HJFK	Pereira, Colombia
6100		Belgrade, Yugoslavia
6100	WRCA	New York, U.S.A.
6110	GSL	London, England
6112	HIIZ	Ciudad Trujillo, D.R.
6115		Berlin, Germany
6120	HC2FB	Guayaquil, Ecua.
6120	ZJ14	Limassol, Cyprus
6120		Tangier, Tangier
6120	WRCA	New York, U.S.A.
6122	HP5H	Panama, Pan.
6124	HRQ	San Pedro Sula, Hond.
6125	GWA	London, England
6130	XEUZ	Mexico, Mex.
6130		Radio Spain ●
6130	COCD	Havana, Cuba
6130		Port Moresby, New Guinea
6135	HJED	Cali, Colombia
6140		Munich, Germany
6145	HJDE	Medellin, Col.
6147	PRL9	Rio de Janeiro, Br.
6150	GRW	London, England
6150	TGAZ	Guatemala, Guat.
6160	HJKJ	Bogota, Colombia
6160		Honolulu, Hawaii
6160		Munich, Germany
6165	GWK	London, England
6165	HER3	Bern, Switzerland ●
6167	4VCM	Port-au-Prince, H.
6170		Munich, Germany
6170	GSZ	London, England
6170	KCBR	Delano, Cal., U.S.A.
6170	YVKO	Caracas, Venez.
6172	ZJM5	Limassol, Cyprus
6175	XEXA	Mexico, Mex.
6180	LRM	Mendoza, Argentina
6180		Ashkabad, U.S.S.R.
6180	GRO	London, England
6182	TGWB	Guatemala, Guat.
6185	KCBR(VOA)	Delano, Calif.
6185	HJCT	Bogota, Colombia
6190		Frankfurt, Germany
6190	HI9T	Puerto Plata, D.R.
6190	WLWO	Cincinnati, U.S.A.
6190	WRCA	New York, U.S.A.
6195	GRN	London, England
6195		Honolulu, Hawaii
6200		Paris, France
6215	SP13	Warsaw, Poland
6235	HRD2	La Ceiba, Hond.
6235		Karachi, Pakistan
6248		Budapest, Hungary
6285	TGTQ	Guatemala, Guat.
6295	OTMI	Leopoldville, Belgian Congo
6295	TGLA	Guatemala, Guat.
6320		Baden-Baden, Germany
6322	COCW	Havana, Cuba
6335	TGTA	Guatemala, Guat.
6351	HRPI	San Pedro Sula, Hond.
6374	CSA21	Lisbon, Port.
6405	TGQA	Quezaltenango, Guat.
6450	COCY	Santa Clara, Cuba
6632	HC2RL	Guayaquil, Ecu.
6660	HROW	Tegucigalpa, Hond.
6758	YNVP	Managua, Nic.
6790	ZJM6	Limassol, Cyprus
6830	4XB21	Tel Aviv, Israel
6870	HC4EB	Manta, Ecuador
7105		Paris, France
7112	CR4AA	Praia, Cape V. Isls.
7120	GRM	London, England
7135	BED7	Taipei, Formosa
7135	MCM	London, England
7145		Radio Free Europe Lisbon, Portugal
7150	GRT	London, England
7165		Moscow, U.S.S.R.
7175	VUD	Delhi, India
7180	JOA	Tokyo, Japan
7185	GRK	London, England
7200	GWZ	London, England
7205		Warsaw, Poland
7210	GWL	London, England
7210	HEI3	Bern, Switzerland
7222		Budapest, Hungary ●
7230	GSW	London, England
7240		Moscow, U.S.S.R.
7240		Paris, France
7250	GWI	London, England
7255		Prague, Czechoslovakia ●
7257	JKH	Tokyo, Japan
7260	GSU	London, England
7260		Moscow, U.S.S.R.
7280	GWN	London, England
7285	JKJ	Tokyo, Japan
7285	TAS	Ankara, Turkey
7290		Hamburg, Germany
7290	VUD	Delhi, India
7295		Moscow, U.S.S.R.
7300		Radio Free Europe, Munich, Germany
7300	SVD2	Athens, Greece
7315	YSO	San Salvador, Salv.
7320	GRJ	London, England
7335	BEC36	Taipei, Formosa
7360		Moscow, U.S.S.R.
7670		Sofia, Bulgaria
7850	ZAA	Tirana, Albania
7863	SUX	Cairo, Egypt
7933	HLKA	Pusan, S. Korea
7951		Alicante, Spain
8036	FXE	Beirut, Lebanon
8664	COJK	Camaguey, Cuba
8825	COCQ	Havana, Cuba
8955	COKG	Santiago, Cuba
9007		Voice of Zion, Tel Aviv, Israel
9026	CDBZ	Havana, Cuba
9236	COBQ	Havana, Cuba
9252		Bucharest, Rumania
9290	PRN9	Rio de Janeiro, Brazil
9316	LRS	Buenos Aires, Arg.
9340	OAX4J	Lima, Peru
9363	COBC	Havana, Cuba
9369		Madrid, Spain
9380		Khabarovsk, U.S.S.R.
9400	OTM2	Leopoldville, Belgian Congo
9410	GRI	London, England
9440		Brazzaville, Fr. Eq. Africa
9452	LRYI	Buenos Aires, Arg.
9463	TAP	Ankara, Turkey
9480		Moscow, U.S.S.R.
9490	KUJ39	Agana, Guam
9500	XEWW	Mexico, Mex.
9504	OLR3B	Prague, Czecho.
9505	HOLA	Colon, Panama
9505	JBD	Kawachi, Japan
9510	YVHJ	Barquisimeto, Ven.
9510	GSB	London, England
9515	KNBH(VOA)	Dixon, Calif.
9515	TAT	Ankara, Turkey
9520		Colombo, Ceylon
9520	HJKF	Bogota, Colombia
9520	OZF	Skamlebak, Denmark ●
9520	VLT9	Port Moresby, British New Guinea
9520	WLWO	Cincinnati, U.S.A.
9525	GWJ	London, England
9525	ZBW3	Victoria, Hong Kong
9527		Warsaw, Poland
9530		Honolulu, Hawaii
9530		Manila, Philippines
9530	KCBR	Delano, Cal., U.S.A.
9530	WABC	New York, U.S.A.
9531	COCO	Havana, Cuba
9535	HER4	Bern, Switzerland ●
9535	SBU	Stockholm, Sweden
9540		Munich, Germany
9540	VLG9	Melbourne, Aus.
9540	ZL2	Wellington, N. Zeal.
9543	XYZ	Rangoon, Burma
9548	XEFT	Vera Cruz, Mex.
9550	HVJ	Vatican City
9550		Paris, France
9550	OLR3A	Prague, Czecho. ●
9550		Grenada, Windward Is.
9555	OIX2	Pori, Finland
9555	XETT	Mexico, Mex.
9560	JBD2	Kawachi, Japan
9560		London, England
9560		Paris, France
9560	WLWO	Cincinnati, U.S.A.
9560	WRCA	New York, U.S.A.
9565		Komsomolsk, U.S.S.R.
9565	ZYK3	Recife, Brazil
9570		Algiers, Algeria
9570	GWX	London, England
9570	KCBR(VOA)	Delano, Calif.
9570		Warsaw, Poland
9570		Bucharest, Rumania ●
9570		Rome, Italy ●
9580	GSC	London, England
9580	VLB9	Shepparton, Aus.
9585		Madrid, Spain ●
9590		Hilversum, Neth. ●
9590	WABC	New York, U.S.A.
9600	GRY	London, England
9600	KCBR	Delano, Cal., U.S.A.
9600	KRCA	San Fran., U.S.A.
9600		Leningrad, U.S.S.R.
9605	HP5J	Panama, Pan.
9605	JKL2	Toyko, Japan
9605		Radio Free Europe, Lisbon, Portugal
9607		Athens, Greece
9610	VLX9	Perth, Australia
9610	ZYC8	Rio de Janeiro, Brazil
9610	LLG	Oslo, Norway
9610	XERQ	Mexico, Mex.
9615		Voice of Amer., Tangier
9615	VLB9	Shepparton, Aus.
9615	WRCA	New York, U.S.A.
9618	TIDCR	San Jose, C.Rica
9620		Horby, Sweden ● (Nov. to Febr. only)
9620		Paris, France
9620	ZL8	Wellington, N.Z.
9625	XEBT	Mexico, Mex.
9625	GWO	London, England
9625	VP4RD	Port-au-Spain, Trinidad
9630	HJKC	Bogota, Colombia
9630	VUD4/10	Delhi, India
9630		Rome, Italy
9635		Munich, Germany
9635		Voice of Amer., Tangier
9640		Accra, Ghana
9640		West Germany Radio, Cologne ●
9640	DZH2	Manila, P.I.
9640	GVZ	London, England
9645		Karachi, Pakistan
9645	LLH	Oslo, Norway
9645	TIFC	San Jose, C.Rica
9646	HVJ9	Vatican City
9650		Honolulu, Hawaii
9650		Moscow, U.S.S.R.
9650		Tangier, Tangier
9650	WDSI(VOA)	Brentwood, N. Y.
9652	ZJM8	Limassol, Cyprus
9654	OTC2	Leopoldville, Belgian Congo
9655	JKI2	Nazaki, Japan
9656	4VEH	Cap-Haitien, Haiti
9660	EQC	Teheran, Iran
9660	GWP	London, England
9660	VLQ9	Brisbane, Aus.
9665	HEU3	Bern, Switzerland
9668	TGNB	Guatemala, Guat.
9670		Munich, Germany
9670		Voice of Amer., Tangier
9670		Moscow, U.S.S.R.
9675	GWT	London, England
9675	JOB3	Tokyo, Japan
9680		Paris, France
9680	XEQQ	Mexico, Mex.
9680	VUD	Delhi, India
9680		Moscow, U.S.S.R.
9680		Voice of America, Tangier

Kc.	C.L.	Location
9680	VLR9/VLH9	Melbourne, Australia
9685		Paris, France
9685	WLWO	Cincinnati, U.S.A.
9690	LRA	Buenos Aires, Arg. ●
9690	GRX	London, England
9690		Moscow, U.S.S.R. ●
9690		Singapore, Malaya
9695	JKM2	Kawachi, Japan
9700	GWY	London, England
9700	WDSI	New York, U.S.A.
9700		Sofia, Bulgaria ●
9700		Voice of America, Tangier
9700	WLWO	Cincinnati, U.S.A.
9700	KCBR	Delano, Cal., U.S.A.
9700	FZF6	Ft. de France, Mart.
9710		Moscow, U.S.S.R. ●
9710		Dakar, Fr. W. Africa
9710	YDF6	Djakarta, Indonesia
9710		Rome, Italy
9715		Cairo, Egypt
9716		Moscow, U.S.S.R. ●
9717		Radio Free Europe, Ger.
9720	PRL7	Rio de Janeiro, Brazil
9730		French Equatorial Africa ●
9730		Nanking, China
9730	DZH7	Manila, P.I.
9730		Leipzig, Germany
9735	HI2T	Ciudad, Trujillo, D.R.
9741	CSA27	Lisbon, Portugal
9743	HCJB	Quito, Ecuador
9745	HCJB	(Missionary Station), Quito, Ecuador ●
9745	ORU	Brussels, Belgium
9760	CR7BE	Lourence Marques, Moz.
9765	TGWA	Guatemala, Guat.
9770		London, England
9770	ORU	Brussels, Belgium
9770	PRL4	Rio de Jan., Brazil
9780		Rome, Italy
9785		Monte Carlo, Monaco
9825	GRH	London, England ●
9833		Budapest, Hungary ●
9833	COBL	Havana, Cuba
9865	YDF8	Djakarta, Indonesia
9915	GRU	London, England
9966		Brazzaville, Fr. Eq. Africa
10058	SUV	Cairo, Egypt
10195		Paris, France
10220	PSH	Rio de Janeiro, Brazil
10258	XRRA	Peiping, China
10780	SDB2	Motala, Sweden
11027	CSA29	Lisbon, Portugal
11090	CSA92	PontaDelgada, Azores
11455		Peking, China
11475	ZNX52	Barbadoes, B.W.I.
11513		Tangier, Morocco
11515		Peking, China
11630		Leningrad, U.S.S.R.
11640		All India Radio, Delhi
11650		Peking, China
11670		Bangkok, Thailand
11680	HJCQ	Bogota, Colombia
11680	GRG	London, England
11685		Peking, China
11695	HP5A	Panama, Panama
11700	GVW	London, England
11702		Paris, France
11705	JOA4	Tokyo, Japan
11705	SBP	Motala, Sweden
11710		Moscow, U.S.S.R.
11710		Voice of America, Tangier
11710	VUD5/7	Delhi, India
11710	WLWO	Cincinnati, U.S.A.
11714	ZJM7	Limassol, Cyprus
11715	HEI5	Bern, Switzerland
11718		Athens, Greece
11720	PRL8	Rio de Janeiro, Brazil
11720		Radio Portugal ●
11720	OTM4	Leopoldville, Belgian Congo
11720	ORY2	Brussels, Belgium
11724	HNG	Baghdad, Iraq
11725	COCY	Havana, Cuba
11730	GVV	London, England
11730	KGEI	San Fran., U.S.A.
11730		Hilversum, Nether. ●
11730	CE1173	Santiago, Chile
11735	BEO6	Taipei, Formosa
11735	LKQ	Frederikstad, Nor.
11735		Radio Free Europe, Ger.
11740		Moscow, U.S.S.R.
11740		Warsaw, Poland ●
11740	WRUL	Boston, U.S.A.
11742	CE1174	Santiago, Chile
11750	GSD	London, England
11755		Radio Portugal ●
11740		Moscow, U.S.S.R.
11760	OLR4B	Prague, Czecho.
11760		Voice of America, Tangier
11760	VLA11/VLB11	Shepparton, Aus.
11760	VUD7/11	Delhi, India
11764	CR7BH	Lourence Marques, Mozambique
11770	GVU	London, England
11770	YDE/YDF7	Djakarta, Indonesia
11775		Radio Poland ●
11780	BBC	London, England ●
11780		Moscow, U.S.S.R.
11780	XEQH	Mexico, D.F.
11780	ZL3	Wellington, N.Z.
11790	WDSI(VOA)	New York
11790	GWV	London, England
11790	VUD	Delhi, India
11790	WRUL	Boston, U.S.A.
11790		Voice of America, Tangier
11795		West Germany Radio, Cologne ●
11795	YDF3	Djakarta, Indonesia
11795	WRUL	Boston, U.S.A.
11795		Radio Pakistan, Karachi
11795	ELWA	Monrovia, Liberia
11800	JK14	Tokyo, Japan
11800	GWH	London, England
11800		Brussels, Belgium
11810		Moscow, U.S.S.R. ●
11810		Radio Sweden ● (except—Nov. to Febr.)
11810		Rome, Italy
11810	VLA11	Shepparton, Aus. ● (Morning program)
11815		Warsaw, Poland
11820	GSN	London, England
11820	XEBR	Hermosillo, Mex.
11825	JK16	Tokyo, Japan
11825		Moscow, U.S.S.R.
11825	ZYK3	Recife, Brazil
11830	FZS4	Saigon, Fr.Indo-C.
11830		Moscow, U.S.S.R. ●
11830		Voice of America, Tangier
11830	WBOU(VOA)	New York, U.S.A.
11830	WDSI(VOA)	New York, U.S.A.
11835	CXA19	Montevideo, Uru.
11835		Prague, Czechoslovakia ●
11840	VLW11	Perth, Australia
11840	OLR4A	Prague, Czecho.
11840	LRT	Tucuman, Argentina
11845		Karachi, Pakistan
11847		Paris, France
11850	VLB11	Shepparton, Aus.
11850	ORU	Brussels, Belgium
11850	TGNC	Guatemala, Guat.
11850	VUD11	Delhi, India
11850	LLK	Oslo, Norway
11855	DZH9	Manila, Philippines
11855		Radio Free Europe, Lisbon, Portugal
11860	GSE	London, England
11860	KWID	San Fran., U.S.A.
11865	CR6RA	Luanda, Angola
11865	HER5	Bern, Switzerland ●
11870		Munich, Germany
11870	KNBH	San Fran., U.S.A.
11870		Voice of America, Tangier
11870	WRUL	Boston, U.S.A.
11875	OLR4C	Prague, Czecho.
11875		Radio Portugal ●
11880		Moscow, U.S.S.R.
11880	LRS	Buenos Aires, Arg.
11880	VLG11/VLH11	Melbourne, Aus.
11880		Horby, Sweden
11880	XEHH	Mexico, Mex.
11880	GRE	London, England
11880	SBP	Stockholm, Sweden
11885	APK3	Karachi, Pakistan
11890		Moscow, U.S.S.R.
11890	GWW	London, England
11890	KZFJ	Manila, P.I.
11890	WBOU	New York, U.S.A.
11895	FHE3	Dakar, Fr.W.Af.
11895		Radio Portugal ●
11895		Manila, Philippines
11900	CE1190	Valparaiso, Chile
11900	CXA10	Montevideo, Uru.
11900	HCJB	Calvary Radio Ministry
11900	XEXE	Mexico City, Mex.
11900		Rome, Italy ●
11910		Budapest, Hungary ●
11910		Karachi, Pakistan
11915		Radio Netherlands ●
11915		Damascus, Syria
11915	HCJB	Quito, Ecuador ●
11915		Radio Portugal ●
11918	BED4	Taipei, Formosa
11924	FZS4	Saigon, Vietnam
11930	GVX	London, England
11935		Warsaw, Poland
11937		Bucharest, Rumania ●
11950		Radio Netherlands ●
11950	YSAX	San Salvador, Salv.
11955	GVY	London, England
11960		Moscow, U.S.S.R.
11964		Lisbon, Portugal ●
11970		Brazzaville, Fr.Eq.Africa ●
11972	TIHH	San Jose, C.Rica
11975		Colombo, Ceylon
11980		Moscow, U.S.S.R.
11995	CSA32	Lisbon, Portugal ●
11998	CE1180	Santiago, Chile
12040	GRV	London, England
12095	GRF	London, England
12175	TFJ	Reykjavik, Iceland
14492		Radio Moscow
14690	PSF	Rio de Janeiro, Brazil
15050	ETAA	Addis Ababa, Eth.
15050	V3USE	Forest Side, Mauritius
15060		Peking, China
15070	GWC	London, England
15095	HVJ	Vatican City
15100	CSA39	Lisbon, Portugal
15100		Moscow, U.S.S.R.
15100	EPB	Teheran, Iran
15105	KGEI	San Fran., U.S.A.
15105	OAX4X	Lima, Peru
15110	GWG	London, England
15110		Moscow, U.S.S.R.
15115	HCJB	Quito, Ecuador ●
15120		Colombo, Ceylon
15120		Moscow, U.S.S.R.
15120		Rome, Italy
15120		Warsaw, Poland ●
15125	CSA36	Lisbon, Portugal
15130		Voice of America, Tangier
15130	WABC	New York, U.S.A.
15130	WLWO	Cincinnati, U.S.A.
15130	KCBR(VOA)	Delano, Calif.
15130	WBOU	Bound Brook, N. J., U.S.A.
15135		Radio Japan, Tokyo ●
15135	PRB23	Sao Paulo, Brazil
15140	GSF	London, England
15150	YDC	Djakarta, Indonesia
15145	ZYK2	Recife, Brazil
15150	OAX4R	Lima, Peru
15150	CE1515	Santiago, Chile
15155	SBT	Motala, Sweden
15156	ZYB9	Sao Paulo, Brazil
15160	VUD5/7	Delhi, India
15160	VLB15	Shepparton, Aus.
15160	TAU	Ankara, Turkey
15165	WLWO	Cincinnati, U.S.A.
15165	ZYN7	Fortaleza, Brazil
15170	LKV	Oslo, Norway
15170	TGWA	Guatemala, Guat.
15170		Moscow, U.S.S.R.
15175	LLM	Oslo, Norway
15180	GSO	London, England
15180		Moscow, U.S.S.R.
15180	OZH2	Shamlebak, Den.
15190	VUD5/11	Delhi, India
15190	OIX4	Pori, Finland ●
15195	TAQ	Ankara, Turkey
15200		Moscow, U.S.S.R.
15200	VLA15/VLC15	Shepparton, Aus.
15205	XESC	Mexico, Mexico
15205		Voice of America, Tangier
15210		Munich, Germany
15210	GWU	London, England
15210	WBOU(VOA)	New York, U.S.A.
15210	VLG15	Melbourne, Aus.
15220		Hilversum, Neth. ●
15220	ZL10	Wellington, N.Z.
15225	JBD3	Kawachi, Japan
15228		Komsomolsk, U.S.S.R.
15230	GWD	London, England
15230		Moscow, U.S.S.R.
15230	OLR5A	Prague, Czecho.
15230	VLH15	Melbourne, Aus.
15230	WRUL	Boston, U.S.A.
15235	BED3	Taipei, Formosa
15235	JOB5	Tokyo, Japan
15240		Radio China (Canton) ●
15240		Belgrade, Yugoslavia
15240	KRCA	San Fran., U.S.A.
15240		Paris, France
15240	VLH15	Melbourne, Aus.
15240	WLWO	Cincinnati, U.S.A.
15250		Bucharest, Rumania ●
15250		Voice of Amer., Manila, P.I.
15250	WLWO	Cincinnati, U.S.A.
15250		Voice of Amer., Tangier
15260	GSI	London, England
15260		Karachi, Pakistan
15270	KCBR	Delano, Cal., U.S.A.
15270		Munich, Germany
15270	WBOU(VOA)	New York, U.S.A.
15270		Sverdlovsk, U.S.S.R.
15280		Munich, Germany
15280	ZL4	Wellington, N.Z.
15280		Moscow, U.S.S.R.
15280		Voice of Amer., Tangier
15285	CR7BG	Lourenco Marques, Mozambique
15285	WBOU(VOA)	New York, U.S.A.
15285	WRUL	Boston, U.S.A.
15290	LRU	Buenos Aires, Arg.
15290	VUO5/9	Delhi, India
15295		Voice of Amer., Tangier
15300	DZH8	Manila, P.I.
15300	GWR	London, England
15300		Singapore, Malaya
15305	HER6	Bern, Switzerland ●
15305	RV97	Novosibirsk, U.S.S.R.
15310	KCBR	Delano, Calif.
15310	GSP	London, England ●
15320	VLG15	Melbourne, Aus.
15320		Moscow, U.S.S.R.
15320	OLR5B	Prague, Czech.
15325		Rome, Italy
15330	KGEI	San Fran., U.S.A.
15330		Sofia, Bulgaria
15330	WLWO	Cincinnati, U.S.A.
15335		Brussels, Belgium
15335		Karachi, Pakistan
15340		Moscow, U.S.S.R.
15340	KCBR	Delano, Cal., U.S.A.
15340		Voice of Amer., Tangier
15345		Athens, Greece
15345		Formosa Radio ●
15347	LRA	Buenos Aires, Arg.
15350		Paris, France
15350	WRUL	Boston, U.S.A.
15350	WLWO	Cincinnati, U.S.A.
15350	VUD8	Delhi, India
15352		Radio Luxemburg
15360		London, England
15360		Moscow, U.S.S.R.
15364	ZYC9	Rio de Jan., Brazil
15365		Radio Netherlands ●
15390		Moscow, U.S.S.R.
15390		Radio China (Canton) ●
15400		Paris, France
15400		Rome, Italy ●
15405	DMQ15	Cologne, W. Germany
15405	PZC	Paramaribo, Surinam
15410		Moscow, U.S.S.R.
15420		Paris, France
15420		Brazzaville, Fr.Equat.Africa
15425		Radio Netherlands ●
15435	GWE	London, England
15440		Moscow, U.S.S.R.
15445		Radio Netherlands ●
15450	GRD	London, England
15595		Brazzaville, Fr.Eq.Africa
15620		Madrid, Spain
15880		Peking, China
17700	GVP	London, England
17710	WRUL	Boston, U.S.A.
17715	GRA	London, England ●
17720	LRA5	Buenos Aires, Arg.
17730	GVQ	London, England
17750	WRUL	Boston, U.S.A.
17750		Rome, Italy
17760	WGEO	Schenectady, U.S.A.
17760	VUD	Delhi, India
17770	KCBR	Delano, Cal., U.S.A.
17770		Rome, Italy
17770		Voice of America, Tangier
17770		Radio Sweden, Stockholm
17775		Hilversum, Netherlands
17780	VUD/10/11	Delhi, India
17780	WBOU	New York, U.S.A.
17780		Voice of Amer., Manila, P.I.
17784	HER7	Bern, Switzerland
17785	JOA	Tokyo, Japan
17790	GSG	London, England
17795	WLWO	Cincinnati, U.S.A.
17800	KNBH	San Fran., U.S.A.
17800	WLWO	Cincinnati, U.S.A.
17800		Radio Australia, Melbourne
17800		Radio Poland ●
17800	KRHO	Honolulu, Hawaii
17800		Stockholm, Sweden
17800	OIX5	Pori, Finland ●
17804		Rome, Italy
17805	DZ16	Manila, P.I.
17810		Formosa Radio ●
17810	GSV	London, England
17810		Moscow, U.S.S.R.
17815	WRUL	Boston, U.S.A.
17820		Colombo, Ceylon
17825	LLN	Oslo, Norway
17825	TAV	Ankara, Turkey
17825		Radio Japan, Tokyo ●
17830		Moscow, U.S.S.R.
17830	WDSI(VOA)	New York, U.S.A.
17835		Karachi, Pakistan
17840		Radio Sweden ●
17840		Brazzaville, Fr.Eq.Africa
17840		Moscow, U.S.S.R.
17840	VLC17	Shepparton, Aus.
17840	HVJ	Vatican City
17850		Paris, France
17860	ORU3	Brussels, Belgium
17865		Damascus, Syria
17870	CSA44	Lisbon, Portugal
17890	HCJB	(Missionary Station) Quito, Ecuador
17910		Grenada, Windward Is.
18250	TFTO	Paris, France
18450		United Nations Radio, Geneva, Switzerland
20088		Moscow, U.S.S.R.
21460	KNBH (VOA)	Dixon, Calif.
21470	GSH	London, England
21480		Hilversum, Netherlands
21490		Paris, France
21500	WRCA	New York, U.S.A.
21510	VUD5	Delhi, India
21520	HER8	Bern, Switzerland
21520	WLWO	Cincinnati, U.S.A.
21530	GSJ	London, England
21540	VLB2	Shepparton, Aus.
21550	GST	London, England
21560		Moscow, U.S.S.R.
21560		Rome, Italy
21570	WDSI(VOA)	New York, U.S.A.
21580		Horby, Sweden
21590	WGEO	Schenectady, N.Y.
21610	WLWO(VOA)	Cincinnati, U.S.A.
21620		Colombo, Ceylon
21640	GRZ	London, England
21650	WLWO	Cincinnati, U.S.A.
21660		Lisbon, Portugal
21670	LLP	Oslo, Norway
21675	GVR	London, England
21680	VLC21	Shepparton, Aus.
21690		Voice of America, Tangier
21700	VUO10	Delhi, India
21710	GVS	London, England
21730	WBOU(VOA)	New York, U.S.A.
21740	KCBR	Delano, Cal., U.S.A.
21740	KGEI	San Fran., U.S.A.
21740		Paris, France
21750	GVT	London, England
25615	OE138	Linz, Austria
25640	HER9	Berne, Switzerland
25650	DMQ25	Cologne, West Germany
25670		Sweden Radio, Stockholm
25675		Radio Australia, Melbourne
25750	GSQ	London, England
26080	GSK	London, England

Canadian Short-Wave Stations

Abbreviations: Kc., frequency in kilocycles (to change to megacycles, divide by 1000); C.L., call letters

Kc.	C.L.	Location
5970	CBNX	St. John's, Nfld.
5970	CKNA	Montreal, Que.*
5990	CHAY	Montreal, Que.*
6005	CFCX	Montreal, Que.
6010	CJCX	Sydney, N.S.
6030	CFVP	Calgary, Alta.
6060	CKRZ	Montreal, Que.*
6070	CFRX	Toronto, Ont.
6080	CKFX	Vancouver, B.C.
6090	CBFW	Montreal, Que.
6090	CKOB	Montreal, Que.*
6130	CHNX	Halifax, N.S.
6150	CKRO	Winnipeg, Man.
6160	CBUX	Vancouver, B.C.
6160	CHAC	Montreal, Que.*
9520	CBFR	Montreal, Que.
9585	CKLP	Montreal, Que.*
9610	CBFX	Montreal, Que.
9610	CHLS	Montreal, Que.*
9630	CBFO	Montreal, Que.
9630	CKLO	Montreal, Que.*
9710	CHLR	Montreal, Que.*
9740	CHFO	Montreal, Que.*
11705	CBFY	Montreal, Que.
11705	CKXA	Montreal, Que.*
11720	CBFL	Montreal, Que.
11720	CHOL	Montreal, Que.*
11720	CKRX	Winnipeg, Man.
11760	CBFA	Montreal, Que.
11760	CKRA	Montreal, Que.*
11900	CKEX	Montreal, Que.*
11945	CKEX	Montreal, Que.*
15090	CKLX	Montreal, Que.*
15105	CKUS	Montreal, Que.*
15190	CBFZ	Montreal, Que.
15190	CKCX	Montreal, Que.*
15255	CKSR	Montreal, Que.*
15275	CKBR	Montreal, Que.*
15320	CKCS	Montreal, Que.*
17710	CHSB	Montreal, Que.*
17735	CHRX	Montreal, Que.*
17820	CKNC	Montreal, Que.*
17865	CHYS	Montreal, Que.*
21600	CKRP	Montreal, Que.*
21710	CHLA	Montreal, Que.*

*Transmitter at Sackville, New Brunswick.

United States FM Stations

(Territories and possessions follow states) Abbreviations: C.L., call letters; Mc., megacycles (for frequency in kilocycles change decimal point to comma and add two zeros); asterisk (*) indicates educational station

ALABAMA

Location	C.L.	Mc.
Albertville	WAVU-FM	105.1
Alexander City	WRFS-FM	106.1
Andalusia	WCTA-FM	98.1
Anniston	WHMA-FM	100.5
Birmingham	WAPI-FM	99.5
	WSFM	93.7
Clanton	WKLF-FM	100.9
Cullman	WFMH-FM	101.1
Decatur	WHOS-FM	102.1
Homewood	WJLN	104.7
Lanett	WRLD-FM	102.9
Mobile	WKRG-FM	99.9
Tuscaloosa	WTBC-FM	95.7
	WUOA	*91.7

ARIZONA

Location	C.L.	Mc.
Globe	KWJB-FM	100.3
Mesa	KTYL-FM	104.7
Phoenix	KELE	95.5
	KFCA	*88.5
Tucson	KFMM	99.5

ARKANSAS

Location	C.L.	Mc.
Blytheville	KLCN-FM	96.1
Ft. Smith	KFPW-FM	94.9
Jonesboro	KBTM-FM	101.9
	KASU	91.9
Mammoth Springs	KAMS	103.9
Siloam Springs	KUOA-FM	105.7

CALIFORNIA

Location	C.L.	Mc.
Atherton	KPEN	101.3
Bakersfield	KERN-FM	94.1
	KQXR	101.5
Berkeley	KPFA	94.1
	KPFB	*89.3
	KRE-FM	102.9
Claremont	KSPC	*90.7
Eureka	KRED-FM	96.3
Fresno	KARM-FM	101.9
	KMJ-FM	97.9
	KRFM	93.7
Glendale	KFMU	97.1
	KUTE	101.9
Long Beach	KFOX-FM	102.3
	KLON	*88.1
	KNOB	97.9
Los Angeles	KABC-FM	95.5
	KBMS	105.9
	KCBH	98.7
	KFAC-FM	92.3
	KGLA	*103.5
	KHJ	101.1
	KMLA	100.3
	KNX-FM	93.1
	KBIQ	104.3
	KPOL-FM	93.9
	KRHM	94.7
	KRKD-FM	96.3
	KUSC	*91.5
	KXLU	*88.7
	KHOF	99.5
Marysville	KMYC-FM	99.9
Modesto	KBEE-FM	103.3
	KTRB-FM	104.1
Oakland	KAFE	98.1
Ontario	KASK-FM	93.5
Pasadena	KPCS	89.3
Sacramento	KCRA-FM	96.1
	KFBK-FM	96.9
	KGMS-FM	100.5
	KJML	95.3
	KXOA-FM	107.9
San Bernardino	KVCR	*91.9
San Diego	KFSD-FM	94.1
	KDWD	98.1
	KITT	105.3
	KSDS	*88.3
San Francisco	KALW	*91.7
	KCBS-FM	98.9
	KDFC	102.1
	KEAR	97.3
	KGO	103.7
	KNBC-FM	99.7
	KSFR	94.9
San Jose	KSJO-FM	92.3
San Mateo	KCSM	*90.9
Santa Ana	KWIZ-FM	96.7
Santa Barbara	KRCW	97.5
Santa Clara	KSCU	*90.1
Santa Monica	KCRW	*89.9
Stockton	KCVN	*91.3
West Covina	KDWC	98.3

COLORADO

Location	C.L.	Mc.
Boulder	KRNW	97.3
Colorado Springs	KRCC	*91.3
	KSHS	*90.5
Denver	KFML-FM	98.5
	KTGM	105.1
Manitou Springs	KCMS-FM	102.7

CONNECTICUT

Location	C.L.	Mc.
Brookfield	WGHF	95.1
Danbury	WLAD-FM	98.3
Hartford	WHCN	105.9
	WRTC-FM	*89.3
	WTIC-FM	96.5
Meriden	WMMW-FM	95.7
New Haven	WNHC-FM	99.1
Stamford	WSTC-FM	96.7
Storrs	WHUS	*90.5

DELAWARE

Location	C.L.	Mc.
Dover	WDOV-FM	94.7
Wilmington	WDEL-FM	93.7
	WJBR	99.5

DISTRICT OF COLUMBIA

Location	C.L.	Mc.
Washington	WASH-FM	97.1
	WFAN	100.3
	WGMS-FM	103.5
	WMAL-FM	107.3
Washington, D.C.	WOL-FM	98.7
	WRC-FM	93.9
	WTOP-FM	96.3
	WWDC-FM	101.1

FLORIDA

Location	C.L.	Mc.
Daytona Beach	WNDB-FM	94.5
Gainesville	WRUF-FM	*104.1
Jacksonville	WJAX-FM	95.1
	WZFM	96.9
	WMBR-FM	96.1
Miami	WCKR-FM	97.3
	WGBS-FM	96.3
	WTHS	*91.7
	WWPB-FM	101.5
Miami Beach	WKAT-FM	93.1
	WMET-FM	93.9
Orlando	WDBO-FM	92.3
	WHOO-FM	96.5
	WORZ	100.3
Palm Beach	WQXT-FM	97.9
Panama City	WDLP-FM	98.9
Tallahassee	WFSU-FM	*91.5
Tampa	WDAE-FM	100.7
	WFLA-FM	93.3
	WPKM	104.7
	WTUN	*88.9
Winter Park	WPRK	*91.5

GEORGIA

Location	C.L.	Mc.
Athens	WGAU-FM	102.5
Atlanta	WABE	*90.1
	WAGA-FM	103.3
	WGKA-FM	92.9
	WSB-FM	98.5
Augusta	WAUG-FM	105.7
	WBBQ-FM	103.7
Columbus	WRBL-FM	93.3
Gainesville	WDUN-FM	103.9
Lagrange	WLAG-FM	104.1
Macon	WMAZ-FM	99.1
Newnan	WCOH-FM	96.7
Savannah	WTOC-FM	97.3
Swainsboro	WJAT-FM	101.7
Toccoa	WLET-FM	106.1

ILLINOIS

Location	C.L.	Mc.
Anna	WRAJ-FM	92.7
Bloomington	WJBC-FM	101.5
Carmi	WROY-FM	97.3
Champaign	WDWS-FM	97.5
Chicago	WBBM-FM	96.3
	WBEZ	*91.5
	WCLM	101.9
	WDHF	95.5
	WEBH	93.9
	WEFM	99.5
	WEHS	97.9
	WENR-FM	94.7
	WFMF	100.3
	WFMT	98.7
	WKFM	103.5
	WMAQ-FM	101.1
	WNIB	97.1
	WSEL	104.3
Decatur	WSOY-FM	102.1
DeKalb	WNIC	*91.1
Effingham	WSEI	95.7
Elgin	WEPS	*88.1
Elmwood Park	WXFM	105.9
Evanston	WEAW	105.1
	WNUR	*89.3
Harrisburg	WEBQ-FM	99.9
Jacksonville	WLDS-FM	100.5
Macomb	WWKS	*91.3
Mattoon	WLBH-FM	96.9
Mt. Vernon	WMIX-FM	94.1
Oak Park	WOPA-FM	102.3
Olney	WVLN-FM	92.9
Paris	WPRS-FM	98.3
Peoria	WMBD-FM	92.5
Quincy	WGEM-FM	105.1
	WTAD-FM	99.5
Rockford	WROK-FM	97.5
Rock Island	WHBF-FM	98.9
Springfield	WTAX-FM	103.7
Urbana	WILL-FM	*90.9

INDIANA

Location	C.L.	Mc.
Bloomington	WFIU	*103.7
Columbus	WCSI-FM	98.3
Connersville	WCNB-FM	100.3
Crawfordsville	WBBS-FM	106.3
Elkhart	WCMR-FM	95.1
	WTRC-FM	100.7
Evansville	WIKY-FM	104.1
	WEVC	*91.5
	WPSR	90.7
Gary	WGVE	*88.1
Goshen	WGCS	91.1
Greencastle	WGRE	*91.7
Hammond	WJOB-FM	92.3
Hartford City	WHCI	*91.9
Huntington	WVSH	*91.9
Indianapolis	WAJC	*104.5
	WFMS	95.5
	WIAN	*90.1
Jasper	WITZ-FM	104.7
Madison	WORX-FM	96.7
Marion	WMRI-FM	106.9
Muncie	WMUN	104.1
	WWHI	*91.5
New Albany	WNAS	*88.1
New Castle	WCTW	102.5
	WYSN	*91.1
Terre Haute	WTHI-FM	99.9
Wabash	WSKS	*91.3
Warsaw	WRSW-FM	107.3
Washington	WFML	106.5

IOWA

Location	C.L.	Mc.
Ames	WOI-FM	*90.1
Boone	KFGQ	*99.3
Clinton	KROS-FM	96.1
Davenport	WOC-FM	103.7
Des Moines	KDPS	*88.1
	WHO-FM	100.3
Dubuque	WDBQ	103.3
Iowa City	KSUI	*91.7
Mason City	KGLO-FM	101.1
Muscatine	KWPC-FM	99.7
Storm Lake	KAYL-FM	101.5
Waverly	KWAR	89.1

KANSAS

Location	C.L.	Mc.
Emporia	KSTE	*88.7
Lawrence	KANU	*91.5
Manhattan	KSDB-FM	*88.1
Ottawa	KTJO-FM	*88.1
Wichita	KFH-FM	100.3
	KMUW	*89.1

KENTUCKY

Location	C.L.	Mc.
Ashland	WCMI-FM	93.7
Central City	WNES-FM	101.9
Fulton	WFUL-FM	104.9
Henderson	WSON-FM	99.5
Hopkinsville	WHOP-FM	98.7
Lexington	WBKY	*91.3
	WLAP-FM	94.5
Louisville	WFPK	*91.9
	WFPL	*89.3
Madisonville	WFMW-FM	93.9
	WNGO-FM	94.7
Owensboro	WOMI-FM	92.5
	WVJS-FM	96.1
Paducah	WPAD-FM	96.9
	WKYB-FM	93.3

LOUISIANA

Location	C.L.	Mc.
Alexandria	KALB-FM	96.9
Baton Rouge	WBRL	98.1
Monroe	KMBL-FM	104.1
New Orleans	WBEH	89.3
	WDSU-FM	105.3
	WRCM	97.1
	WMMT	95.7
Shreveport	KRMD-FM	101.1
	KWKH-FM	94.5

MAINE

Location	C.L.	Mc.
Brunswick	WBOR	*91.1
Caribou	WFST-FM	97.7
Lewiston	WCOU-FM	93.9

MARYLAND

Location	C.L.	Mc.
Annapolis	WNAV-FM	99.1
Baltimore	WBJC	*88.1
	WCAO-FM	102.7
	WITH-FM	104.3
Bethesda	WUST-FM	106.3
Bradbury Heights	WPGC	95.5
Cumberland	WCUM-FM	102.9
Hagerstown	WJEJ-FM	104.7
	WARK-FM	106.9
Oakland	WBUZ	95.5

MASSACHUSETTS

Location	C.L.	Mc.
Amherst	WAMF	*88.1
	WMUA	*91.1
Boston	WBUR	*90.9
	WBCN	104.1
	WBZ-FM	106.7
	WCOP-FM	100.7
	WEEI-FM	103.3
	WERS	*88.9
	WHDH-FM	94.5
	WRKO-FM	98.5
Brockton	WBET-FM	97.7
Brookline	WBOS-FM	92.9
Cambridge	WGBH-FM	*89.7
	WHRB-FM	107.1
	WXHR	96.9
Greenfield	WHAI-FM	98.3
Lowell	WLLH-FM	99.5
New Bedford	WBSM-FM	97.3
	WNBH-FM	98.1
S. Hadley	WMHC	88.5

Location	C.L.	Mc.
Springfield	WHYN-FM	93.1
	WEDK	91.7
	WMAS-FM	94.7
Waltham	WCRB-FM	102.5
W. Yarmouth	WOCB-FM	94.3
Williamstown	WCFM	*90.1
Winchester	WHSR-FM	*91.9
Worcester	WTAG-FM	96.1

MICHIGAN

Location	C.L.	Mc.
Ann Arbor	WUOM	*91.7
Benton Hrbr.	WHFB-FM	99.9
Coldwater	WTVB-FM	98.3
Dearborn	WKMH-FM	100.3
Detroit	WDET-FM	*101.9
	WDTR	*90.9
	WHFI	94.7
	WJBK-FM	93.1
	WMUZ	103.5
	WMZK	97.9
	WJR-FM	96.3
	WWJ-FM	97.1
	WXYZ-FM	101.1
E. Lansing	WKAR-FM	*90.5
Flint	WFBE	*95.1
Grand Rapids	WFRS	92.5
	WJEF-FM	93.7
	WLAV-FM	96.9
Highland Pk.	WHPR	*88.1
Kalamazoo	WMCR	*102.1
Oak Park	WLDM	95.5
Royal Oak	WOAK	*89.3
	WOMC	104.3
Saginaw	WSAM-FM	98.1
Sturgis	WSTR-FM	103.1

MINNESOTA

Location	C.L.	Mc.
Mankato	KYSM-FM	103.5
Minneapolis	KTIS-FM	*98.5
	KWFM	97.1
	WLOL-FM	99.5
St. Cloud	KFAM-FM	104.7
Winona	KWNO-FM	97.5

MISSISSIPPI

Location	C.L.	Mc.
Jackson	WJDX-FM	102.9
Meridian	WMMI	*88.1

MISSOURI

Location	C.L.	Mc.
Clayton	KFUO-FM	99.1
Joplin	WMBH-FM	96.1
Kansas City	KCMO-FM	94.9
	KCMK	93.3
	KCUR-FM	89.3
Kennett	KBOA-FM	98.9
Poplar Bluff	KWOC-FM	94.5
St. Louis	KCFM	93.7
	KSLH	*91.5
Springfield	KTTS-FM	94.7
West Plains	KWPM-FM	93.9

NEBRASKA

Location	C.L.	Mc.
Lincoln	KFMQ	95.3

NEVADA

Location	C.L.	Mc.
Reno	KNEV	95.5

NEW HAMPSHIRE

Location	C.L.	Mc.
Berlin	WKCQ	103.7
Claremont	WTSV-FM	106.1
Manchester	WKBR-FM	95.7
Mt. Washington	WMTW-FM	94.9
Nashua	WOTW-FM	106.3

NEW JERSEY

Location	C.L.	Mc.
Asbury Park	WJLK-FM	94.3
Bridgeton	WSNJ-FM	98.9
E. Orange	WFMU	*91.1
Hackettstown	WNTI	*91.9
Newark	WNTA-FM	94.7
	WBGO	*88.3
New Brunswk.	WCTC-FM	98.3
Paterson	WPAT-FM	93.1
Princeton	WPRB	103.9
South Orange	WSOU	*89.5
Trenton	WTOA	97.5
Zarepath	WAWZ-FM	99.1

NEW MEXICO

Location	C.L.	Mc.
Albuquerque	KANW	*89.1
	KHFM	96.3
Los Alamos	KRSN-FM	98.5
Mountain Park	KMFM	97.9

NEW YORK

Location	C.L.	Mc.
Albany	WAMC	*90.7
Auburn	WMBO-FM	96.1
Babylon	WTFM	103.5
Binghamton	WNBF-FM	98.1
	WKOP-FM	95.3
Brooklyn	WNYE	*91.5
Buffalo	WBEN-FM	106.5
	WBNY-FM	92.9
	KWOL-FM	104.1
Cherry Valley	WRRC	101.9
Corning	WCLI-FM	106.1
Cortland	WKRT-FM	99.9
DeRuyter	WRRD	105.1
Floral Park	WSHS	*90.3
Hempstead	WHLI-FM	98.3
Hornell	WWHG-FM	105.3
Ithaca	WHCU-FM	97.3
	WICB	*91.7
	WRRA-FM	103.7
	WVBR-FM	101.7
Jamestown	WJTN-FM	93.3
Kenmore	WINE-FM	103.3
Massena	WMSA-FM	105.3
New Rochelle	WNRC-FM	93.5
New York	WABC-FM	95.5
	WBAI	99.5
	WBFM	101.9
	WCBS-FM	101.1
	WEVD-FM	97.9
	WFUV	*90.7
	WHOM-FM	92.3
	WKCR-FM	*89.9
	WNCN	104.3
	WNEW-FM	102.7
	WNYC-FM	93.9
	WNYE	91.5
	WOR-FM	98.7
	WQXR-FM	96.3
	WRCA-FM	97.1
	WRFM	105.1
Niagara Falls	WHLD-FM	98.5
Olean	WHDL-FM	95.7
Patchogue	WALK-FM	97.5
	WPAC-FM	106.1
Poughkeepsie	WKIP-FM	104.7
Rochester	WHFM	98.9
Schenectady	WGFM	99.5
South Bristol	WRRE	95.1
Springville	WSPE	*88.1
Syracuse	WAER	*88.1
	WDDS-FM	93.1
	WONO	100.9
	WSYR-FM	94.5
Troy	WFLY	92.3
	WRPI	91.5
Utica	WRUN-FM	105.7
Wethersfield	WRRL	107.7
White Plains	WFAS-FM	103.9
Woodside	WWRL-FM	105.1

NORTH CAROLINA

Location	C.L.	Mc.
Albemarle	WABZ-FM	100.9
Asheboro	WGWR-FM	92.3
Asheville	WLOS-FM	104.3
Burlington	WBBB-FM	101.1
	WFNS-FM	93.9
Chapel Hill	WUNC	*91.5
Charlotte	WSOC-FM	103.5
Clingman's Pk.	WMIT	106.9
Durham	WDNC-FM	105.1
Elkin	WIFM-FM	100.9
Fayetteville	WFNC-FM	98.1
Forest City	WBBO-FM	93.3
Franklin	WFSC-FM	94.5
Gastonia	WGNC-FM	101.9
Goldsboro	WEQR	96.9
Greensboro	WGPS	*89.9
	WMDE	98.7
Greenville	WWWS	*91.3
Henderson	WHNC-FM	92.5
	WHKP-FM	102.5
Hendersonville	WHKP-FM	102.5
High Point	WHPE-FM	95.5
	WHPS	*89.3
	WMFR-FM	99.5
	WNOS-FM	100.3
Laurinburg	WEWO-FM	96.5
Leaksville	WLOE-FM	94.5
Lexington	WBUY-FM	94.3
Raleigh	WKIX-FM	96.1
	WPTF-FM	94.7
	WRAL-FM	101.5
Reidsville	WREV-FM	102.1
Rocky Mount	WEED-FM	92.1
	WFMA	100.7
Salisbury	WSTP-FM	106.5
Sanford	WWGP-FM	105.5
Shelby	WOHS-FM	96.1
Statesville	WFMX	105.7
Tarboro	WCPS-FM	104.3
Thomasville	WTNC-FM	98.3
Winston-Salem	WAIR-FM	93.1
	WSJS-FM	104.1

OHIO

Location	C.L.	Mc.
Akron	WAKR-FM	97.5
	WAPS	*89.1
Alliance	WFAH-FM	101.7
Ashland	WNCO-FM	101.3
Ashtabula	WICA-FM	103.7
Athens	WOUI	*91.5
Bellaire	WTRX-FM	100.5
Berea	WBWC	*88.3
Bowling Green	WBGU	*88.1
Canton	WHBC-FM	94.1
Cincinnati	WCPO-FM	105.1
	WKRC-FM	101.9
	WSAI-FM	102.7
Cleveland	KYW-FM	105.7
	WBOE	*90.3
	WDOK-FM	102.1
	WERE-FM	98.5
	WGAR-FM	99.5
	WHK-FM	100.7
	WJW-FM	104.1
Cleveland Hts.	WSRS-FM	95.3
Columbus	WCBE	*90.5
	WBNS-FM	97.1
	WCOL-FM	92.3
	WOSU-FM	*89.7
	WVKO	94.7
Dayton	WHIO-FM	99.1
Delaware	WSLN	*91.1
Elyria	WEOL-FM	107.3
Findlay	WFIN-FM	100.5
Fostoria	WFOB	96.7
Fremont	WFRO-FM	99.3
Hamilton	WQMS	96.7
Kent	WKSU-FM	*88.1
Lima	WIMA-FM	102.1
Marion	WMRN-FM	106.9
Mt. Vernon	WMVO-FM	93.7
Newark	WCLT-FM	100.3
Oxford	WMUB	*88.5
Portsmouth	WPAY-FM	104.1
Springfield	WBLY-FM	103.9
Steubenville	WSTV-FM	103.5
Toledo	WSPD-FM	101.5
	WMHE	92.5
	WTDS	*91.3
	WTOL-FM	104.7
	WTRT	99.9
Wooster	WWST-FM	104.5
Youngstown	WKBN-FM	98.9

OKLAHOMA

Location	C.L.	Mc.
Norman	WNAD-FM	*90.9
Oklahoma City	KOKH	*88.9
	KEFM	94.7
	KYFM	98.9
Shawnee	KBGC	*89.9
Stillwater	KAMC-FM	*91.7
	KSPI-FM	93.9
Tulsa	KWGS	*90.5

OREGON

Location	C.L.	Mc.
Eugene	KRVM	*91.9
	KUGN-FM	99.1
	KWAX	*91.1
Grants Pass	KGPO	96.9
Oretech, Oregon	KTEC	*88.1
Portland	KEX-FM	92.3
	KOIN-FM	101.1
	KPFM	97.1
	KPOJ-FM	98.7
	KQFM	100.3
	KRRC	*89.3

PENNSYLVANIA

Location	C.L.	Mc.
Allentown	WFMZ	100.7
Altoona	WVAM-FM	100.1
Bethlehem	WGPA-FM	95.1
Bloomsburg	WHLM-FM	106.5
Butler	WBUT-FM	97.7
Chambersburg	WCHA-FM	95.9
Dubois	WCED-FM	102.1
Easton	WEST-FM	107.9
	WEEX-FM	99.9
Erie	WERC-FM	99.9
Harrisburg	WHP-FM	97.3
Havertown	WHHS	*89.3
Hazleton	WAZL-FM	97.9
Johnstown	WARD-FM	92.1
	WJAC-FM	95.5
Lancaster	WGAL-FM	101.3
	WLAN-FM	96.9
Lebanon	WLBR-FM	100.1
Meadville	WMGW-FM	100.3
Philadelphia	WCAU-FM	98.1
	WFIL-FM	102.1
	WFLN	95.7
	WHAT-FM	96.5
	WHYY	*90.9
	WIBG-FM	94.1
	WIP-FM	93.3
	WPEN-FM	102.9
	WPWT	*91.7
	WRTI-FM	*90.1
	WXPN	*88.9
Pittsburgh	KDKA-FM	92.9
	WDUQ	*91.5
	WFMP	99.7
	WKJF	93.7
	WWSW-FM	94.5
Pottsville	WPPA-FM	101.9
Scranton	WGBI-FM	101.3
	WUSV	*88.9
Sharon	WPIC-FM	102.9
State College	WDFM	*91.1
Sunbury	WKOK-FM	94.1
Warren	WRRN	92.3
Washington	WJPA-FM	104.3
Wilkes-Barre	WBRE-FM	98.5
Williamsport	WLYC-FM	105.1
	WRAK-FM	100.3
York	WNOW-FM	105.7

RHODE ISLAND

Location	C.L.	Mc.
Providence	WPJB-FM	105.1
	WPFM	95.5
	WPRO-FM	92.3
	WXCN	101.5
Woonsocket	WWON-FM	106.3

SOUTH CAROLINA

Location	C.L.	Mc.
Anderson	WCAC	101.1
Charleston	WCSC-FM	96.9
	WTMA-FM	95.1
Columbia	WCOS-FM	97.9
	WUSC-FM	*89.9
Dillon	WDSC-FM	92.9
Greenville	WESC-FM	92.5
	WFBC-FM	93.7
Orangeburg	WORG-FM	102.7
Rock Hill	WRHI-FM	98.3
Seneca	WSNW-FM	98.1
Spartanburg	WSPA-FM	98.9

TENNESSEE

Location	C.L.	Mc.
Bristol	WOPI-FM	96.9
Greeneville	WGRV-FM	94.9
Jackson	WTJS-FM	104.1
Johnson City	WJHL-FM	100.7
Kingsport	WKPT-FM	98.5
Knoxville	WBIR-FM	93.3
	WKCS	*91.1
	WUOT	*91.9
Memphis	WMCF	99.7
Nashville	WFMB	105.9

TEXAS

Location	C.L.	Mc.
Abilene	KACC-FM	*91.1
Austin	KHFI	98.3
	KAZZ	95.5
Beaumont	KRIC-FM	97.5
Cedar Hills	KDFW	107.9
Cleburne	KCLE-FM	94.9
Corpus Christi	KDMC	95.5
Dallas	KIXL-FM	104.5
	KNER	*88.1
	KRLD-FM	92.5
	WRR-FM	101.1
	KSFM	105.3
	KVTT	*91.7
Denton	KDNT-FM	106.3
El Paso	KVOF-FM	*88.5
Ft. Worth	WBAP-FM	96.3
Houston	KHGM	102.9
	KFMK	97.9
	KTRH-FM	101.1
	KUHF	*91.3
Lubbock	KSEL-FM	93.7
Plainview	KHBL	*88.1
San Antonio	KISS	99.5
	KEEZ	97.3
	KONO-FM	92.9
Texarkana	KCMC-FM	98.1

UTAH

Location	C.L.	Mc.
Ephraim	KEPH	*88.9
Logan	KVSC	*88.1
Salt Lake City	KDYL-FM	98.7
	KSL-FM	100.3

VIRGINIA

Location	C.L.	Mc.
Arlington	WARL-FM	105.1
Charlottesville	WINA-FM	95.3
	WTJU	91.3
Crewe	WSVS-FM	104.7
Harrisonburg	WEMC	*91.7
	WSVA-FM	100.7
Lynchburg	WWOD-FM	100.1
Martinsville	WMVA-FM	96.3
Newport News	WGH-FM	97.3
Norfolk	WMTI	*91.5
	WRVC	102.5
Richmond	WCOD	98.1
	WRFK	91.1
	WRVA-FM	94.5
	WRNL-FM	102.1
Roanoke	WDBJ-FM	94.9
	WROV-FM	103.7
	WSLS-FM	99.1
South Norfolk	WFOS	*90.5
Winchester	WRFL	92.5

WASHINGTON

Location	C.L.	Mc.
Cheney	KEWC-FM	*89.9
Seattle	KING-FM	98.1
	KIRO-FM	100.7
	KISW	99.9
	KMCS	98.9
	KUOW	94.9
Spokane	KREM-FM	92.9
Tacoma	KCPS	90.9
	KTNT-FM	97.3
	KTOY	*91.7
	KTWR	103.9

WEST VIRGINIA

Location	C.L.	Mc.
Beckley	WBKW	99.5
Charleston	WKAZ-FM	97.5
Huntington	WHTN-FM	100.5
Logan	WLOG-FM	103.3
Martinsburg	WEPM-FM	94.3
Morgantown	WAJR-FM	99.3
Oak Hill	WOAY-FM	94.1
Parkersburg	WAAM-FM	106.5
Wheeling	WKWK-FM	97.3
	WWVA-FM	98.7

WISCONSIN

Location	C.L.	Mc.
Appleton	WLFM	*91.1
Chilton	WHKW	*89.3
Colfax	WHWC	*88.3
Delafield	WHAD	*90.7
Eau Claire	WEAU-FM	94.1
Greenfield Twp.	WWCF	94.5
Highland	WHHI	91.3
Highland Twp.	WHSA	*89.9
Janesville	WCLO-FM	99.9
La Crosse	WHLA	*90.3
Madison	WHA-FM	*88.7
	WISC-FM	98.1
	WMFM	104.1
Merrill	WLIN	100.7
Milwaukee	WFMR	96.5
	WQFM	93.3
Racine	WRJN-FM	100.7
Rice Lake	WJMC-FM	96.3
Wausau	WHRM	*91.9
West Bend	WBKV-FM	92.5
Wisc. Rapids	WFHR-FM	103.3

HAWAII

Location	C.L.	Mc.
Honolulu	KAIM-FM	95.5
	KUOH	*90.5
	KVOK	*88.1

Canadian FM Stations

C.L., call letters, Mc., megacycles (For frequency in kilocycles, change decimal point to comma and add two zeros)

Location	C.L.	Mc.
Brantford, Ont.	CKPC-FM	92.1
Cornwall, Ont.	CKSF-FM	104.5
Edmonton, Alta.	CFRN-FM	100.3
	CJCA-FM	99.5
	CKUA-FM	98.1
Ft. William, Ont.	CKPR-FM	94.3
Halifax, N.S.	CHNS-FM	96.1
Kingston, Ont.	CFRC-FM	91.9
	CKLC-FM	99.5
	CKWS-FM	96.3
Kitchener, Ont.	CKCR-FM	96.7
London, Ont.	CFPL-FM	95.9
Montreal, Que.	CBF-FM	95.1
	CBM-FM	100.7
	CFCF-FM	106.5
Oshawa, Ont.	CKLB-FM	93.5
Ottawa, Ont.	CBO-FM	103.3
	CFRA-FM	93.9
Quebec, Que.	CHRC-FM	98.1
Rimouski, Que.	CJBR-FM	101.5
St. Catharines, Ont.	CKTB-FM	97.7
Sydney, N.S.	CJCB-FM	94.9
Timmins, Ont.	CKGB-FM	94.5
Toronto, Ont.	CBC-FM	99.1
	CFRB-FM	99.9
	CHFI-FM	98.1
	CJRT-FM	91.1
Vancouver, B.C.	CBU-FM	105.7
Verdun, Que.	CKVL-FM	96.9
Victoria, B.C.	CKOA-FM	98.5
Windsor, Ont.	CKLW-FM	93.9
Winnipeg, Man.	CJOB-FM	103.1

United States Television Stations

(Territories and possessions follow states). C.L., call letters; Chan., channel number; asterisk (*) indicates educational station.

Location	C.L.	Chan.
ALABAMA		
Andalusia	WAIQ	*2
Birmingham	WAPI-TV	13
	WBIQ	*10
	WBRC-TV	6
Decatur	WMSL-TV	23
Dothan	WTVY	9
Florence	WOWL	15
Mobile	WALA-TV	10
	WKRG-TV	5
Montgomery	WCOV-TV	20
	WSFA-TV	12
Munford	WTIQ	*7
ALASKA		
Anchorage	KENI-TV	2
	KTVA	11
Fairbanks	KFAR-TV	2
	KTVF	11
Juneau	KINY-TV	8
ARIZONA		
Phoenix	KOOL-TV	10
	KPHO-TV	5
	KTVK	3
	KVAR	12
Tucson	KGUN-TV	9
	KOLD-TV	13
	KVOA-TV	4
Yuma	KIVA	11
ARKANSAS		
El Dorado	KTVE	10
Ft. Smith	KNAC-TV	5
Little Rock	KARK-TV	4
	KTHV	11
	KATV	7
Texarkana	KCMC-TV	6
CALIFORNIA		
Bakersfield	KBAK-TV	29
	KERO-TV	10
Chico	KHSL-TV	12
El Centro	XEM-TV	3
Eureka	KIEM-TV	3
	KVIQ-TV	6
Fresno	KFRE-TV	12
	KJEO	47
	KMJ-TV	24
Los Angeles	KABC-TV	7
	KCOP	13
	KHJ-TV	9
	KNXT	2
	KRCA	4
	KTLA	5
	KTTV	11
Oakland	KTVU	2
Redding	KVIP-TV	7
Sacramento	KBET-TV	10
	KCRA-TV	3
Salinas	KSBW-TV	8
San Diego	KFMB-TV	8
	KFSD-TV	10
(Tijuana, Mex.)	XETV	6
San Francisco	KGO-TV	7
	KPIX	5
	KQED	*9
	KRON-TV	4
San Jose	KNTV	11
San Luis Obispo	KSBY-TV	6
Santa Barbara	KEY-T	3
Stockton	KOVR	13
COLORADO		
Colorado Springs	KKTV	11
	KRDO-TV	13
Denver	KBTV	9
	KLZ-TV	7
	KOA-TV	4
	KRMA-TV	*6
	KTVR	2
Grand Junction	KREX-TV	5
Montrose	KREY-TV	10
Pueblo	KCSJ-TV	5
CONNECTICUT		
Bridgeport	WICC-TV	43
Hartford	WTIC-TV	3
New Britain	WNBC	30
New Haven	WNHC-TV	8
Waterbury	WATR-TV	53
DIST. OF COLUMBIA		
Washington	WMAL-TV	7
	WRC-TV	4
	WTOP-TV	9
	WTTG	5
FLORIDA		
Daytona Beach	WESH-TV	2
Fort Myers	WINK-TV	11
Gainesville	WUFT	*5
Jacksonville	WFGA-TV	12
	WJCT	*7
	WJXT	4
Miami	WCKT	7
	WPST-TV	10
	WTHS-TV	*2
	WTVJ	4
Orlando	WDBO-TV	6
	WLOF-TV	9
Palm Beach	WPTV	5
Panama City	WJDM-TV	7
Pensacola	WEAR-TV	3
St. Petersburg	WSUN-TV	38
Tampa	WFLA-TV	8
	WEDU	3
	WTVT	13
W. Palm Beach	WEAT-TV	12
GEORGIA		
Albany	WALB-TV	10
Atlanta	WAGA-TV	5
	WSB-TV	2
	WETV	*30
	WLW-A	11
Augusta	WJBF	6
	WRDW-TV	12
Columbus	WRBL-TV	4
	WTVM	28
Macon	WMAZ-TV	13
Savannah	WSAV-TV	3
	WTOC-TV	11
Thomasville	WCTV	6
IDAHO		
Boise	KBOI	2
	KIDO-TV	7
Idaho Falls	KID-TV	3
Lewiston	KLEW-TV	3
Nampa	KCIX-TV	6
Twin Falls	KLIX-TV	11
ILLINOIS		
Champaign	WCIA	3
Chicago	WBBM-TV	2
	WBKB	7
	WGN-TV	9
	WNBQ	5
	WTTW	*11
Danville	WDAN-TV	24
Decatur	WTVP	17
Harrisburg	WSIL-TV	3
La Salle	WEEQ-TV	35
Peoria	WEEK-TV	43
	WMBD	31
	WTVH	19
Quincy	WGEM-TV	10
Rockford	WREX-TV	13
	WTVO	39
Rock Island	WHBF-TV	4
Springfield	WICS	20
Urbana	WILL-TV	*12
INDIANA		
Bloomington	WTTV	4
Elkhart	WSJV-TV	28
Evansville	WFIE-TV	14
	WEHT	50
	WTVW	7
Ft. Wayne	WANE-TV	15
	WKJG-TV	33
	WPTA	21
Indianapolis	WFBM-TV	6
	WLWI	13
	WISH-TV	8
Lafayette	WFAM-TV	59
Muncie	WLBC-TV	49
South Bend	WNDU-TV	16
	WSBT-TV	22
Terre Haute	WTHI-TV	10
IOWA		
Ames	WOI-TV	5
Cedar Rapids	KCRG-TV	9
	WMT-TV	2
Davenport	WOC-TV	6
Des Moines	KRNT-TV	8
	WHO-TV	13
Fort Dodge	KQTV	21
Mason City	KGLO-TV	3
Ottumwa	KTVO	3
Sioux City	KTIV	4
	KVTV	9
Waterloo	KWWL-TV	7
KANSAS		
Ensign	KTVC	6
Garden City	KGLD	11
Goodland	KBLR-TV	10
Great Bend	KCKT	2
Hays	KAYS-TV	7
Hutchinson	KTVH	12
Pittsburg	KOAM-TV	7
Topeka	WIBW-TV	13
Wichita	KAKE-TV	10
	KARD-TV	3
KENTUCKY		
Lexington	WLEX-TV	18
	WKYT	27
Louisville	WAVE-TV	3
	WFPK-TV	*15
	WHAS-TV	11
	WQXL-TV	41
Paducah	WPSD-TV	6
LOUISIANA		
Alexandria	KALB-TV	5
Baton Rouge	WAFB-TV	28
	WBRZ	2
Lafayette	KLFY-TV	10
Lake Charles	KPLC-TV	7
	KTAG-TV	25
Monroe	KNOE-TV	8
	KLSE	*13
New Orleans	WDSU-TV	6
	WJMR-TV	20
	WWL-TV	4
	WYES	*8
Shreveport	KSLA-TV	12
	KTBS-TV	3
MAINE		
Bangor	WABI-TV	5
	WLBZ-TV	2
Poland Spring	WMTW-TV	8
Portland	WCSH-TV	6
	WGAN-TV	13
Presque Isle	WAGM-TV	8
MARYLAND		
Baltimore	WJZ-TV	13
	WBAL-TV	11
	WMAR-TV	2
Salisbury	WBOC-TV	16
MASSACHUSETTS		
Adams	WCDC	19
Boston	WBZ-TV	4
	WGBH-TV	*2
	WHDH-TV	5
	WNAC-TV	7
Greenfield	WRLP	32
Springfield	WHYN-TV	40
	WWLP	22
Worcester	WWOR-TV	14
MICHIGAN		
Bay City	WNEM-TV	5
Cadillac	WWTV	13
Detroit	WJBK-TV	2
	WTVS	*56
	WWJ-TV	4
	WXYZ-TV	7
(Windsor, Ont.)	CKLW-TV	9
Flint	WJRT	12
Grand Rapids	WOOD-TV	8
Kalamazoo	WKZO-TV	3
Lansing	WJIM-TV	6
Marquette	WDMJ-TV	6
Saginaw	WKNX-TV	57
Traverse City	WPBN-TV	7
MINNESOTA		
Alexandria	KCMT	7
Austin	KMMT	6
Duluth	KDAL-TV	3
	WDSM-TV	6
Minneapolis	KMSP	9
	WCCO-TV	4
	WTCN-TV	11
Rochester	KROC-TV	10
St. Paul	KSTP-TV	5
	KTCA-TV	*2
MISSISSIPPI		
Columbus	WCBI-TV	4
Hattiesburg	WDAM-TV	9
Jackson	WJTV	12
	WLBT	3
Meridian	WTOK-TV	11
	WCOC-TV	30
Tupelo	WTWV	9
MISSOURI		
Cape Girardeau	KFVS-TV	12
Columbia	KOMU-TV	8
Hannibal	KHQA-TV	7
Jefferson City	KRCG-TV	13
Joplin	KODE-TV	12
Kansas City	KCMO-TV	5
	KMBC-TV	9
	WDAF-TV	4
Kirksville	KTVO	3
St. Joseph	KFEQ-TV	2
St. Louis	KETC	*9
	KSD-TV	5
	KTVI	2
	KCPP	11
Sedalia	KDRO-TV	6
Springfield	KTTS-TV	10
	KYTV	3
MONTANA		
Billings	KOOK-TV	2
	KGHL-TV	8
Butte	KXLF-TV	4
Glendive	KXGN-TV	5
Great Falls	KFBB-TV	5
	KRTV	3
Helena	KXLJ-TV	12
Kalispell	KULR	9
Missoula	KMSO-TV	13
NEBRASKA		
Hastings	KHAS-TV	5
Hay Springs	KDUH-TV	4
Hayes Center	KHPL-TV	6
Kearney	KHOL-TV	13
Lincoln	KOLN-TV	10
	KUON-TV	*12
North Platte	KNOP	2
Omaha	KMTV	3
	KETV	7
	WOW-TV	6
Scottsbluff	KSTF	10
NEVADA		
Henderson	KLRJ-TV	2
Las Vegas	KLAS-TV	8
	KSHO-TV	13
Reno	KOLO-TV	8
NEW HAMPSHIRE		
Manchester	WMUR-TV	9
NEW JERSEY		
Newark	WNTA-TV	13
NEW MEXICO		
Albuquerque	KGGM-TV	13
	KNME-TV	*5
	KOAT-TV	7
	KOB-TV	4
Carlsbad	KAVE-TV	6
Clovis	KICA-TV	12
Roswell	KSWS-TV	8
NEW YORK		
Albany	WTEN	10
	WTRI	35
Binghamton	WINR-TV	40

Location	C.L.	Chan.
	WNBF-TV	12
Buffalo	WBEN-TV	4
	WBUF	17
	WGR-TV	2
	WKBW	7
Carthage	WCNY-TV	7
Elmira	WSYE-TV	18
New York	WABC-TV	7
	WNEW-TV	5
	WCBS-TV	2
	WOR-TV	9
	WPIX	11
	WRCA-TV	4
Plattsburg	WPTZ-TV	5
Rochester	WHEC-TV	10
	WROC-TV	5
	WVET-TV	10
Schenectady	WRGB	6
Syracuse	WHEN-TV	8
	WSYR-TV	3
Utica	WKTV	13

NORTH CAROLINA

Location	C.L.	Chan.
Asheville	WISE-TV	62
	WLOS-TV	13
Chapel Hill	WUNC-TV	*4
Charlotte	WBTV	3
	WSOC-TV	9
Durham	WTVD	11
Greensboro	WFMY-TV	2
Greenville	WNCT	9
Raleigh	WRAL-TV	5
Washington	WITN	7
Wilmington	WECT	6
Winston-Salem	WSJS-TV	12

NORTH DAKOTA

Location	C.L.	Chan.
Bismarck	KBMB-TV	12
	KFYR-TV	5
Dickinson	KDIX-TV	2
Fargo	WDAY-TV	6
Grand Forks	KNOX-TV	10
Minot	KXMC-TV	13
	KMOT	10
Valley City	KXJB-TV	4
Williston	KUMV-TV	8

OHIO

Location	C.L.	Chan.
Akron	WAKR-TV	49
Cincinnati	WCET	*48
	WCPO-TV	9
	WKRC-TV	12
	WLW-T	5
	WSOK-TV	54
Cleveland	KYW-TV	3
	WEWS	5
	WJW-TV	8
Columbus	WBNS-TV	10
	WLW-C	4
	WOSU-TV	*34
	WTVN-TV	6
Dayton	WHIO-TV	7
	WLW-D	2
Lima	WIMA-TV	35
Steubenville	WSTV-TV	9
Toledo	WSPD-TV	13
	WTOL-TV	11
Youngstown	WFMJ-TV	21
	WKBN-TV	27
	WKST-TV	45
Zanesville	WHIZ-TV	18

OKLAHOMA

Location	C.L.	Chan.
Ada	KTEN	10
Ardmore	KXII	12
Enid	KOCO-TV	5
Lawton	KSWO-TV	7
Oklahoma City	KETA	*13
	KWTV	9
	WKY-TV	4
Tulsa	KOTV	6
	KTUL-TV	8
	KVOO-TV	2

OREGON

Location	C.L.	Chan.
Corvallis	KOAC-TV	*7
Eugene	KVAL-TV	13
Klamath	KOTI	2
Medford	KBES-TV	5
Portland	KGW-TV	8
	KOIN-TV	6
	KPTV	12
Roseburg	KPIC	4

PENNSYLVANIA

Location	C.L.	Chan.
Altoona	WFBG-TV	10
Erie	WICU	12
	WSEE-TV	35
Harrisburg	WHP-TV	55
	WTPA	27
Johnstown	WARD-TV	56
	WJAC-TV	6
Lancaster	WGAL-TV	8
Lebanon	WLVH-TV	15
Lockhaven	WBPZ-TV	32
New Castle	WKST-TV	45
Philadelphia	WCAU-TV	10
	WFIL-TV	6
	WHYY-TV	*35
	WRCV-TV	3
Pittsburgh	KDKA-TV	2
	WIIC	11
	WQED	*13
	WTAE	4
Scranton	WNEP-TV	16
	WDAU-TV	22
Wilkes-Barre	WBRE-TV	28
York	WSBA-TV	43

RHODE ISLAND

Location	C.L.	Chan.
Providence	WJAR-TV	10
	WPRO-TV	12

SOUTH CAROLINA

Location	C.L.	Chan.
Anderson	WAIM-TV	40
Charleston	WCSC-TV	5
	WUSN-TV	2
Columbia	WIS-TV	10
	WNOK-TV	67
Florence	WBTW	13
Greenville	WFBC-TV	4
Spartanburg	WSPA-TV	7

SOUTH DAKOTA

Location	C.L.	Chan.
Aberdeen	KXAB-TV	9
Florence	KDLO-TV	3
Rapid City	KOTA-TV	3
	KRSD-TV	7
Reliance	KPLO-TV	6
Sioux Falls	KELO-TV	11

TENNESSEE

Location	C.L.	Chan.
Chattanooga	WDEF-TV	12
	WRGP-TV	3
	WTVC	9
Jackson	WDXI-TV	7
Johnson City	WJHL-TV	11
Knoxville	WATE-TV	6
	WBIR-TV	10
	WTVK	26
Memphis	WHBQ-TV	13
	WKNO	*10
	WMCT	5
	WREC-TV	3
Nashville	WLAC-TV	5
	WSIX-TV	8
	WSM-TV	4

TEXAS

Location	C.L.	Chan.
Abilene	KRBC-TV	9
Amarillo	KFDA-TV	10
	KGNC-TV	4
	KVII	7
Austin	KTBC-TV	7
Beaumont	KFDM-TV	6
Big Spring	KEDY-TV	4
Bryan	KBTX-TV	3
Corpus Christi	KRIS-TV	6
	KZTV	10
Dallas	KRLD-TV	4
	WFAA-TV	8
El Paso	KELP-TV	13
	KROD-TV	4
	KTSM-TV	9
(Ciudad Juarez, Mex.)	XEJ-TV	5
Ft. Worth	KFJZ-TV	11
	WBAP-TV	5
Harlingen	KGBT-TV	4
Houston	KPRC-TV	2
	KGUL-TV	11
	KTRK-TV	13
	KUHT	*8
Laredo	KGNS-TV	8
Lubbock	KCBD-TV	11
	KDUB-TV	13
Lufkin	KTRE-TV	9
Midland	KMID-TV	2
Monahans	KVKM-TV	9
Nacogdoches	KTES	19
Odessa	KOSA-TV	7
Port Arthur-Beaumont	KPAC-TV	4
San Angelo	KCTV	8
San Antonio	KCOR-TV	41
	KENS-TV	5
	KONO-TV	12
	WOAI-TV	4
Sweetwater	KPAR-TV	12
Temple	KCEN-TV	6
Texarkana	KCMC-TV	6
Tyler	KLTV	7
Waco	KWTX-TV	10
Weslaco	KRGV-TV	5
Wichita Falls	KFDX-TV	3
	KSYD-TV	6

UTAH

Location	C.L.	Chan.
Provo	KLOR-TV	11
Salt Lake City	KSL-TV	5
	KTVT	4
	KUED	*7
	KUTV	2

VERMONT

Location	C.L.	Chan.
Burlington	WCAX-TV	3

VIRGINIA

Location	C.L.	Chan.
Bristol	WCYB-TV	5
Hampton	WVEC-TV	15
Harrisonburg	WSVA-TV	3
Lynchburg	WLVA-TV	13
Norfolk	WTAR-TV	3
	WAVY-TV	10
	WTOV-TV	27
Petersburg	WXEX-TV	8
Richmond	WRVA-TV	12
	WTVR	6
Roanoke	WDBJ-TV	7
	WSLS-TV	10

WASHINGTON

Location	C.L.	Chan.
Bellingham	KVOS-TV	12
Ephrata	KBAS-TV	16
Pasco	KEPR-TV	19
Seattle	KCTS	*9
	KING-TV	5
	KIRO-TV	7
	KOMO-TV	4
Spokane	KHQ-TV	6
	KREM-TV	2
	KXLY-TV	4
Tacoma	KTNT-TV	11
	KTVW	13
Yakima	KIMA-TV	29

WEST VIRGINIA

Location	C.L.	Chan.
Bluefield	WHIS-TV	6
Charleston	WCHS-TV	8
Clarksburg	WBOY-TV	12
Huntington	WHTN-TV	13
	WSAZ-TV	3
Oak Hill	WOAY-TV	4
Parkersburg	WTAP	15
Wheeling	WTRF-TV	7

WISCONSIN

Location	C.L.	Chan.
Eau Claire	WEAU-TV	13
Green Bay	WBAY-TV	2
	WFRV-TV	5
La Crosse	WKBT	8
Madison	WHA-TV	*21
	WISC-TV	3
	WKOW-TV	27
	WMTV	33
Marinette	WMBV-TV	11
Milwaukee	WISN-TV	12
	WMVS-TV	*10
	WTMJ-TV	4
	WXIX	18
Wausau	WSAU-TV	7
Whitefish Bay	WITI-TV	6

WYOMING

Location	C.L.	Chan.
Casper	KTWO-TV	2
	KSPR-TV	6
Cheyenne	KFBC-TV	5
Riverton	KWRB-TV	10

U. S. TERRITORIES AND POSSESSIONS

GUAM

Location	C.L.	Chan.
Agana	KUAM-TV	8

HAWAII

Location	C.L.	Chan.
Hilo	KHBC-TV	9
Honolulu	KGMB-TV	9
	KONA	2
	KULA-TV	4
Wailuku	KMAU	3
	KALA	7
	KMVI-TV	12

PUERTO RICO

Location	C.L.	Chan.
Mayaguez	WORA-TV	5
Ponce	WRIK-TV	7
	WSUR-TV	9
San Juan	WAPA-TV	4
	WIPR-TV	*6
	WKAQ-TV	2

Canadian Television Stations

Abbreviations: C.L., call letters; Chan., channel number.

ALBERTA

Location	C.L.	Chan.
Calgary	CHCT-TV	2
Edmonton	CFRN-TV	3
Lethbridge	CJLH-TV	7
Medicine Hat	CHAT-TV	6
Red Deer	CHCA-TV	6

BRITISH COLUMBIA

Location	C.L.	Chan.
Kamloops	CFCR-TV	4
Kelowna	CHBC-TV	2
Penticton	CHBC-TV	13
Vancouver	CBUT	2
Vernon	CHBC-TV	7
Victoria	CHEK-TV	6

LABRADOR

Location	C.L.	Chan.
Goose Bay	CFLA-TV	8

MANITOBA

Location	C.L.	Chan.
Brandon	CKX-TV	5
Winnipeg	CBWT	3

NEW BRUNSWICK

Location	C.L.	Chan.
Moncton	CKCW-TV	2
Saint John	CHSJ-TV	4

NEWFOUNDLAND

Location	C.L.	Chan.
Argentia	CJOX-TV	10
St. John's	CJON-TV	6
Stephenville	CFSN-TV	8

NOVA SCOTIA

Location	C.L.	Chan.
Halifax	CBHT	3
Liverpool	CBHT-1	12
Shelburne	CBHT-2	8
Sydney	CJCB-TV	4

ONTARIO

Location	C.L.	Chan.
Barrie	CKVR-TV	3
Elk Lake	CFCL-TV-2	2
Elliot Lake	CKSO-TV-1	3
Hamilton	CHCH-TV	11
Kapuskasing	CFCL-TV-1	3
Kingston	CKWS-TV	11
Kitchener	CKCO-TV	13
London	CFPL-TV	10
North Bay	CKGN-TV	10
Peterborough	CHEX-TV	12
Ottawa	CBOFT	9
	CBOT	4
Port Arthur	CFCJ-TV	2
Sault Ste. Marie	CJIC-TV	2
Sudbury	CKSO-TV	5
Timmins	CFCL-TV	6
Toronto	CBLT	6
Windsor	CKLW-TV	9
Wingham	CKNX-TV	8

PRINCE EDWARD ISLAND

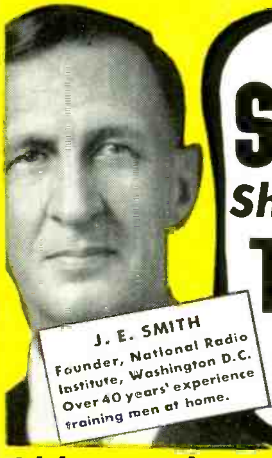
Location	C.L.	Chan.
Charlottetown	CFCY-TV	13

QUEBEC

Location	C.L.	Chan.
Estcourt	CJES-TV-1	70
Jonquiere	CKRS-TV	12
Matane	CKBL-TV	9
Montreal	CBFT	2
	CBMT	6
Quebec	CFCM-TV	4
	CKMI-TV	5
Rimouski	CJBR-TV	3
Rouyn	CKRN-TV	4
Sherbrooke	CHLT-TV	7
Three Rivers	CKTM-TV	13

SASKATCHEWAN

Location	C.L.	Chan.
Prince Albert	CKBI-TV	5
Regina	CKCK-TV	2
Saskatoon	CFQC-TV	8
Swift Current	CFJB-TV	5
Yorkton	CKOS-TV	3



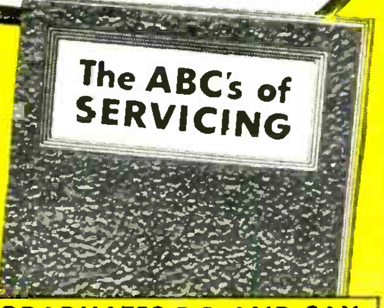
Mail Postage-Free Card for

SAMPLE LESSON FREE

Shows you how easy, practical it is to

Train at Home for Good Radio-Television Jobs

Oldest and Largest Home Study Radio-Television Training School. N.R.I. has Trained Thousands for Good Pay Jobs



Since 1914 . . . for more than 40 years—N.R.I. has been training ambitious men at home in spare time for Radio-TV. Let us send you a sample lesson to help prove you can keep your job and TRAIN AT HOME in your spare time for better pay and a brighter future. We will also send N.R.I.'s 64-page catalog to show you that Radio-Television is today's field of OPPORTUNITY for properly trained men.

Television Making Good Jobs, Prosperity

The technical man is looked up to. He should be. He does important work, is respected for what he knows, gets good pay for it. There are splendid opportunities for the man well trained in Radio-Television Servicing or Broadcasting. Government, Aviation, Police, Ship, Micro-Wave, Relay, Two-Way Communications for buses, taxis, trucks are growing Radio-TV fields, making more good jobs.

N.R.I. is the Tested Way to Better Pay

N.R.I. Training is practical, thorough. You get the benefit of N.R.I.'s 40 years' experience. Many successful N.R.I. men start without any knowledge of Radio, many without a high school education. Find out what Radio-Television training can mean to you. Make the first move today toward becoming one of that select group — a Radio-TV Technician. Send postage-free card for Actual Lesson and 64-page Catalog, both FREE. NATIONAL RADIO INSTITUTE, Dept. 9CB3, Washington 16, D. C.

WHAT N.R.I. GRADUATES DO AND SAY

Has Own Radio-TV Business
"We have an appliance store with Radio-TV servicing. During Army service. NRI training helped me get top rated job."—W. M. WEIDNER, Fairfax, S. D.

Chief Engineer with KGCU
"I am Chief Engineer with station and also have my own spare time servicing business." —R. BARNETT, Bismarck, N. D.

Paid for Instruments from Earnings
"I am doing very well in spare time. Sometimes have three TV jobs waiting also fix car Radios."—G. F. SEAMAN, N. Y., N. Y.

See Other Side

N.R.I. Sends Equipment for Practical Experience

Nothing takes the place of practical experience. That's why N.R.I. training is based on LEARNING-BY-DOING. N.R.I. training includes kits of parts which you use to build equipment and get practical experience on circuits common to both Radio and Television. Shown at left is low-power Broadcasting Transmitter you build as part of N. R. I. Communications Course. FREE Catalog shows other equipment you get, things you learn.

FIRST CLASS
Permit No. 20-R
(Sec. 34.9, P.L.& R.)
Washington, D.C.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in The United States

POSTAGE WILL BE PAID BY

NATIONAL RADIO INSTITUTE

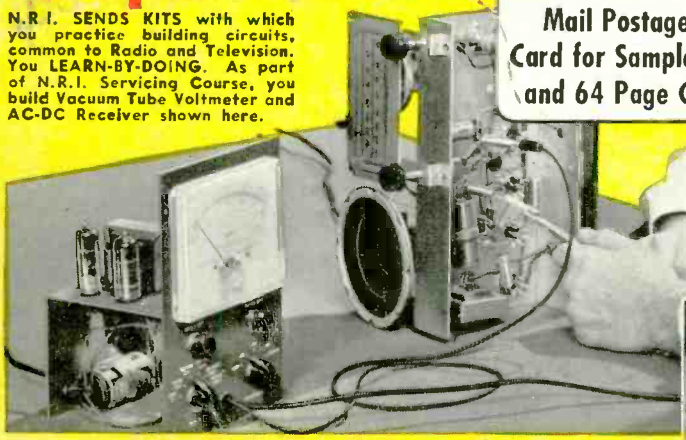
Washington 16, D. C.

Learn Radio-Television

Servicing or Communications

by Practicing at Home in Spare Time

2 BOOKS FREE
Mail Postage-Free Card for Sample Lesson and 64 Page Catalog



N.R.I. SENDS KITS with which you practice building circuits, common to Radio and Television. You LEARN-BY-DOING. As part of N.R.I. Servicing Course, you build Vacuum Tube Voltmeter and AC-DC Receiver shown here.

Fast Growing Field Offers You Good Pay, Success, Bright Future

J. E. SMITH, Founder, N.R.I.

Bigger than ever and still growing. That's why Radio-Television has special appeal to ambitious men not satisfied with their future prospects. More than 4,000 Radio and TV Stations use trained technicians. 150 million home and auto Radios and 40 million TV sets must be kept in service. Color TV promises added opportunities. There are good jobs, bright futures in Radio-TV Servicing or Communications. Training PLUS Opportunity is the ideal combination for success. Plan now to get into Radio-TV. The technical man is looked up to, does important work, gets good pay. Keep your job while training. With N.R.I. you learn at home in spare time. N.R.I. is the OLDEST and LARGEST home study Radio-TV school. Its methods have proved successful for more than 40 years.

See Other Side

Many Good Jobs in Radio-TV Servicing and Communications for Trained Men

Start Soon to Make $10—$15 a Week Extra in Your Spare Time

Soon after enrolling, many N.R.I. students start to earn $10, $15 a week in spare time fixing sets for friends and neighbors. Some make enough to start their own full time Radio-TV shops. Easy-to-understand lessons teach you basic principles. You LEARN-BY-DOING on N.R.I. equipment which "brings to life" things you study.

Find out what N.R.I. offers. Study fast or slow —as you like. Diploma when you graduate. Mail postage-free postcard now. ACTUAL LESSON FREE. Also 64-page catalog that shows opportunities, equipment you get. Cost of N.R.I. courses low. Easy terms. NATIONAL RADIO INSTITUTE, Dept. 9CB3, Washington 16, D. C.

CUT OUT AND MAIL THIS CARD NOW

Sample Lesson & 64-Page Catalog

Both FREE

NO STAMP NEEDED—WE PAY POSTAGE

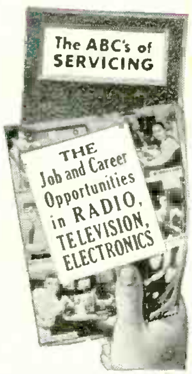
NATIONAL RADIO INSTITUTE
Dept. 9CB3, Washington 16, D. C.

Mail me Sample Lesson and 64-page Catalog. (No salesman will call. Please write plainly.)

NAME____________________ AGE_____

ADDRESS__________________________

CITY____________ ZONE____ STATE______



ACCREDITED MEMBER, NATIONAL HOME STUDY COUNCIL